



■ Made  
■ in  
■ Germany



**FRANKEN**  
*Hard-Cut*

Hochleistungsfräser für den Werkzeug- und Formenbau  
High Performance End Mills for the Die and Mould Industry



## Mehr als 100 Jahre Präzision und Innovation. More than 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 wendeplattenbestückten 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 Fräserspannmitteln 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.





Mit Hard-Cut Kugel- und Torusfräsern bietet FRANKEN Hochleistungs-werkzeuge für die Bearbeitung von gehärteten Werkstoffen an. Speziell für den Werkzeug- und Formenbau wurde eine Vielzahl an Baumaßen mit Halsfreilängen von bis zu  $16 \times d_1$  ergänzt. Sehr enge Radiustoleranzen und eine weiterentwickelte Schneidengeometrie ermöglichen eine prozesssichere Herstellung hochgenauer 3D-Formen, Matrizen sowie Form- und Prägestempel bei höchster Leistung.

Ein sehr verschleißfestes Hartmetall, kombiniert mit einer modernen Hochleistungs-PVD-Beschichtung, machen FRANKEN Hard-Cut Fräser zu Spezialisten beim Hartfräsen.

#### Besonderheiten:

- Engste Radiustoleranzen für höchste Genauigkeiten am Bauteil
- Hochpräzise Zylinderschäfte mit Toleranz h4 ermöglichen eine hohe Rundlaufgenauigkeit
- Spezielle Schneidengeometrie für die Hartbearbeitung
- Optimierte Querschnidengeometrie
- Verschiedene Halsfreilängen (bis  $16 \times d_1$ ) ab Lager verfügbar
- Hohe Zähnezahlen ermöglichen hohe Vorschubgeschwindigkeiten
- Angepasstes Hartmetallsubstrat für gehärtete Werkstoffe
- Moderne Hochleistungs-PVD-Beschichtung

#### Hauptmerkmal:

- Bearbeitung harter Materialien bis 66 HRC
- Zum Schrumpfen, Vorschlichten, Schlichten und HSC-Schlichten geeignet

FRANKEN's Hard-Cut ball nose and torus end mills are high-performance tools for the machining of hardened materials.

A wide range of dimensions with relieved neck and lengths of up to  $16 \times d_1$  has been added to the product line. Very tight tolerances and a sophisticated cutting edge geometry enable the reliable production of high-precision 3D moulds, dies as well as moulding and embossing punches with highest performance.

An extremely wear-resistant carbide, combined with a modern high-performance PVD coating, make FRANKEN Hard-Cut end mills the specialists when it comes to hard milling.

#### Characteristics:

- Very tight radius tolerances for highest accuracies on the component
- Highly precise straight shanks with tolerance h4 enable high runout accuracy
- Special cutting edge geometry for hard machining
- Optimised chisel edge geometry
- Various relieved neck lengths (up to  $16 \times d_1$ ) available from stock
- High number of flutes provides high feed rates
- Adapted carbide substrate for hardened materials
- Modern high-performance PVD coating

#### Main feature:

- Machining of hard materials up to 66 HRC
- Suitable for roughing, pre-finishing, finishing and HSC-finishing

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## Wegweiser

### Bitte beachten:

Die Eignung der Hartmetall-Kugel- und Torusfräser ist folgendermaßen gekennzeichnet:

- = sehr gut geeignet  
□ = gut geeignet

## Product finder

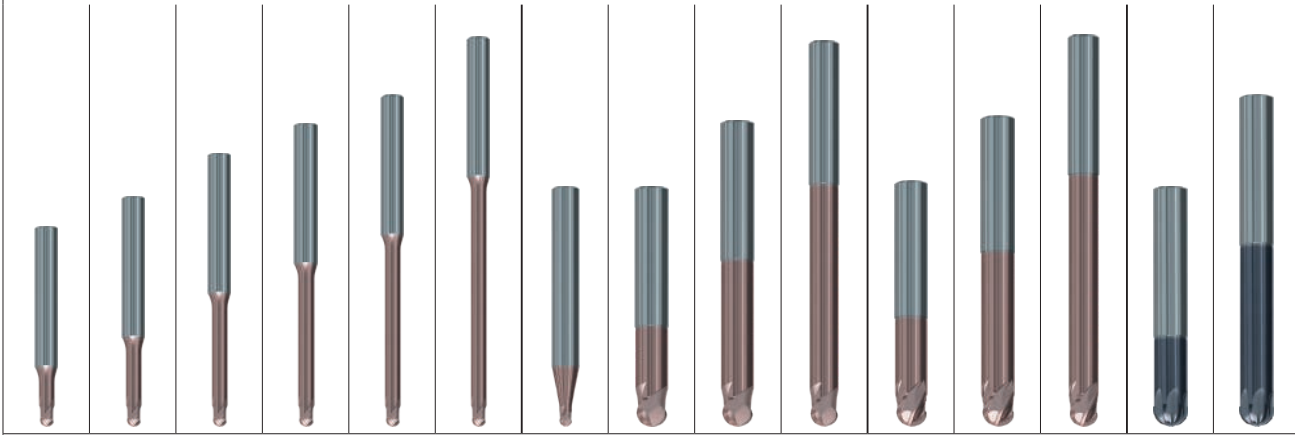
### Please note:

The suitability of the solid carbide ball nose and torus end mills is indicated as follows:

- = very suitable  
□ = suitable

| Einsatzgebiete – Material<br>Applications – material |                                                                     |                                                                       |                           | Material-Beispiele<br>Material examples | Material-Nummern<br>Material numbers |
|------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------|-----------------------------------------|--------------------------------------|
| P                                                    | <b>Stahlwerkstoffe</b>                                              | <b>Steel materials</b>                                                |                           |                                         |                                      |
|                                                      | 1.1 Kaltfließpressstähle, Baustähle, Automatenstähle, u.a.          | Cold-extrusion steels, Construction steels, Free-cutting steels, etc. | ≤ 600 N/mm <sup>2</sup>   | Cq15                                    | 1.1132                               |
|                                                      |                                                                     |                                                                       |                           | S235JR (St37-2)                         | 1.0037                               |
|                                                      |                                                                     |                                                                       |                           | 10SPb20                                 | 1.0722                               |
|                                                      | 2.1 Baustähle, Einsatzstähle, Stahlguss, u.a.                       | Construction steels, Case-hardened steels, Steel castings, etc.       | ≤ 800 N/mm <sup>2</sup>   | E360 (St70-2)                           | 1.0070                               |
|                                                      |                                                                     |                                                                       |                           | 16MnCr5                                 | 1.7131                               |
| M                                                    | 3.1 Einsatzstähle, Vergütungsstähle, Kaltarbeitsstähle, u.a.        | Case-hardened steels, Heat-treatable steels, Cold work steels, etc.   | ≤ 1000 N/mm <sup>2</sup>  | GS-25CrMo4                              | 1.7218                               |
|                                                      |                                                                     |                                                                       |                           | 20MoCr3                                 | 1.7320                               |
|                                                      |                                                                     |                                                                       |                           | 42CrMo4                                 | 1.7225                               |
|                                                      |                                                                     |                                                                       |                           | 102Cr6                                  | 1.2067                               |
|                                                      | 4.1 Vergütungsstähle, Kaltarbeitsstähle, Nitrierstähle, u.a.        | Heat-treatable steels, Cold work steels, Nitriding steels, etc.       | ≤ 1200 N/mm <sup>2</sup>  | 50CrMo4                                 | 1.7228                               |
|                                                      |                                                                     |                                                                       |                           | X45NiCrMo4                              | 1.2767                               |
| K                                                    |                                                                     |                                                                       |                           | 31CrMo12                                | 1.8515                               |
|                                                      | 5.1 Hochlegierte Stähle, Kaltarbeitsstähle, Warmarbeitsstähle, u.a. | High-alloyed steels, Cold work steels, Hot work steels, etc.          | ≤ 1400 N/mm <sup>2</sup>  | X38CrMoV5-3                             | 1.2367                               |
|                                                      |                                                                     |                                                                       |                           | X100CrMoV8-1-1                          | 1.2990                               |
|                                                      |                                                                     |                                                                       |                           | X40CrMoV5-1                             | 1.2344                               |
|                                                      | <b>Nichtrostende Stahlwerkstoffe</b>                                | <b>Stainless steel materials</b>                                      |                           |                                         |                                      |
|                                                      | 1.1 Ferritisch, martensitisch                                       | Ferritic, martensitic                                                 | ≤ 950 N/mm <sup>2</sup>   | X2CrTi12                                | 1.4512                               |
| N                                                    | 2.1 Austenitisch                                                    | Austenitic                                                            | ≤ 950 N/mm <sup>2</sup>   | X6CrNiMoTi17-12-2                       | 1.4571                               |
|                                                      | 3.1 Austenitisch-ferritisch (Duplex)                                | Austenitic-ferritic (Duplex)                                          | ≤ 1100 N/mm <sup>2</sup>  | X2CrNiMoN22-5-3                         | 1.4462                               |
|                                                      | 4.1 Austenitisch-ferritisch hitzebeständig (Super Duplex)           | Austenitic-ferritic heat-resistant (Super Duplex)                     | ≤ 1250 N/mm <sup>2</sup>  | X2CrNiMoN25-7-4                         | 1.4410                               |
|                                                      | <b>Gusswerkstoffe</b>                                               | <b>Cast materials</b>                                                 |                           |                                         |                                      |
|                                                      | 1.1 Gusseisen mit Lamellengrafit (GJL)                              | Cast iron with lamellar graphite (GJL)                                | 100-250 N/mm <sup>2</sup> | EN-GJL-200 (GG20)                       | EN-JL-1030                           |
|                                                      | 1.2 Gusseisen mit Kugelgrait (GJS)                                  | Cast iron with nodular graphite (GJS)                                 | 250-450 N/mm <sup>2</sup> | EN-GJL-300 (GG30)                       | EN-JL-1050                           |
| S                                                    | 2.1 Gusseisen mit Kugelgrait (GJS)                                  | Cast iron with nodular graphite (GJS)                                 | 350-500 N/mm <sup>2</sup> | EN-GJS-400-15 (GGG40)                   | EN-JS-1030                           |
|                                                      | 2.2 Gusseisen mit Kugelgrait (GJS)                                  | Cast iron with nodular graphite (GJS)                                 | 500-900 N/mm <sup>2</sup> | EN-GJS-700-2 (GGG70)                    | EN-JS-1070                           |
|                                                      | 3.1 Gusseisen mit Vermiculargrafit (GJV)                            | Cast iron with vermicular graphite (GJV)                              | 300-400 N/mm <sup>2</sup> | GJV 300                                 |                                      |
|                                                      | 3.2 Gusseisen mit Vermiculargrafit (GJV)                            | Cast iron with vermicular graphite (GJV)                              | 400-500 N/mm <sup>2</sup> | GJV 450                                 |                                      |
|                                                      | 4.1 Temperguss (GTMW, GTMB)                                         | Malleable cast iron (GTMW, GTMB)                                      | 250-500 N/mm <sup>2</sup> | EN-GJMW-350-4 (GTW-35)                  | EN-JM-1010                           |
|                                                      | 4.2 Temperguss (GTMW, GTMB)                                         | Malleable cast iron (GTMW, GTMB)                                      | 500-800 N/mm <sup>2</sup> | EN-GJMB-450-6 (GTS-45)                  | EN-JM-1140                           |
| H                                                    | <b>Nichteisenwerkstoffe</b>                                         | <b>Non-ferrous materials</b>                                          |                           |                                         |                                      |
|                                                      | <b>Aluminium-Legierungen</b>                                        | <b>Aluminium alloys</b>                                               |                           |                                         |                                      |
|                                                      | 1.1 Aluminium-Knetlegierungen                                       | Wrought aluminium alloys                                              | ≤ 200 N/mm <sup>2</sup>   | EN AW-AlMn1                             | EN AW-3103                           |
|                                                      | 1.2 Aluminium-Knetlegierungen                                       | Wrought aluminium alloys                                              | ≤ 350 N/mm <sup>2</sup>   | EN AW-AlMgSi                            | EN AW-6060                           |
|                                                      | 1.3 Aluminium-Knetlegierungen                                       | Wrought aluminium alloys                                              | ≤ 550 N/mm <sup>2</sup>   | EN AW-AlZn5Mg3Cu                        | EN AW-7022                           |
|                                                      | 1.4 Aluminium-Knetlegierungen                                       | Wrought aluminium alloys                                              | Si ≤ 7%                   | EN AC-AlMg5                             | EN AC-51300                          |
| H                                                    | 1.5 Aluminium-Gusslegierungen                                       | Aluminium cast alloys                                                 | 7% < Si ≤ 12%             | EN AC-AISi9Cu3                          | EN AC-46500                          |
|                                                      | 1.6 Aluminium-Gusslegierungen                                       | Aluminium cast alloys                                                 | 12% < Si ≤ 17%            | GD-AISi17Cu4FeMg                        |                                      |
|                                                      | <b>Kupfer-Legierungen</b>                                           | <b>Copper alloys</b>                                                  |                           |                                         |                                      |
|                                                      | 2.1 Reinkupfer, niedriglegiertes Kupfer                             | Pure copper, low-alloyed copper                                       | ≤ 400 N/mm <sup>2</sup>   | E-Cu 57                                 | EN CW 004 A                          |
|                                                      | 2.2 Kupfer-Zink-Legierungen (Messing, langspanend)                  | Copper-zinc alloys (brass, long-chipping)                             | ≤ 550 N/mm <sup>2</sup>   | CuZn37 (Ms63)                           | EN CW 508 L                          |
|                                                      | 2.3 Kupfer-Zink-Legierungen (Messing, kurzspanend)                  | Copper-zinc alloys (brass, short-chipping)                            | ≤ 550 N/mm <sup>2</sup>   | CuZn36Pb3 (Ms58)                        | EN CW 603 N                          |
| H                                                    | 2.4 Kupfer-Aluminium-Legierungen (Alubronze, langspanend)           | Copper-aluminium alloys (alu bronze, long-chipping)                   | ≤ 800 N/mm <sup>2</sup>   | CuAl10Ni5Fe4                            | EN CW 307 G                          |
|                                                      | 2.5 Kupfer-Zinn-Legierungen (Zinnbronze, langspanend)               | Copper-tin alloys (tin bronze, long-chipping)                         | ≤ 700 N/mm <sup>2</sup>   | CuSn8P                                  | EN CW 459 K                          |
|                                                      | 2.6 Kupfer-Zinn-Legierungen (Zinnbronze, kurzspanend)               | Copper-tin alloys (tin bronze, short-chipping)                        | ≤ 400 N/mm <sup>2</sup>   | CuSn7 ZnPb (Rg7)                        | 2.1090                               |
|                                                      | 2.7 Kupfer-Sonderlegierungen                                        | Special copper alloys                                                 | ≤ 600 N/mm <sup>2</sup>   | (AMPCO® 8)                              |                                      |
|                                                      | 2.8 Kupfer-Sonderlegierungen                                        | Special copper alloys                                                 | ≤ 1400 N/mm <sup>2</sup>  | (AMPCO® 45)                             |                                      |
|                                                      | <b>Magnesium-Legierungen</b>                                        | <b>Magnesium alloys</b>                                               |                           |                                         |                                      |
| H                                                    | 3.1 Magnesium-Knetlegierungen                                       | Magnesium wrought alloys                                              | ≤ 500 N/mm <sup>2</sup>   | MgAl6Zn                                 | 3.5612                               |
|                                                      | 3.2 Magnesium-Gusslegierungen                                       | Magnesium cast alloys                                                 | ≤ 500 N/mm <sup>2</sup>   | EN-MCMgAl9Zn1                           | EN-MC21120                           |
|                                                      | <b>Kunststoffe</b>                                                  | <b>Synthetics</b>                                                     |                           |                                         |                                      |
|                                                      | 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                           |                                      |
| H                                                    | 4.4 Faserverstärkte Kunststoffe (Faseranteil > 30%)                 | Fibre-reinforced synthetics (fibre content > 30%)                     |                           | GFK, CFK, AFK                           |                                      |
|                                                      | <b>Besondere Werkstoffe</b>                                         | <b>Special materials</b>                                              |                           |                                         |                                      |
|                                                      | 5.1 Graphit                                                         | Graphite                                                              |                           | C 8000                                  |                                      |
|                                                      | 5.2 Wolfram-Kupfer-Legierungen                                      | Tungsten-copper alloys                                                |                           | W-Cu 80/20                              |                                      |
|                                                      | 5.3 Verbundwerkstoffe                                               | Composite materials                                                   |                           | Hyllite, Alucobond                      |                                      |
|                                                      | <b>Spezialwerkstoffe</b>                                            | <b>Special materials</b>                                              |                           |                                         |                                      |
| H                                                    | <b>Titan-Legierungen</b>                                            | <b>Titanium alloys</b>                                                |                           |                                         |                                      |
|                                                      | 1.1 Reintitan                                                       | Pure titanium                                                         | ≤ 450 N/mm <sup>2</sup>   | Ti1                                     | 3.7025                               |
|                                                      | 1.2 Titan-Legierungen                                               | Titanium alloys                                                       | ≤ 900 N/mm <sup>2</sup>   | TiAl6V4                                 | 3.7165                               |
|                                                      | 1.3 Titan-Legierungen                                               | Titanium alloys                                                       | ≤ 1250 N/mm <sup>2</sup>  | TiAl4Mo4Sn2                             | 3.7185                               |
|                                                      | <b>Nickel-, Kobalt- und Eisen-Legierungen</b>                       | <b>Nickel alloys, cobalt alloys and iron alloys</b>                   |                           |                                         |                                      |
|                                                      | 2.1 Reinnickel                                                      | Pure nickel                                                           | ≤ 600 N/mm <sup>2</sup>   | Ni 99.6                                 | 2.4060                               |
| H                                                    | 2.2 Nickel-Basis-Legierungen                                        | Nickel-base alloys                                                    | ≤ 1000 N/mm <sup>2</sup>  | Monel 400                               | 2.4360                               |
|                                                      | 2.3 Nickel-Basis-Legierungen                                        | Nickel-base alloys                                                    | ≤ 1600 N/mm <sup>2</sup>  | Inconel 718                             | 2.4668                               |
|                                                      | 2.4 Kobalt-Basis-Legierungen                                        | Cobalt-base alloys                                                    | ≤ 1000 N/mm <sup>2</sup>  | Udimet 605                              |                                      |
|                                                      | 2.5 Eisen-Basis-Legierungen                                         | Iron-base alloys                                                      | ≤ 1600 N/mm <sup>2</sup>  | Haynes 25                               | 2.4964                               |
|                                                      | 2.6 Eisen-Basis-Legierungen                                         | Iron-base alloys                                                      | ≤ 1500 N/mm <sup>2</sup>  | Incoloy 800                             | 1.4958                               |
|                                                      | <b>Harte Werkstoffe</b>                                             | <b>Hard materials</b>                                                 |                           |                                         |                                      |
| H                                                    | 1.1 Hochfeste Stähle, gehärtete Stähle, Hartguss                    | High strength steels, hardened steels, hard castings                  | 44 - 50 HRC               | Weldox 1100                             |                                      |
|                                                      | 1.2 Hochfeste Stähle, gehärtete Stähle, Hartguss                    | High strength steels, hardened steels, hard castings                  | 50 - 55 HRC               | Hardox 550                              |                                      |
|                                                      | 1.3 Hochfeste Stähle, gehärtete Stähle, Hartguss                    | High strength steels, hardened steels, hard castings                  | 55 - 60 HRC               | Armox 600T                              |                                      |
|                                                      | 1.4 Hochfeste Stähle, gehärtete Stähle, Hartguss                    | High strength steels, hardened steels, hard castings                  | 60 - 63 HRC               | Ferro-Titanit                           |                                      |
|                                                      | 1.5 Hochfeste Stähle, gehärtete Stähle, Hartguss                    | High strength steels, hardened steels, hard castings                  | 63 - 66 HRC               | HSSE                                    |                                      |

Hartmetall-Kugelfräser  
Solid carbide ball nose end mills

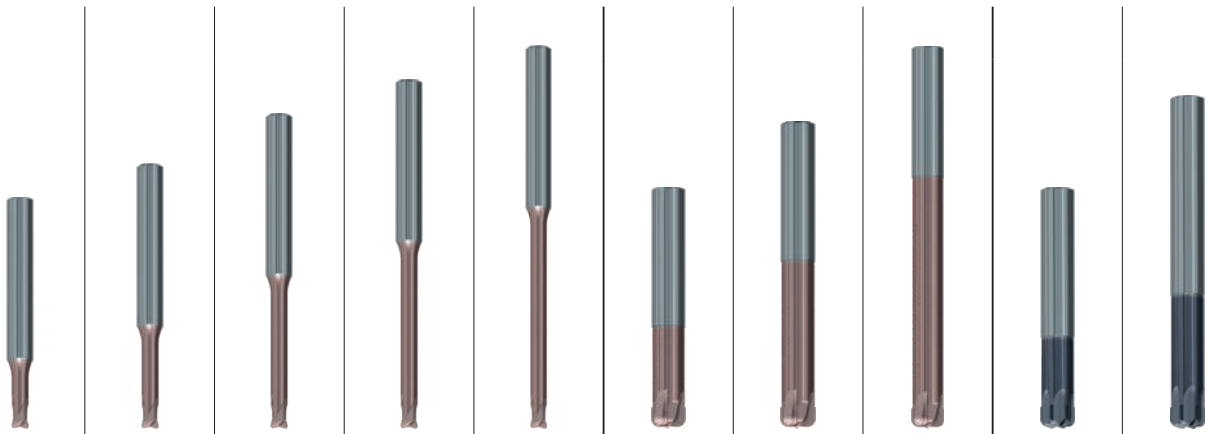


H

| 3 x d <sub>1</sub> | 5 x d <sub>1</sub> | 8 x d <sub>1</sub> | 10 x d <sub>1</sub> | 12 x d <sub>1</sub> | 16 x d <sub>1</sub> | 1,5 x d <sub>1</sub> | 3 x d <sub>1</sub> | 5 x d <sub>1</sub> | 8 x d <sub>1</sub> | 3 x d <sub>1</sub> | 5 x d <sub>1</sub> | 8 x d <sub>1</sub> | –        | –        | l <sub>3</sub>                  |
|--------------------|--------------------|--------------------|---------------------|---------------------|---------------------|----------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------|----------|---------------------------------|
| ø0,4-6mm           | ø0,4-6mm           | ø0,4-6mm           | ø0,4-6mm            | ø0,4-6mm            | ø1-2mm              | ø0,5-3mm             | ø0,5-12mm          | ø0,5-12mm          | ø0,5-8mm           | ø2-12mm            | ø2-12mm            | ø2-8mm             | ø10-12mm | ø10-16mm | d <sub>1</sub>                  |
| 2                  | 2                  | 2                  | 2                   | 2                   | 2                   | 2                    | 2                  | 2                  | 2                  | 4                  | 4                  | 4                  | 6-8      | 6-8      | Z (Flutes)                      |
| 3860A              | 3861A              | 3862A              | 3863A               | 3864A               | 3865A               | 3826A                | 3827A              | 3828A              | 3829A              | 3831A              | 3832A              | 3833A              | 2836A    | 2837A    |                                 |
| 8                  | 10                 | 12                 | 12                  | 14                  | 14                  | 16                   | 16                 | 18                 | 20                 | 22                 | 24                 | 26                 | 28       | 28       | Seite · Page                    |
| 9                  | 11                 | 13                 | 13                  | 15                  | 15                  | 17                   | 17                 | 19                 | 21                 | 23                 | 25                 | 27                 | 29       | 29       | v <sub>c</sub> / f <sub>z</sub> |

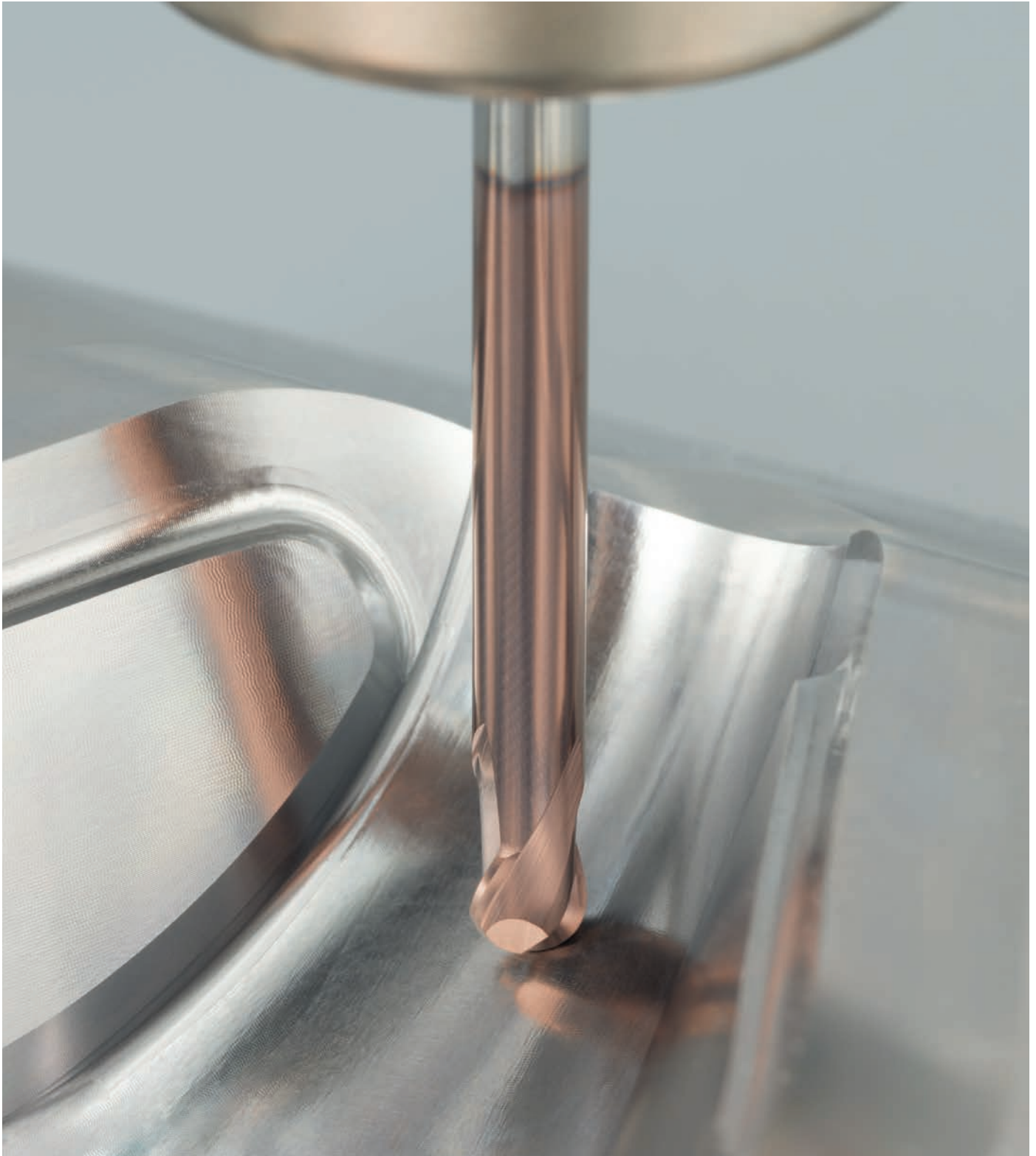
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|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.1 | M |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 3.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 4.1 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.1 | K |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.2 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.1 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.2 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 3.1 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 3.2 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 4.1 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 4.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.1 | N |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.3 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.4 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.5 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.6 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input type="checkbox"/>            | <input type="checkbox"/>            | 2.3 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.4 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.5 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input type="checkbox"/>            | <input type="checkbox"/>            | 2.6 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.7 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.8 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 3.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 3.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 4.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 4.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 4.3 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 4.4 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 5.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 5.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 5.3 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |     |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 1.1 | S |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.3 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | 2.1 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.2 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.3 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.4 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.5 |   |
|                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2.6 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.1 | H |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.2 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.3 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.4 |   |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1.5 |   |

**Hartmetall-Torusfräser**  
Solid carbide torus end mills



**H**

| $l_3$                                                                                        | 3 x $d_1$    | 5 x $d_1$                           | 8 x $d_1$                           | 10 x $d_1$                          | 12 x $d_1$                          | 3 x $d_1$                           | 5 x $d_1$                           | 8 x $d_1$                           | –                                   | –                                   |
|----------------------------------------------------------------------------------------------|--------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| $d_1$                                                                                        | ø0,5-6mm     | ø0,5-6mm                            | ø0,5-6mm                            | ø0,5-6mm                            | ø0,5-6mm                            | ø2-16mm                             | ø2-16mm                             | ø2-8mm                              | ø10-12mm                            | ø10-16mm                            |
| Z (Flutes)                                                                                   | 2            | 2                                   | 2                                   | 2                                   | 2                                   | 4                                   | 4                                   | 4                                   | 6-8                                 | 6-8                                 |
|              | <b>3867A</b> | <b>3868A</b>                        | <b>3869A</b>                        | <b>3870A</b>                        | <b>3871A</b>                        | <b>3874A</b>                        | <b>3875A</b>                        | <b>3876A</b>                        | <b>2876A</b>                        | <b>2877A</b>                        |
| Seite · Page                                                                                 | 30           | 32                                  | 34                                  | 36                                  | 38                                  | 40                                  | 42                                  | 44                                  | 46                                  | 46                                  |
|  $v_c / f_z$ | 31           | 33                                  | 35                                  | 37                                  | 39                                  | 41                                  | 43                                  | 45                                  | 47                                  | 47                                  |
| <b>P</b>                                                                                     | 1.1          | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |                                     |
|                                                                                              | 2.1          | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |                                     |
|                                                                                              | 3.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
|                                                                                              | 4.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
|                                                                                              | 5.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| <b>M</b>                                                                                     | 1.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 2.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 3.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 4.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
| <b>K</b>                                                                                     | 1.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 1.2          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.2          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 3.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 3.2          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 4.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 4.2          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 4.2          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| <b>N</b>                                                                                     | 1.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 1.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 1.3          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 1.4          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 1.5          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 1.6          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 2.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 2.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 2.3          |                                     |                                     |                                     |                                     | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
|                                                                                              | 2.4          |                                     |                                     |                                     |                                     | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
|                                                                                              | 2.5          |                                     |                                     |                                     |                                     | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
|                                                                                              | 2.6          |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
|                                                                                              | 2.7          |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |                                     |
|                                                                                              | 2.8          |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |                                     |                                     |
|                                                                                              | 3.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 3.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 4.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 4.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 4.3          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 4.4          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 5.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 5.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 5.3          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
| <b>S</b>                                                                                     | 1.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |                                     |
|                                                                                              | 1.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 1.3          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.1          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.2          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.3          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.4          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 2.5          |                                     |                                     |                                     |                                     |                                     |                                     |                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| <b>H</b>                                                                                     | 1.1          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 1.2          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 1.3          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 1.4          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                                                              | 1.5          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

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Anmelden  Warenkorb  
 Unternehmen



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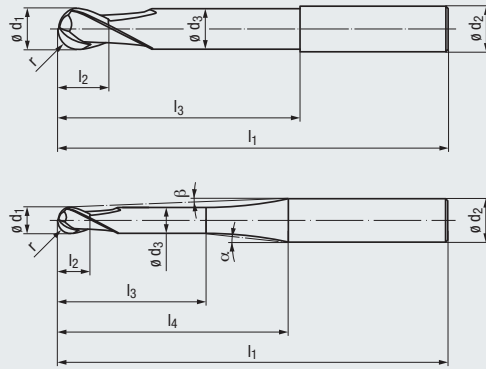
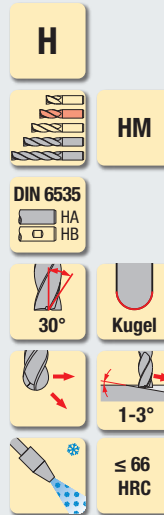
Bei Registrierung stehen Ihnen noch weitere Produktdaten und Funktionen zur Verfügung. Dazu zählen neben standardisierten Werkzeugdaten (2D / 3D / Sachmerkmale) auch eine Bestell- oder Angebotshistorie, individuelle Merklisen sowie weitere nützliche Funktionen.

The QR code shown with the tools will take you directly to the respective articles in our web store where you can find comprehensive tool information and cutting data.

Registration provides you with additional product data and functions. These include standardised tool data (2D / 3D / characteristics), an order or quotation history and individual watch lists as well as other useful functions.

- Hochleistungswerkzeug
- 6 zylindrische Halslängen bis 16 x d<sub>1</sub> verfügbar
- Hochgenauer Radius
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- 6 cylindrical neck lengths up to 16 x d<sub>1</sub> available
- High-precision radius
- Highly precise straight shank with tolerance h4



new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

#### l<sub>3</sub> = 3 x d<sub>1</sub> – Kurze Ausführung · Short design

#### Bestell-Code · Order code

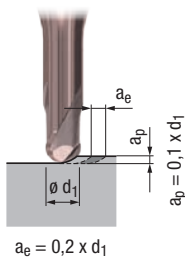
| ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | ø d <sub>3</sub> | l <sub>4</sub> | ø d <sub>2</sub><br>h4 | α     | β     | Z<br>(Flutes) | Dimens.-<br>Code | 3860A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------------|-------|-------|---------------|------------------|-------|--|
| -0,014           | -0,007 |                |                |                |                  |                |                        |       |       |               |                  |       |  |
| 0,4              | 0,2    | 0,3            | 1,2            | 57             | 0,35             | 8              | 6                      | 23°   | 20°   | 2             | .0004            | ●     |  |
| 0,5              | 0,25   | 0,4            | 1,5            | 57             | 0,45             | 8,5            | 6                      | 22,5° | 18,5° | 2             | .0005            | ●     |  |
| 0,6              | 0,3    | 0,5            | 1,8            | 57             | 0,55             | 8,5            | 6                      | 23°   | 18,5° | 2             | .0006            | ●     |  |
| 0,8              | 0,4    | 0,5            | 2,4            | 57             | 0,75             | 9              | 6                      | 22,5° | 17°   | 2             | .0008            | ●     |  |
| 1                | 0,5    | 1              | 3              | 57             | 0,95             | 9,5            | 6                      | 22°   | 15,5° | 2             | .001             | ●     |  |
| 1,2              | 0,6    | 1              | 3,6            | 57             | 1,15             | 10             | 6                      | 21,5° | 14°   | 2             | .0012            | ●     |  |
| 1,5              | 0,75   | 1,25           | 4,5            | 57             | 1,4              | 10,5           | 6                      | 21,5° | 12,5° | 2             | .0015            | ●     |  |
| 2                | 1      | 1,5            | 6              | 57             | 1,9              | 11,5           | 6                      | 21°   | 10,5° | 2             | .002             | ●     |  |
| 3                | 1,5    | 2              | 9              | 57             | 2,9              | 14,5           | 6                      | 16,5° | 6,5°  | 2             | .003             | ●     |  |
| 4                | 2      | 2,5            | 12             | 57             | 3,9              | 16             | 6                      | 15,5° | 4°    | 2             | .004             | ●     |  |
| 5                | 2,5    | 3              | 15             | 57             | 4,9              | 18             | 6                      | 11°   | 2°    | 2             | .005             | ●     |  |
| 6                | 3      | 3,5            | 20             | 57             | 5,9              | —              | 6                      | —     | —     | 2             | .006             | ●     |  |


**Hartmetall-Kugelfräser – kurze Ausführung (2 Schneiden)**  
 Solid carbide ball nose end mills – short design (2 flutes)

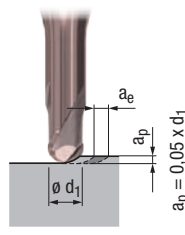
 Gültig für · Valid for  
 3860A

H

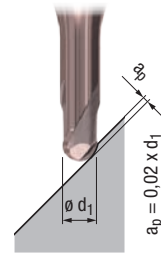
$$l_3 = 3 \times d_1$$

 Schruppen  
 Roughing


$$a_e = 0,2 \times d_1$$

 Vorschlichten  
 Pre-finishing


$$a_e = 0,1 \times d_1$$

 Schlichten  
 Finishing


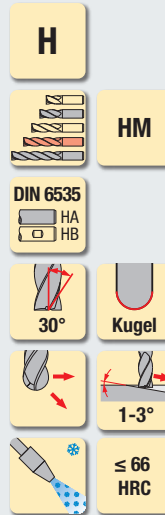
|                                          |                                                                                       | $v_c$<br>[m/min]                             | $f_z$<br>[mm]          | $v_c$<br>[m/min] | $f_z$<br>[mm]          | $v_c$<br>[m/min] | $f_z$<br>[mm]          |  |  |  |  |
|------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------|------------------------|------------------|------------------------|------------------|------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| P                                        | Stahlwerkstoffe · Steel materials                                                     |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.1                                                                                   | 260                                          | 0,013 x d <sub>1</sub> | 320              | 0,015 x d <sub>1</sub> | 360              | 0,013 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |
|                                          | 2.1                                                                                   | 240                                          | 0,012 x d <sub>1</sub> | 280              | 0,014 x d <sub>1</sub> | 320              | 0,012 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |
|                                          | 3.1                                                                                   | 220                                          | 0,011 x d <sub>1</sub> | 240              | 0,013 x d <sub>1</sub> | 280              | 0,011 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            |                                                                                     |
|                                          | 4.1                                                                                   | 200                                          | 0,010 x d <sub>1</sub> | 220              | 0,012 x d <sub>1</sub> | 240              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            |                                                                                     |
|                                          | 5.1                                                                                   | 180                                          | 0,009 x d <sub>1</sub> | 200              | 0,010 x d <sub>1</sub> | 220              | 0,009 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            |                                                                                     |
| M                                        | Nichtrostende Stahlwerkstoffe · Stainless steel materials                             |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.1                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.1                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 3.1                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 4.1                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| K                                        | Gusswerkstoffe · Cast materials                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.1                                                                                   | 260                                          | 0,011 x d <sub>1</sub> | 320              | 0,013 x d <sub>1</sub> | 360              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|                                          | 1.2                                                                                   | 260                                          | 0,011 x d <sub>1</sub> | 320              | 0,013 x d <sub>1</sub> | 360              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|                                          | 2.1                                                                                   | 240                                          | 0,011 x d <sub>1</sub> | 280              | 0,013 x d <sub>1</sub> | 320              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|                                          | 2.2                                                                                   | 240                                          | 0,011 x d <sub>1</sub> | 280              | 0,013 x d <sub>1</sub> | 320              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|                                          | 3.1                                                                                   | 220                                          | 0,010 x d <sub>1</sub> | 240              | 0,011 x d <sub>1</sub> | 270              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 3.2                                                                                   | 220                                          | 0,010 x d <sub>1</sub> | 240              | 0,011 x d <sub>1</sub> | 270              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 4.1                                                                                   | 200                                          | 0,008 x d <sub>1</sub> | 220              | 0,009 x d <sub>1</sub> | 240              | 0,007 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 4.2                                                                                   | 180                                          | 0,008 x d <sub>1</sub> | 200              | 0,009 x d <sub>1</sub> | 220              | 0,007 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | N                                                                                     | Nichteisenwerkstoffe · Non-ferrous materials |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Aluminium-Legierungen · Aluminium alloys |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.2                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.3                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.4                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.5                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.6                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 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                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 5.2                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 5.3                                      |                                                                                       |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| S                                        | Spezialwerkstoffe · Special materials                                                 |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | Titan-Legierungen · Titanium alloys                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.1                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.2                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.3                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.1                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.2                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.3                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.4                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.5                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 2.6                                                                                   |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| H                                        | Harte Werkstoffe · Hard materials                                                     |                                              |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                          | 1.1                                                                                   | 160                                          | 0,008 x d <sub>1</sub> | 200              | 0,009 x d <sub>1</sub> | 220              | 0,009 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 1.2                                                                                   | 120                                          | 0,007 x d <sub>1</sub> | 180              | 0,008 x d <sub>1</sub> | 200              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 1.3                                                                                   |                                              |                        | 160              | 0,008 x d <sub>1</sub> | 180              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 1.4                                                                                   |                                              |                        | 140              | 0,007 x d <sub>1</sub> | 160              | 0,007 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|                                          | 1.5                                                                                   |                                              |                        | 120              | 0,006 x d <sub>1</sub> | 140              | 0,006 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |

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

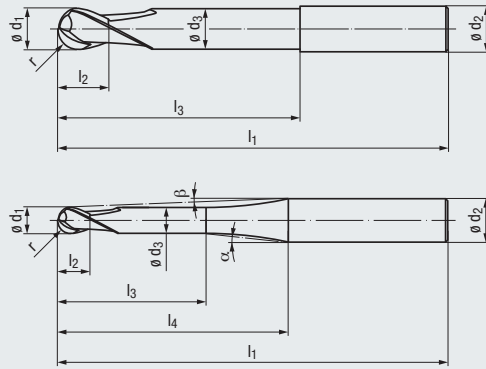
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 6 zylindrische Halslängen bis 16 x d<sub>1</sub> verfügbar
- Hochgenauer Radius
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- 6 cylindrical neck lengths up to 16 x d<sub>1</sub> available
- High-precision radius
- Highly precise straight shank with tolerance h4



new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

#### l<sub>3</sub> = 5 x d<sub>1</sub> – Lange Ausführung · Long design

#### Bestell-Code · Order code

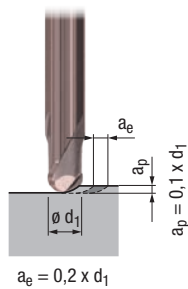
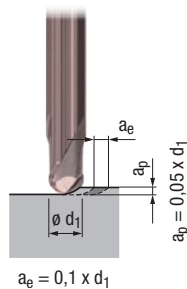
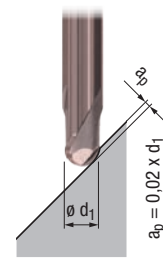
| Ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | Ø d <sub>3</sub> | l <sub>4</sub> | Ø d <sub>2</sub><br>h4 | α     | β     | Z<br>(Flutes) | Dimens.-<br>Code | 3861A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------------|-------|-------|---------------|------------------|-------|--|
| -0,014           | -0,007 |                |                |                |                  |                |                        |       |       |               |                  |       |  |
| 0,4              | 0,2    | 0,3            | 2              | 57             | 0,35             | 8,5            | 6                      | 24°   | 19°   | 2             | .0004            | ●     |  |
| 0,5              | 0,25   | 0,4            | 2,5            | 57             | 0,45             | 9,5            | 6                      | 22,5° | 17°   | 2             | .0005            | ●     |  |
| 0,6              | 0,3    | 0,5            | 3              | 57             | 0,55             | 9,5            | 6                      | 23,5° | 16,5° | 2             | .0006            | ●     |  |
| 0,8              | 0,4    | 0,5            | 4              | 57             | 0,75             | 10,5           | 6                      | 22,5° | 14,5° | 2             | .0008            | ●     |  |
| 1                | 0,5    | 1              | 5              | 57             | 0,95             | 11,5           | 6                      | 22°   | 13°   | 2             | .001             | ●     |  |
| 1,2              | 0,6    | 1              | 6              | 57             | 1,15             | 12             | 6                      | 22,5° | 12°   | 2             | .0012            | ●     |  |
| 1,5              | 0,75   | 1,25           | 7,5            | 57             | 1,4              | 13,5           | 6                      | 21,5° | 10°   | 2             | .0015            | ●     |  |
| 2                | 1      | 1,5            | 10             | 57             | 1,9              | 14             | 6                      | 28°   | 9°    | 2             | .002             | ●     |  |
| 3                | 1,5    | 2              | 15             | 57             | 2,9              | 20,5           | 6                      | 16°   | 5°    | 2             | .003             | ●     |  |
| 4                | 2      | 2,5            | 20             | 63             | 3,9              | 24             | 6                      | 15,5° | 3°    | 2             | .004             | ●     |  |
| 5                | 2,5    | 3              | 25             | 72             | 4,9              | 35             | 6                      | 4°    | 1,5°  | 2             | .005             | ●     |  |
| 6                | 3      | 3,5            | 30             | 72             | 5,9              | —              | 6                      | —     | —     | 2             | .006             | ●     |  |


**Hartmetall-Kugelfräser – lange Ausführung (2-Schneiden)**  
 Solid carbide ball nose end mills – long design (2 flutes)

 Gültig für · Valid for  
 3861A

H

$$l_3 = 5 \times d_1$$

 Schruppen  
 Roughing

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

**Stahlwerkstoffe · Steel materials**

|   |     |     |                    |     |                    |     |                    |                          |                                     |                          |                                     |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P | 1.1 | 240 | $0,013 \times d_1$ | 300 | $0,015 \times d_1$ | 340 | $0,013 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 2.1 | 220 | $0,012 \times d_1$ | 260 | $0,014$            | 340 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 3.1 | 200 | $0,011 \times d_1$ | 220 | $0,013 \times d_1$ | 260 | $0,011 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
|   | 4.1 | 180 | $0,010 \times d_1$ | 200 | $0,012 \times d_1$ | 220 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
|   | 5.1 | 160 | $0,009 \times d_1$ | 180 | $0,010 \times d_1$ | 200 | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

**Nichtrostende Stahlwerkstoffe · Stainless steel materials**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| M | 1.1 |  |  |  |  |  |  |  |  |  |  |
|   | 2.1 |  |  |  |  |  |  |  |  |  |  |
|   | 3.1 |  |  |  |  |  |  |  |  |  |  |
|   | 4.1 |  |  |  |  |  |  |  |  |  |  |

**Gusswerkstoffe · Cast materials**

|   |     |     |                    |     |                    |     |                    |                          |                                     |                          |                          |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|
| K | 1.1 | 240 | $0,011 \times d_1$ | 300 | $0,013 \times d_1$ | 340 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 | 240 | $0,011 \times d_1$ | 300 | $0,013 \times d_1$ | 340 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.1 | 220 | $0,011 \times d_1$ | 260 | $0,013 \times d_1$ | 300 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.2 | 220 | $0,011 \times d_1$ | 260 | $0,013 \times d_1$ | 300 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.1 | 200 | $0,010 \times d_1$ | 220 | $0,011 \times d_1$ | 250 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.2 | 200 | $0,010 \times d_1$ | 220 | $0,011 \times d_1$ | 250 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.1 | 180 | $0,008 \times d_1$ | 200 | $0,009 \times d_1$ | 220 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.2 | 160 | $0,008 \times d_1$ | 180 | $0,009 \times d_1$ | 200 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Nichteisenwerkstoffe · Non-ferrous materials**
**Aluminium-Legierungen · Aluminium alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| N | 1.1 |  |  |  |  |  |  |  |  |  |  |
|   | 1.2 |  |  |  |  |  |  |  |  |  |  |
|   | 1.3 |  |  |  |  |  |  |  |  |  |  |
|   | 1.4 |  |  |  |  |  |  |  |  |  |  |
|   | 1.5 |  |  |  |  |  |  |  |  |  |  |
|   | 1.6 |  |  |  |  |  |  |  |  |  |  |
|   | 2.1 |  |  |  |  |  |  |  |  |  |  |
|   | 2.2 |  |  |  |  |  |  |  |  |  |  |
|   | 2.3 |  |  |  |  |  |  |  |  |  |  |
|   | 2.4 |  |  |  |  |  |  |  |  |  |  |
|   | 2.5 |  |  |  |  |  |  |  |  |  |  |
|   | 2.6 |  |  |  |  |  |  |  |  |  |  |
|   | 2.7 |  |  |  |  |  |  |  |  |  |  |
|   | 2.8 |  |  |  |  |  |  |  |  |  |  |
|   | 3.1 |  |  |  |  |  |  |  |  |  |  |
|   | 3.2 |  |  |  |  |  |  |  |  |  |  |

**Kupfer-Legierungen · Copper alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| N | 2.1 |  |  |  |  |  |  |  |  |  |  |
|   | 2.2 |  |  |  |  |  |  |  |  |  |  |
|   | 2.3 |  |  |  |  |  |  |  |  |  |  |
|   | 2.4 |  |  |  |  |  |  |  |  |  |  |
|   | 2.5 |  |  |  |  |  |  |  |  |  |  |
|   | 2.6 |  |  |  |  |  |  |  |  |  |  |
|   | 2.7 |  |  |  |  |  |  |  |  |  |  |
|   | 2.8 |  |  |  |  |  |  |  |  |  |  |

**Magnesium-Legierungen · Magnesium alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| N | 3.1 |  |  |  |  |  |  |  |  |  |  |
|   | 3.2 |  |  |  |  |  |  |  |  |  |  |

**Kunststoffe · Synthetics**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| N | 4.1 |  |  |  |  |  |  |  |  |  |  |
|   | 4.2 |  |  |  |  |  |  |  |  |  |  |
|   | 4.3 |  |  |  |  |  |  |  |  |  |  |
|   | 4.4 |  |  |  |  |  |  |  |  |  |  |

**Besondere Werkstoffe · Special materials**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| N | 5.1 |  |  |  |  |  |  |  |  |  |  |
|   | 5.2 |  |  |  |  |  |  |  |  |  |  |
|   | 5.3 |  |  |  |  |  |  |  |  |  |  |

**Spezialwerkstoffe · Special materials**
**Titan-Legierungen · Titanium alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| S | 1.1 |  |  |  |  |  |  |  |  |  |  |
|   | 1.2 |  |  |  |  |  |  |  |  |  |  |
|   | 1.3 |  |  |  |  |  |  |  |  |  |  |
|   | 2.1 |  |  |  |  |  |  |  |  |  |  |

**Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|
| S | 2.2 |  |  |  |  |  |  |  |  |  |  |
|   | 2.3 |  |  |  |  |  |  |  |  |  |  |
|   | 2.4 |  |  |  |  |  |  |  |  |  |  |
|   | 2.5 |  |  |  |  |  |  |  |  |  |  |
|   | 2.6 |  |  |  |  |  |  |  |  |  |  |
|   | 2.7 |  |  |  |  |  |  |  |  |  |  |

**Harte Werkstoffe · Hard materials**

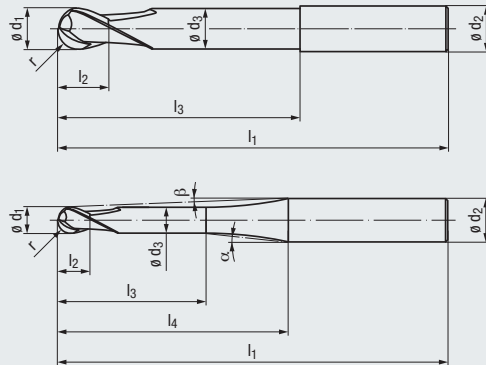
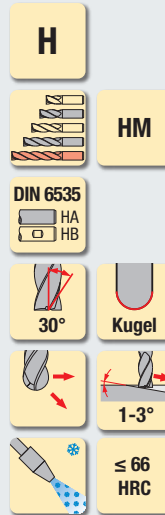
|   |     |     |                    |     |                    |     |                    |                          |                                     |                          |                          |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|
| H | 1.1 | 140 | $0,008 \times d_1$ | 180 | $0,009 \times d_1$ | 200 | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 | 110 | $0,007 \times d_1$ | 160 | $0,008 \times d_1$ | 180 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.3 |     |                    | 140 | $0,008 \times d_1$ | 160 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.4 |     |                    | 130 | $0,007 \times d_1$ | 140 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.5 |     |                    | 110 | $0,006 \times d_1$ | 130 | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.6 |     |                    |     |                    |     |                    | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 6 zylindrische Halslängen bis 16 x d<sub>1</sub> verfügbar
- Hochgenauer Radius
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- 6 cylindrical neck lengths up to 16 x d<sub>1</sub> available
- High-precision radius
- Highly precise straight shank with tolerance h4



new

new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

|   | TIALN   |         |   | TIALN   |         |
|---|---------|---------|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 | P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         | K | 1.1-4.2 |         |
| H | 1.1-1.5 |         | H | 1.1-1.5 |         |

#### l<sub>3</sub> = 8 x d<sub>1</sub> – Extra lange Ausführung · Extra long design

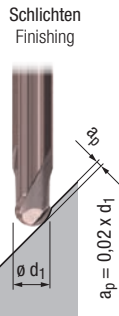
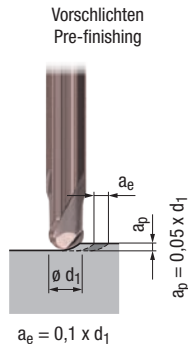
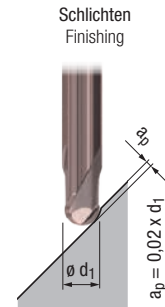
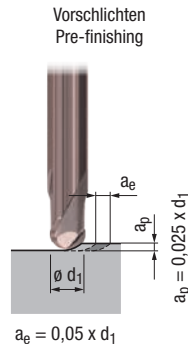
| Bestell-Code · Order code |        |                |                |                |                  |                |                  |       |       |          |              | 3862A |  |
|---------------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------|-------|-------|----------|--------------|-------|--|
| ø d <sub>1</sub>          | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | ø d <sub>3</sub> | l <sub>4</sub> | ø d <sub>2</sub> | α     | β     | Z        | Dimens.-Code |       |  |
| -0,014                    | -0,007 |                |                |                |                  |                | h4               |       |       | (Flutes) |              |       |  |
| 0,4                       | 0,2    | 0,3            | 3,2            | 57             | 0,35             | 9,5            | 6                | 25°   | 17°   | 2        | .0004        | ●     |  |
| 0,5                       | 0,25   | 0,4            | 4              | 57             | 0,45             | 11             | 6                | 22,5° | 14,5° | 2        | .0005        | ●     |  |
| 0,6                       | 0,3    | 0,5            | 4,8            | 57             | 0,55             | 11             | 6                | 24,5° | 14,5° | 2        | .0006        | ●     |  |
| 0,8                       | 0,4    | 0,5            | 6,4            | 57             | 0,75             | 13             | 6                | 22,5° | 12°   | 2        | .0008        | ●     |  |
| 1                         | 0,5    | 1              | 8              | 57             | 0,95             | 14,5           | 6                | 22°   | 10,5° | 2        | .001         | ●     |  |
| 1,2                       | 0,6    | 1              | 9,6            | 57             | 1,15             | 16             | 6                | 21,5° | 9°    | 2        | .0012        | ●     |  |
| 1,5                       | 0,75   | 1,25           | 12             | 57             | 1,4              | 18             | 6                | 21,5° | 8°    | 2        | .0015        | ●     |  |
| 2                         | 1      | 1,5            | 16             | 57             | 1,9              | 20             | 6                | 28°   | 6,5°  | 2        | .002         | ●     |  |
| 3                         | 1,5    | 2              | 24             | 68             | 2,9              | 30             | 6                | 15°   | 3,5°  | 2        | .003         | ●     |  |
| 4                         | 2      | 2,5            | 32             | 80             | 3,9              | 42             | 6                | 6,5°  | 2°    | 2        | .004         | ●     |  |
| 5                         | 2,5    | 3              | 40             | 80             | 4,9              | 43             | 6                | 11°   | 1,5°  | 2        | .005         | ●     |  |
| 6                         | 3      | 3,5            | 48             | 86             | 5,9              | –              | 6                | –     | –     | 2        | .006         | ●     |  |

#### l<sub>3</sub> = 10 x d<sub>1</sub> – Extra lange Ausführung · Extra long design

| Bestell-Code · Order code |        |                |                |                |                  |                |                  |       |       |          |              | 3863A |  |
|---------------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------|-------|-------|----------|--------------|-------|--|
| ø d <sub>1</sub>          | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | ø d <sub>3</sub> | l <sub>4</sub> | ø d <sub>2</sub> | α     | β     | Z        | Dimens.-Code |       |  |
| -0,014                    | -0,007 |                |                |                |                  |                | h4               |       |       | (Flutes) |              |       |  |
| 0,4                       | 0,2    | 0,3            | 4              | 57             | 0,35             | 10,5           | 6                | 24°   | 15,5° | 2        | .0004        | ●     |  |
| 0,5                       | 0,25   | 0,4            | 5              | 57             | 0,45             | 12             | 6                | 22,5° | 13,5° | 2        | .0005        | ●     |  |
| 0,6                       | 0,3    | 0,5            | 6              | 57             | 0,55             | 12,5           | 6                | 23,5° | 13°   | 2        | .0006        | ●     |  |
| 0,8                       | 0,4    | 0,5            | 8              | 57             | 0,75             | 14,5           | 6                | 22,5° | 11°   | 2        | .0008        | ●     |  |
| 1                         | 0,5    | 1              | 10             | 57             | 0,95             | 16,5           | 6                | 22°   | 9,5°  | 2        | .001         | ●     |  |
| 1,2                       | 0,6    | 1              | 12             | 57             | 1,15             | 18,5           | 6                | 21°   | 8°    | 2        | .0012        | ●     |  |
| 1,5                       | 0,75   | 1,25           | 15             | 57             | 1,4              | 20             | 6                | 25,5° | 7°    | 2        | .0015        | ●     |  |
| 2                         | 1      | 1,5            | 20             | 63             | 1,9              | 24             | 6                | 28°   | 5,5°  | 2        | .002         | ●     |  |
| 3                         | 1,5    | 2              | 30             | 72             | 2,9              | 35             | 6                | 18°   | 3°    | 2        | .003         | ●     |  |
| 4                         | 2      | 2,5            | 40             | 80             | 3,9              | 44             | 6                | 15,5° | 2°    | 2        | .004         | ●     |  |
| 5                         | 2,5    | 3              | 50             | 100            | 4,9              | 53             | 6                | 11°   | 1°    | 2        | .005         | ●     |  |
| 6                         | 3      | 3,5            | 60             | 100            | 5,9              | –              | 6                | –     | –     | 2        | .006         | ●     |  |


**Hartmetall-Kugelfräser – extra lange Ausführung (2-Schneiden)**  
 Solid carbide ball nose end mills – extra long design (2 flutes)

H

 Gültig für · Valid for  
 3862A  
 3863A
 $l_3 = 8 \times d_1$  $l_3 = 10 \times d_1$ 
 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]
**Stahlwerkstoffe · Steel materials**

|   |     |     |                    |     |                    |     |                    |     |                    |                          |                                     |                          |                                     |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P | 1.1 | 240 | $0,013 \times d_1$ | 280 | $0,013 \times d_1$ | 240 | $0,013 \times d_1$ | 280 | $0,013 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 2.1 | 220 | $0,012 \times d_1$ | 260 | $0,012 \times d_1$ | 220 | $0,012 \times d_1$ | 260 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 3.1 | 200 | $0,011 \times d_1$ | 240 | $0,011 \times d_1$ | 200 | $0,011 \times d_1$ | 240 | $0,011 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 4.1 | 180 | $0,010 \times d_1$ | 210 | $0,010 \times d_1$ | 180 | $0,010 \times d_1$ | 210 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 5.1 | 160 | $0,009 \times d_1$ | 190 | $0,009 \times d_1$ | 160 | $0,009 \times d_1$ | 190 | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

**Nichtrostende Stahlwerkstoffe · Stainless steel materials**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| M | 1.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 4.1 |  |  |  |  |  |  |  |  |  |  |  |  |

**Gusswerkstoffe · Cast materials**

|   |     |     |                    |     |                    |     |                    |     |                    |                          |                                     |                          |                          |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|
| K | 1.1 | 240 | $0,011 \times d_1$ | 280 | $0,010 \times d_1$ | 240 | $0,011 \times d_1$ | 280 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 | 240 | $0,011 \times d_1$ | 280 | $0,010 \times d_1$ | 240 | $0,011 \times d_1$ | 280 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.1 | 220 | $0,011 \times d_1$ | 260 | $0,010 \times d_1$ | 220 | $0,011 \times d_1$ | 260 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.2 | 220 | $0,011 \times d_1$ | 260 | $0,010 \times d_1$ | 220 | $0,011 \times d_1$ | 260 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.1 | 200 | $0,010 \times d_1$ | 240 | $0,008 \times d_1$ | 200 | $0,010 \times d_1$ | 240 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.2 | 200 | $0,010 \times d_1$ | 240 | $0,008 \times d_1$ | 200 | $0,010 \times d_1$ | 240 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.1 | 180 | $0,008 \times d_1$ | 210 | $0,007 \times d_1$ | 180 | $0,008 \times d_1$ | 210 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.2 | 160 | $0,008 \times d_1$ | 190 | $0,007 \times d_1$ | 160 | $0,008 \times d_1$ | 190 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Nichteisenwerkstoffe · Non-ferrous materials****Aluminium-Legierungen · Aluminium alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| N | 1.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.3 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.4 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.5 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.6 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.3 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.4 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.5 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.6 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.7 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.8 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3.2 |  |  |  |  |  |  |  |  |  |  |  |  |

**Kupfer-Legierungen · Copper alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| N | 2.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.3 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.4 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.5 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.6 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.7 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.8 |  |  |  |  |  |  |  |  |  |  |  |  |

**Magnesium-Legierungen · Magnesium alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| N | 3.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3.2 |  |  |  |  |  |  |  |  |  |  |  |  |

**Kunststoffe · Synthetics**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| N | 4.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 4.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 4.3 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 4.4 |  |  |  |  |  |  |  |  |  |  |  |  |

**Besondere Werkstoffe · Special materials**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| N | 5.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 5.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 5.3 |  |  |  |  |  |  |  |  |  |  |  |  |

**Spezialwerkstoffe · Special materials****Titan-Legierungen · Titanium alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| S | 1.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 1.3 |  |  |  |  |  |  |  |  |  |  |  |  |

**Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys**

|   |     |  |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| S | 2.1 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.2 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.3 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.4 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.5 |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 2.6 |  |  |  |  |  |  |  |  |  |  |  |  |

**Harte Werkstoffe · Hard materials**

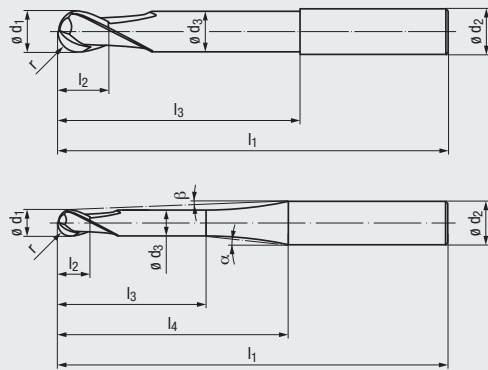
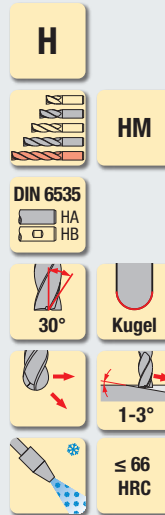
|   |     |     |                    |     |                    |     |                    |     |                    |                          |                                     |                          |                          |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|
| H | 1.1 | 140 | $0,008 \times d_1$ | 180 | $0,009 \times d_1$ | 140 | $0,008 \times d_1$ | 180 | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 | 120 | $0,007 \times d_1$ | 160 | $0,008 \times d_1$ | 120 | $0,007 \times d_1$ | 160 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.3 | 110 | $0,008 \times d_1$ | 140 | $0,008 \times d_1$ | 110 | $0,008 \times d_1$ | 140 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.4 | 100 | $0,007 \times d_1$ | 120 | $0,007 \times d_1$ | 100 | $0,007 \times d_1$ | 120 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.5 | 80  | $0,006 \times d_1$ | 100 | $0,006 \times d_1$ | 80  | $0,006 \times d_1$ | 100 | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 6 zylindrische Halslängen bis 16 x d<sub>1</sub> verfügbar
- Hochgenauer Radius
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- 6 cylindrical neck lengths up to 16 x d<sub>1</sub> available
- High-precision radius
- Highly precise straight shank with tolerance h4



new



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

TIALN

|   |         |         |   |         |         |
|---|---------|---------|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 | P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         | K | 1.1-4.2 |         |
| H | 1.1-1.5 |         | H | 1.1-1.5 |         |

**l<sub>3</sub> = 12 x d<sub>1</sub> – Extra lange Ausführung · Extra long design**

Bestell-Code · Order code

| Ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | Ø d <sub>3</sub> | l <sub>4</sub> | Ø d <sub>2</sub><br>h4 | α     | β     | Z<br>(Flutes) | Dimens.-<br>Code | 3864A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------------|-------|-------|---------------|------------------|-------|--|
| -0,014           | -0,007 |                |                |                |                  |                |                        |       |       |               |                  |       |  |
| 0,4              | 0,2    | 0,3            | 4,8            | 57             | 0,35             | 11,5           | 6                      | 23,5° | 14,5° | 2             | .0004            | ●     |  |
| 0,5              | 0,25   | 0,4            | 6              | 57             | 0,45             | 13             | 6                      | 22,5° | 12,5° | 2             | .0005            | ●     |  |
| 0,6              | 0,3    | 0,5            | 7,2            | 57             | 0,55             | 13,5           | 6                      | 24°   | 12°   | 2             | .0006            | ●     |  |
| 0,8              | 0,4    | 0,5            | 9,6            | 57             | 0,75             | 16             | 6                      | 23°   | 10°   | 2             | .0008            | ●     |  |
| 1                | 0,5    | 1              | 12             | 57             | 0,95             | 18,5           | 6                      | 22°   | 8,5°  | 2             | .001             | ●     |  |
| 1,2              | 0,6    | 1              | 14,4           | 57             | 1,15             | 21             | 6                      | 21°   | 7°    | 2             | .0012            | ●     |  |
| 1,5              | 0,75   | 1,25           | 18             | 63             | 1,4              | 24             | 6                      | 21,5° | 6°    | 2             | .0015            | ●     |  |
| 2                | 1      | 1,5            | 24             | 66             | 1,9              | 28             | 6                      | 28°   | 4,5°  | 2             | .002             | ●     |  |
| 3                | 1,5    | 2              | 36             | 80             | 2,9              | 42,5           | 6                      | 14°   | 2,5°  | 2             | .003             | ●     |  |
| 4                | 2      | 2,5            | 48             | 100            | 3,9              | 61             | 6                      | 5,5°  | 1,5°  | 2             | .004             | ●     |  |
| 5                | 2,5    | 3              | 60             | 100            | 4,9              | 63             | 6                      | 11°   | 1°    | 2             | .005             | ●     |  |
| 6                | 3      | 3,5            | 72             | 110            | 5,9              | –              | 6                      | –     | –     | 2             | .006             | ●     |  |

**l<sub>3</sub> = 16 x d<sub>1</sub> – Extra lange Ausführung · Extra long design**

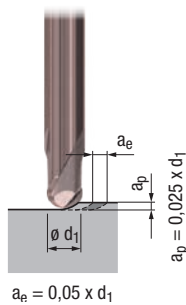
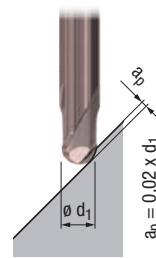
Bestell-Code · Order code

| Ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | Ø d <sub>3</sub> | l <sub>4</sub> | Ø d <sub>2</sub><br>h4 | α   | β    | Z<br>(Flutes) | Dimens.-<br>Code | 3865A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------------|-----|------|---------------|------------------|-------|--|
| -0,014           | -0,007 |                |                |                |                  |                |                        |     |      |               |                  |       |  |
| 1                | 0,5    | 1              | 16             | 57             | 0,95             | 20,5           | 6                      | 30° | 7,5° | 2             | .001             | ●     |  |
| 2                | 1      | 1,5            | 32             | 80             | 1,9              | 37,5           | 6                      | 21° | 3,1° | 2             | .002             | ●     |  |


**Hartmetall-Kugelfräser – extra lange Ausführung (2-Schneiden)**  
 Solid carbide ball nose end mills – extra long design (2 flutes)

H

$$l_3 = 12 \times d_1 \cdot l_3 = 16 \times d_1$$

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing

 Gültig für · Valid for  
 3864A  
 3865A

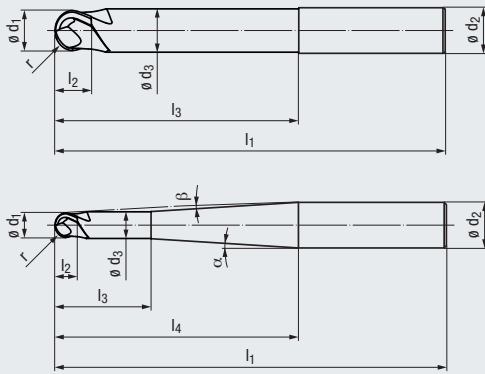
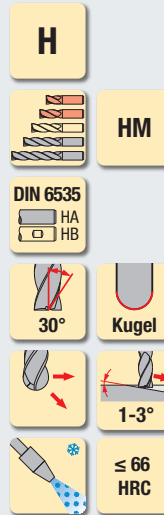
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>P</b>                                                         | 1.1                                                                                          | 240           | 0,013 x $d_1$    | 280           | 0,013 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,012 x $d_1$    | 260           | 0,012 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,011 x $d_1$    | 240           | 0,011 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,010 x $d_1$    | 210           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 160           | 0,009 x $d_1$    | 190           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>M</b>                                                         | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>K</b>                                                         | 1.1                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,008 x $d_1$    | 210           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 160           | 0,008 x $d_1$    | 190           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>N</b>                                                         | <b>Aluminium-Legierungen · Aluminium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>S</b>                                                         | <b>Titan-Legierungen · Titanium alloys</b>                                                   |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Harte Werkstoffe · Hard materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>H</b>                                                         | 1.1                                                                                          | 140           | 0,008 x $d_1$    | 180           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 120           | 0,007 x $d_1$    | 160           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 110           | 0,008 x $d_1$    | 140           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 100           | 0,007 x $d_1$    | 120           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 80            | 0,006 x $d_1$    | 100           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Optimierte Querschneide
- Hochgenauer Radius
- 4 Baulängen verfügbar
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- Optimised chisel edge
- High-precision radius
- 4 lengths available
- Highly precise straight shank with tolerance h4



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Schrappen, Schlichten sowie zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- Suitable for roughing, finishing and HSC finishing

new



new



TIALN

TIALN

|   |         |         |   |         |         |
|---|---------|---------|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 | P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         | K | 1.1-4.2 |         |
| H | 1.1-1.5 |         | H | 1.1-1.5 |         |

$l_3 = 1,5 \times d_1$  – Extra kurze Ausführung · Extra short design

Bestell-Code · Order code

| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z        | Dimens.-Code | 3826A |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|----------|--------------|-------|
| -0,014          | -0,007 |       |       |       |                 |       | h4              |          |         | (Flutes) |              |       |
| 0,5             | 0,25   | 0,5   | 0,75  | 54    | 0,45            | 16,4  | 6               | 10°      | 10°     | 2        | .0005        | ●     |
| 1               | 0,5    | 1     | 1,5   | 54    | 0,95            | 15,8  | 6               | 10°      | 9,5°    | 2        | .001         | ●     |
| 1,5             | 0,75   | 1,5   | 2,25  | 54    | 1,4             | 15,3  | 6               | 10°      | 9°      | 2        | .0015        | ●     |
| 2               | 1      | 2     | 3     | 54    | 1,8             | 14,9  | 6               | 10°      | 8°      | 2        | .002         | ●     |
| 3               | 1,5    | 3     | 4,5   | 54    | 2,8             | 13,5  | 6               | 10°      | 7°      | 2        | .003         | ●     |

$l_3 = 3 \times d_1$  – Kurze Ausführung · Short design

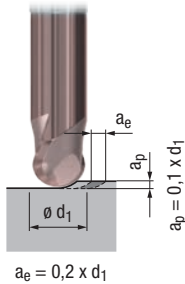
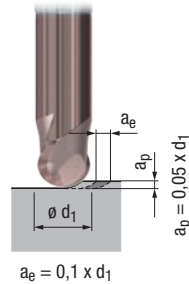
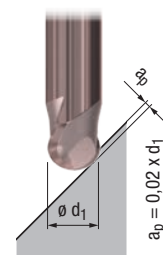
Bestell-Code · Order code

| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z        | Dimens.-Code | 3827A |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|----------|--------------|-------|
| -0,014          | -0,007 |       |       |       |                 |       | h4              |          |         | (Flutes) |              |       |
| 0,5             | 0,25   | 1     | 2     | 54    | 0,45            | 17,7  | 6               | 10°      | 9°      | 2        | .0005        | ●     |
| 1               | 0,5    | 2     | 4     | 57    | 0,95            | 18,3  | 6               | 10°      | 8,5°    | 2        | .001         | ●     |
| 1,5             | 0,75   | 2,5   | 4,5   | 57    | 1,4             | 17,5  | 6               | 10°      | 8,5°    | 2        | .0015        | ●     |
| 2               | 1      | 3     | 8     | 57    | 1,8             | 19,9  | 6               | 10°      | 6,5°    | 2        | .002         | ●     |
| 3               | 1,5    | 3,5   | 10    | 57    | 2,8             | 19    | 6               | 10°      | 5,5°    | 2        | .003         | ●     |
| 4               | 2      | 4     | 12    | 57    | 3,8             | 18,2  | 6               | 10°      | 3,5°    | 2        | .004         | ●     |
| 5               | 2,5    | 5     | 15    | 57    | 4,7             | 18,6  | 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    | 36    | 83    | 11,5            | —     | 12              | —        | —       | 2        | .012         | ●     |


**Hartmetall-Kugelfräser – extra kurze und kurze Ausführung (2 Schneiden)**  
 Solid carbide ball nose end mills – extra short and short design (2 flutes)

H

$$l_3 = 1,5 \times d_1 \cdot l_3 = 3 \times d_1$$

 Schruppen  
 Roughing

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing

 Gültig für · Valid for  
 3826A  
 3827A

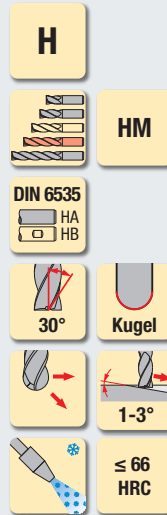

|   |                                                                                       | Stahlwerkstoffe · Steel materials                         |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|---|---------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------|-----|------------------------|-----|------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P | 1.1                                                                                   | 260                                                       | 0,013 x d <sub>1</sub> | 320 | 0,015 x d <sub>1</sub> | 360 | 0,013 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 2.1                                                                                   | 240                                                       | 0,012 x d <sub>1</sub> | 280 | 0,014 x d <sub>1</sub> | 320 | 0,012 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 3.1                                                                                   | 220                                                       | 0,011 x d <sub>1</sub> | 240 | 0,013 x d <sub>1</sub> | 280 | 0,011 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|   | 4.1                                                                                   | 200                                                       | 0,010 x d <sub>1</sub> | 220 | 0,012 x d <sub>1</sub> | 240 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|   | 5.1                                                                                   | 180                                                       | 0,009 x d <sub>1</sub> | 200 | 0,010 x d <sub>1</sub> | 220 | 0,009 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|   |                                                                                       | Nichtrostende Stahlwerkstoffe · Stainless steel materials |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| M | 1.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 3.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 4.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   |                                                                                       | Gusswerkstoffe · Cast materials                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| K | 1.1                                                                                   | 260                                                       | 0,011 x d <sub>1</sub> | 320 | 0,013 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 1.2                                                                                   | 260                                                       | 0,011 x d <sub>1</sub> | 320 | 0,013 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 2.1                                                                                   | 240                                                       | 0,011 x d <sub>1</sub> | 280 | 0,013 x d <sub>1</sub> | 320 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 2.2                                                                                   | 240                                                       | 0,011 x d <sub>1</sub> | 280 | 0,013 x d <sub>1</sub> | 320 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 3.1                                                                                   | 220                                                       | 0,010 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 3.2                                                                                   | 220                                                       | 0,010 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 4.1                                                                                   | 200                                                       | 0,008 x d <sub>1</sub> | 220 | 0,009 x d <sub>1</sub> | 240 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 4.2                                                                                   | 180                                                       | 0,008 x d <sub>1</sub> | 200 | 0,009 x d <sub>1</sub> | 220 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   |                                                                                       | Nichteisenwerkstoffe · Non-ferrous materials              |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| N | Aluminium-Legierungen · Aluminium alloys                                              |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.4                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.5                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.6                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 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                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 5.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 5.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   |                                                                                       | Spezialwerkstoffe · Special materials                     |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| S | Titan-Legierungen · Titanium alloys                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.4                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.5                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.6                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   |                                                                                       | Harte Werkstoffe · Hard materials                         |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| H | 1.1                                                                                   | 160                                                       | 0,008 x d <sub>1</sub> | 200 | 0,009 x d <sub>1</sub> | 220 | 0,009 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.2                                                                                   | 120                                                       | 0,007 x d <sub>1</sub> | 180 | 0,008 x d <sub>1</sub> | 200 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.3                                                                                   |                                                           |                        | 160 | 0,008 x d <sub>1</sub> | 180 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.4                                                                                   |                                                           |                        | 140 | 0,007 x d <sub>1</sub> | 160 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.5                                                                                   |                                                           |                        | 120 | 0,006 x d <sub>1</sub> | 140 | 0,006 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |

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

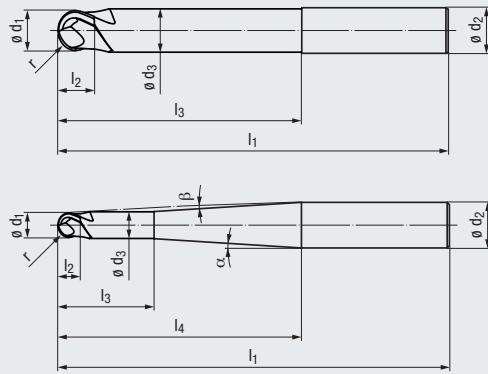
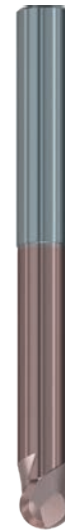
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Optimierte Querschnitte
- Hochgenauer Radius
- 4 Baulängen verfügbar
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- Optimised chisel edge
- High-precision radius
- 4 lengths available
- Highly precise straight shank with tolerance h4



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Schrappen, Schlichten sowie zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- Suitable for roughing, finishing and HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

$l_3 = 5 \times d_1$  – Lange Ausführung · Long design

Bestell-Code · Order code

3828A

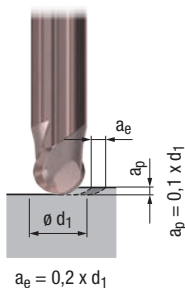
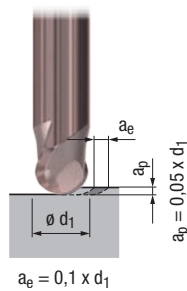
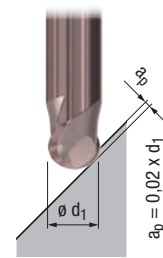
| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code |   |  |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|---------------|------------------|---|--|
| -0,014          | -0,007 |       |       |       |                 |       | h4              |          |         |               |                  |   |  |
| 0,5             | 0,25   | 1     | 2,5   | 57    | 0,45            | 18,2  | 6               | 10°      | 9°      | 2             | .0005            | ● |  |
| 1               | 0,5    | 2     | 5     | 57    | 0,95            | 19,3  | 6               | 10°      | 8°      | 2             | .001             | ● |  |
| 1,5             | 0,75   | 2,5   | 7,5   | 57    | 1,4             | 20,5  | 6               | 10°      | 6,5°    | 2             | .0015            | ● |  |
| 2               | 1      | 3     | 10    | 63    | 1,8             | 21,9  | 6               | 10°      | 5,5°    | 2             | .002             | ● |  |
| 3               | 1,5    | 3,5   | 15    | 63    | 2,8             | 24    | 6               | 10°      | 4°      | 2             | .003             | ● |  |
| 4               | 2      | 4     | 20    | 63    | 3,8             | 26,2  | 6               | 10°      | 2,5°    | 2             | .004             | ● |  |
| 5               | 2,5    | 5     | 25    | 66    | 4,7             | 28,6  | 6               | 10°      | 1,5°    | 2             | .005             | ● |  |
| 6               | 3      | 6     | 30    | 68    | 5,6             | —     | 6               | —        | —       | 2             | .006             | ● |  |
| 8               | 4      | 7     | 40    | 78    | 7,6             | —     | 8               | —        | —       | 2             | .008             | ● |  |
| 10              | 5      | 8     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 2             | .010             | ● |  |
| 12              | 6      | 10    | 60    | 106   | 11,5            | —     | 12              | —        | —       | 2             | .012             | ● |  |


**Hartmetall-Kugelfräser – lange Ausführung (2-Schneiden)**  
 Solid carbide ball nose end mills – long design (2 flutes)

 Gültig für · Valid for  
 3828A

H

$$l_3 = 5 \times d_1$$

 Schruppen  
 Roughing

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

 $v_c$   
 [m/min]

 $f_z$   
 [mm]

**Stahlwerkstoffe · Steel materials**

|   |     |     |                    |     |                    |     |                    |                          |                                     |                          |                                     |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P | 1.1 | 240 | $0,013 \times d_1$ | 300 | $0,015 \times d_1$ | 340 | $0,013 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 2.1 | 220 | $0,012 \times d_1$ | 260 | $0,014 \times d_1$ | 340 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 3.1 | 200 | $0,011 \times d_1$ | 220 | $0,013 \times d_1$ | 260 | $0,011 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
|   | 4.1 | 180 | $0,010 \times d_1$ | 200 | $0,012 \times d_1$ | 220 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
|   | 5.1 | 160 | $0,009 \times d_1$ | 180 | $0,010 \times d_1$ | 200 | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

**Nichtrostende Stahlwerkstoffe · Stainless steel materials**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                                     |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| M | 1.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 2.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 3.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 4.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

**Gusswerkstoffe · Cast materials**

|   |     |     |                    |     |                    |     |                    |                          |                                     |                          |                          |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|
| K | 1.1 | 240 | $0,011 \times d_1$ | 300 | $0,013 \times d_1$ | 340 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 | 240 | $0,011 \times d_1$ | 300 | $0,013 \times d_1$ | 340 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.1 | 220 | $0,011 \times d_1$ | 260 | $0,013 \times d_1$ | 300 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.2 | 220 | $0,011 \times d_1$ | 260 | $0,013 \times d_1$ | 300 | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.1 | 200 | $0,010 \times d_1$ | 220 | $0,011 \times d_1$ | 250 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.2 | 200 | $0,010 \times d_1$ | 220 | $0,011 \times d_1$ | 250 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.1 | 180 | $0,008 \times d_1$ | 200 | $0,009 \times d_1$ | 220 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.2 | 160 | $0,008 \times d_1$ | 180 | $0,009 \times d_1$ | 200 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Nichteisenwerkstoffe · Non-ferrous materials**
**Aluminium-Legierungen · Aluminium alloys**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| N | 1.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.4 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.5 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.6 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.4 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.5 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.6 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.7 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.8 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Kupfer-Legierungen · Copper alloys**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| N | 2.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.4 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.5 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.6 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.7 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.8 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Magnesium-Legierungen · Magnesium alloys**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| N | 3.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 3.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Kunststoffe · Synthetics**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| N | 4.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 4.4 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Besondere Werkstoffe · Special materials**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| N | 5.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 5.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 5.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Spezialwerkstoffe · Special materials**
**Titan-Legierungen · Titanium alloys**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| S | 1.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys**

|   |     |  |  |  |  |  |  |                          |                                     |                          |                          |
|---|-----|--|--|--|--|--|--|--------------------------|-------------------------------------|--------------------------|--------------------------|
| S | 2.1 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.2 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.3 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.4 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.5 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 2.6 |  |  |  |  |  |  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Harte Werkstoffe · Hard materials**

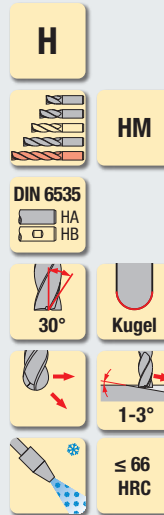
|   |     |     |                    |     |                    |     |                    |                          |                                     |                          |                          |
|---|-----|-----|--------------------|-----|--------------------|-----|--------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|
| H | 1.1 | 140 | $0,008 \times d_1$ | 180 | $0,009 \times d_1$ | 200 | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.2 | 110 | $0,007 \times d_1$ | 160 | $0,008 \times d_1$ | 180 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.3 |     |                    | 140 | $0,008 \times d_1$ | 160 | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.4 |     |                    | 130 | $0,007 \times d_1$ | 140 | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1.5 |     |                    | 110 | $0,006 \times d_1$ | 130 | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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

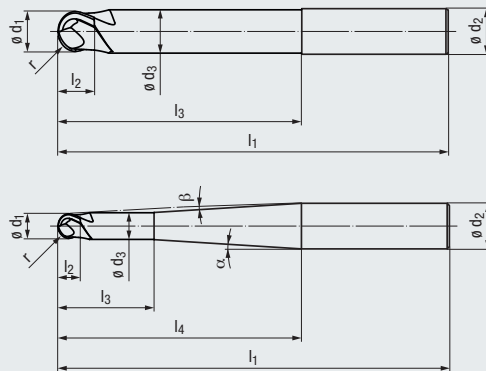
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Optimierte Querschneide
- Hochgenauer Radius
- 4 Baulängen verfügbar
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- Optimised chisel edge
- High-precision radius
- 4 lengths available
- Highly precise straight shank with tolerance h4



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Vorschlichten, Schlichten sowie zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- Suitable for pre-finishing, finishing and HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

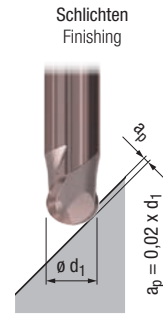
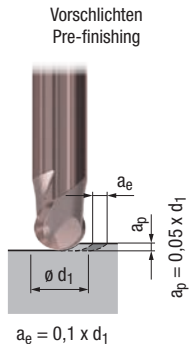
$l_3 = 8 \times d_1$  – Extra lange Ausführung · Extra long design

| Bestell-Code · Order code |        |       |       |       |                 |       |                       |          |         |               | 3829A            |   |
|---------------------------|--------|-------|-------|-------|-----------------|-------|-----------------------|----------|---------|---------------|------------------|---|
| $\emptyset d_1$           | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$<br>h4 | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code |   |
| -0,014                    | -0,007 |       |       |       |                 |       |                       |          |         |               |                  |   |
| 0,5                       | 0,25   | 1     | 4     | 57    | 0,45            | 19,7  | 6                     | 10°      | 8°      | 2             | .0005            | ● |
| 1                         | 0,5    | 2     | 8     | 60    | 0,95            | 22,3  | 6                     | 10°      | 6,5°    | 2             | .001             | ● |
| 1,5                       | 0,75   | 2,5   | 12    | 63    | 1,4             | 25    | 6                     | 10°      | 5,5°    | 2             | .0015            | ● |
| 2                         | 1      | 3     | 16    | 66    | 1,8             | 27,9  | 6                     | 10°      | 4,5°    | 2             | .002             | ● |
| 3                         | 1,5    | 3,5   | 24    | 72    | 2,8             | 33    | 6                     | 10°      | 3°      | 2             | .003             | ● |
| 4                         | 2      | 4     | 32    | 76    | 3,8             | 38,2  | 6                     | 10°      | 2°      | 2             | .004             | ● |
| 5                         | 2,5    | 5     | 40    | 80    | 4,7             | 43,6  | 6                     | 10°      | 1°      | 2             | .005             | ● |
| 6                         | 3      | 6     | 48    | 86    | 5,6             | —     | 6                     | —        | —       | 2             | .006             | ● |
| 8                         | 4      | 7     | 64    | 102   | 7,6             | —     | 8                     | —        | —       | 2             | .008             | ● |


**Hartmetall-Kugelfräser – extra lange Ausführung (2-Schneiden)**  
 Solid carbide ball nose end mills – extra long design (2 flutes)

H

$$l_3 = 8 \times d_1$$


 Gültig für · Valid for  
 3829A

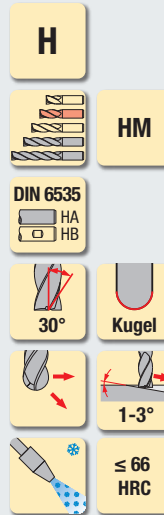
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| P                                                                | 1.1                                                                                          | 240           | 0,013 x $d_1$    | 280           | 0,013 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,012 x $d_1$    | 260           | 0,012 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,011 x $d_1$    | 240           | 0,011 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,010 x $d_1$    | 210           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 160           | 0,009 x $d_1$    | 190           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| M                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| K                                                                | 1.1                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,008 x $d_1$    | 210           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 160           | 0,008 x $d_1$    | 190           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| N                                                                | <b>Aluminium-Legierungen · Aluminium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| S                                                                | <b>Titan-Legierungen · Titanium alloys</b>                                                   |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| H                                                                | <b>Harte Werkstoffe · Hard materials</b>                                                     |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          | 140           | 0,008 x $d_1$    | 180           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 120           | 0,007 x $d_1$    | 160           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 110           | 0,008 x $d_1$    | 140           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 100           | 0,007 x $d_1$    | 120           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 80            | 0,006 x $d_1$    | 100           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

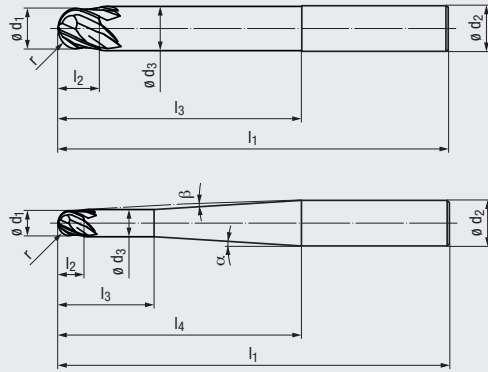
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Optimierte Querschnitte
- Mit 4 Schneiden
- 2 Schneiden zur Mitte
- Hochgenauer Radius
- 3 Baulängen verfügbar
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- Optimised chisel edge
- With 4 flutes
- 2 centre cutting edges
- High-precision radius
- 3 lengths available
- Highly precise straight shank with tolerance h4



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Vorschlichten, Schlichten sowie zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- Suitable for pre-finishing, finishing and HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

$l_3 = 3 \times d_1$  – Kurze Ausführung · Short design

Bestell-Code · Order code

| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code | 3831A |  |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|---------------|------------------|-------|--|
| -0,014          | -0,007 |       |       |       |                 |       | h4              |          |         |               |                  |       |  |
| 2               | 1      | 3     | 8     | 57    | 1,8             | 19,9  | 6               | 10°      | 6,5°    | 4             | .002             | ●     |  |
| 3               | 1,5    | 3,5   | 10    | 57    | 2,8             | 19    | 6               | 10°      | 5,5°    | 4             | .003             | ●     |  |
| 4               | 2      | 4     | 12    | 57    | 3,8             | 18,2  | 6               | 10°      | 3,5°    | 4             | .004             | ●     |  |
| 5               | 2,5    | 5     | 15    | 57    | 4,7             | 18,6  | 6               | 10°      | 2°      | 4             | .005             | ●     |  |
| 6               | 3      | 6     | 20    | 57    | 5,6             | —     | 6               | —        | —       | 4             | .006             | ●     |  |
| 8               | 4      | 7     | 25    | 63    | 7,6             | —     | 8               | —        | —       | 4             | .008             | ●     |  |
| 10              | 5      | 8     | 30    | 72    | 9,6             | —     | 10              | —        | —       | 4             | .010             | ●     |  |
| 12              | 6      | 10    | 36    | 83    | 11,5            | —     | 12              | —        | —       | 4             | .012             | ●     |  |



15-90° Alle Schneiden effektiv im Einsatz  
All cutting edges in operation

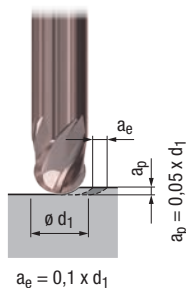
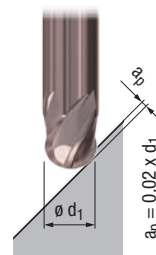
0-15° 2 Schneiden effektiv im Einsatz  
2 cutting edges in operation


**Hartmetall-Kugelfräser – kurze Ausführung (4-Schneiden)**  
 Solid carbide ball nose end mills – short design (4 flutes)

 Gültig für · Valid for  
 3831A

H

$$l_3 = 3 \times d_1$$

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing


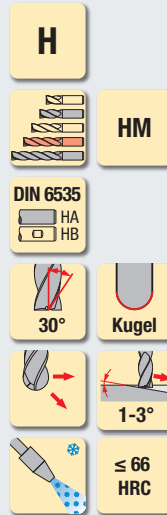
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min]   | $f_z$<br>[mm] |                    |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|--------------------|---------------|--------------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>P</b>                                                         | 1.1                                                                                          | 320           | $0,015 \times d_1$ | 360           | $0,013 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 280           | $0,014 \times d_1$ | 320           | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 240           | $0,013 \times d_1$ | 280           | $0,011 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 220           | $0,012 \times d_1$ | 240           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 200           | $0,010 \times d_1$ | 220           | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>M</b>                                                         | 1.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>K</b>                                                         | 1.1                                                                                          | 320           | $0,013 \times d_1$ | 360           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 320           | $0,013 \times d_1$ | 360           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 280           | $0,013 \times d_1$ | 320           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 280           | $0,013 \times d_1$ | 320           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 220           | $0,009 \times d_1$ | 240           | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 200           | $0,009 \times d_1$ | 220           | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>Aluminium-Legierungen · Aluminium alloys</b>                  |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>N</b>                                                         | 1.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
| <b>Kunststoffe · Synthetics</b>                                  |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>N</b>                                                         | 4.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                    |               |                    |                          |                                     |                          |
| <b>Besondere Werkstoffe · Special materials</b>                  |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>N</b>                                                         | 5.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                    |               |                    |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>Titan-Legierungen · Titanium alloys</b>                       |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>S</b>                                                         | 1.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                    |               |                    |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                    |               |                    |                          |                                     |                          |
| <b>Harte Werkstoffe · Hard materials</b>                         |                                                                                              |               |                    |               |                    |                          |                                     |                          |
| <b>H</b>                                                         | 1.1                                                                                          | 200           | $0,009 \times d_1$ | 220           | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 180           | $0,008 \times d_1$ | 200           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 160           | $0,008 \times d_1$ | 180           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 140           | $0,007 \times d_1$ | 160           | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 120           | $0,006 \times d_1$ | 140           | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

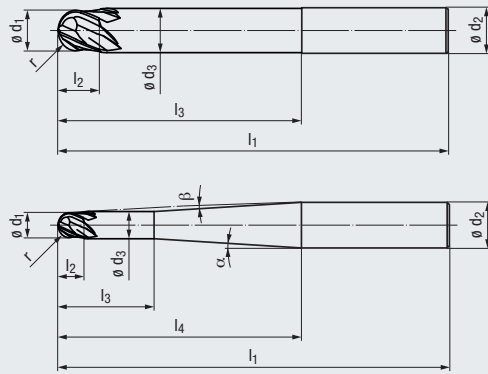
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Optimierte Querschnitte
- Mit 4 Schneiden
- 2 Schneiden zur Mitte
- Hochgenauer Radius
- 3 Baulängen verfügbar
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- Optimised chisel edge
- With 4 flutes
- 2 centre cutting edges
- High-precision radius
- 3 lengths available
- Highly precise straight shank with tolerance h4



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Vorschlichten, Schlichten sowie zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- Suitable for pre-finishing, finishing and HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

$l_3 = 5 \times d_1$  – Lange Ausführung · Long design

Bestell-Code · Order code

| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code | 3832A |  |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|---------------|------------------|-------|--|
| -0,014          | -0,007 |       |       |       |                 |       | h4              |          |         |               |                  |       |  |
| 2               | 1      | 3     | 10    | 63    | 1,8             | 21,9  | 6               | 10°      | 5,5°    | 4             | .002             | ●     |  |
| 3               | 1,5    | 3,5   | 15    | 63    | 2,8             | 24    | 6               | 10°      | 4°      | 4             | .003             | ●     |  |
| 4               | 2      | 4     | 20    | 63    | 3,8             | 26,2  | 6               | 10°      | 2,5°    | 4             | .004             | ●     |  |
| 5               | 2,5    | 5     | 25    | 66    | 4,7             | 28,6  | 6               | 10°      | 1,5°    | 4             | .005             | ●     |  |
| 6               | 3      | 6     | 30    | 68    | 5,6             | —     | 6               | —        | —       | 4             | .006             | ●     |  |
| 8               | 4      | 7     | 40    | 78    | 7,6             | —     | 8               | —        | —       | 4             | .008             | ●     |  |
| 10              | 5      | 8     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 4             | .010             | ●     |  |
| 12              | 6      | 10    | 60    | 106   | 11,5            | —     | 12              | —        | —       | 4             | .012             | ●     |  |



15-90° Alle Schneiden effektiv im Einsatz  
All cutting edges in operation

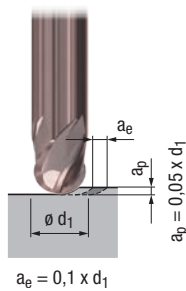
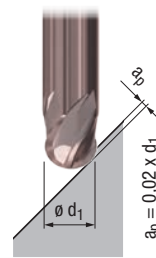
0-15° 2 Schneiden effektiv im Einsatz  
2 cutting edges in operation


**Hartmetall-Kugelfräser – lange Ausführung (4-Schneiden)**  
 Solid carbide ball nose end mills – long design (4 flutes)

 Gültig für · Valid for  
 3832A

H

$$l_3 = 5 \times d_1$$

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing


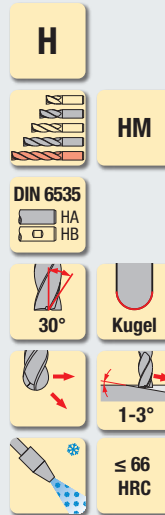
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| P                                                                | 1.1                                                                                          | 300           | 0,015 x $d_1$    | 340           | 0,013 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 260           | 0,014 x $d_1$    | 340           | 0,012 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 220           | 0,013 x $d_1$    | 260           | 0,011 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 200           | 0,012 x $d_1$    | 220           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 180           | 0,010 x $d_1$    | 200           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| M                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| K                                                                | 1.1                                                                                          | 300           | 0,013 x $d_1$    | 340           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 300           | 0,013 x $d_1$    | 340           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 260           | 0,013 x $d_1$    | 300           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 260           | 0,013 x $d_1$    | 300           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 220           | 0,011 x $d_1$    | 250           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 220           | 0,011 x $d_1$    | 250           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 200           | 0,009 x $d_1$    | 220           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 180           | 0,009 x $d_1$    | 200           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| N                                                                | <b>Aluminium-Legierungen · Aluminium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| S                                                                | <b>Titan-Legierungen · Titanium alloys</b>                                                   |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| H                                                                | <b>Harte Werkstoffe · Hard materials</b>                                                     |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          | 180           | 0,009 x $d_1$    | 200           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 160           | 0,008 x $d_1$    | 180           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 140           | 0,008 x $d_1$    | 160           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 130           | 0,007 x $d_1$    | 140           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 110           | 0,006 x $d_1$    | 130           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

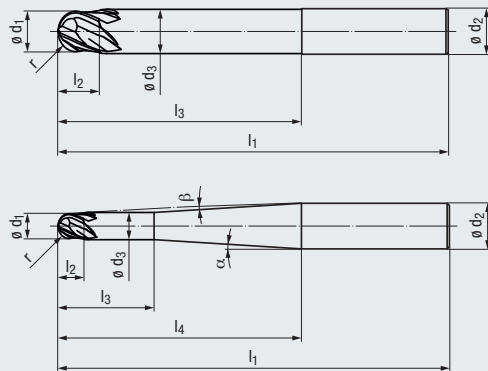
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Optimierte Querschneide
- Mit 4 Schneiden
- 2 Schneiden zur Mitte
- Hochgenauer Radius
- 3 Baulängen verfügbar
- Hochpräziser Zylinderschaft mit Toleranz h4

- High performance tool
- Optimised chisel edge
- With 4 flutes
- 2 centre cutting edges
- High-precision radius
- 3 lengths available
- Highly precise straight shank with tolerance h4



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Vorschlichten, Schlichten sowie zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- Suitable for pre-finishing, finishing and HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

$l_3 = 8 \times d_1$  – Extra lange Ausführung · Extra long design

Bestell-Code · Order code

| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$<br>h4 | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code | 3833A |  |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------------|----------|---------|---------------|------------------|-------|--|
| -0,014          | -0,007 |       |       |       |                 |       |                       |          |         |               |                  |       |  |
| 2               | 1      | 3     | 16    | 66    | 1,8             | 27,9  | 6                     | 10°      | 4,5°    | 4             | .002             | ●     |  |
| 3               | 1,5    | 3,5   | 24    | 72    | 2,8             | 33    | 6                     | 10°      | 3°      | 4             | .003             | ●     |  |
| 4               | 2      | 4     | 32    | 76    | 3,8             | 38,2  | 6                     | 10°      | 2°      | 4             | .004             | ●     |  |
| 5               | 2,5    | 5     | 40    | 80    | 4,7             | 43,6  | 6                     | 10°      | 1°      | 4             | .005             | ●     |  |
| 6               | 3      | 6     | 48    | 86    | 5,6             | —     | 6                     | —        | —       | 4             | .006             | ●     |  |
| 8               | 4      | 7     | 64    | 102   | 7,6             | —     | 8                     | —        | —       | 4             | .008             | ●     |  |



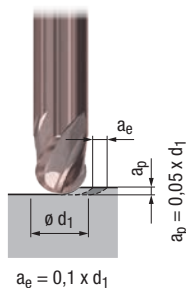
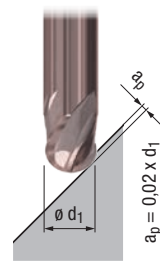
15-90° Alle Schneiden effektiv im Einsatz  
All cutting edges in operation

0-15° 2 Schneiden effektiv im Einsatz  
2 cutting edges in operation


**Hartmetall-Kugelfräser – extra lange Ausführung (4-Schneiden)**  
 Solid carbide ball nose end mills – extra long design (4 flutes)

H

$$l_3 = 8 \times d_1$$

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing

 Gültig für · Valid for  
 3833A

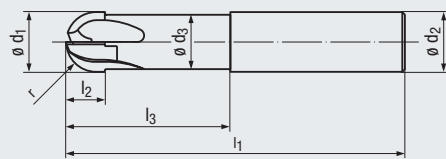
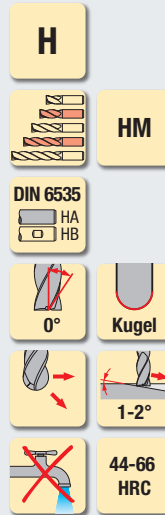
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| P                                                                | 1.1                                                                                          | 240           | 0,013 x $d_1$    | 280           | 0,013 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,012 x $d_1$    | 260           | 0,012 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,011 x $d_1$    | 240           | 0,011 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,010 x $d_1$    | 210           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 160           | 0,009 x $d_1$    | 190           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| M                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| K                                                                | 1.1                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,008 x $d_1$    | 210           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 160           | 0,008 x $d_1$    | 190           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| N                                                                | <b>Aluminium-Legierungen · Aluminium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| S                                                                | <b>Titan-Legierungen · Titanium alloys</b>                                                   |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| H                                                                | <b>Harte Werkstoffe · Hard materials</b>                                                     |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          | 140           | 0,008 x $d_1$    | 180           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 120           | 0,007 x $d_1$    | 160           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 110           | 0,008 x $d_1$    | 140           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 100           | 0,007 x $d_1$    | 120           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 80            | 0,006 x $d_1$    | 100           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Patentierte Querschneide
- Mit 6 und 8 Schneiden
- 2 Schneiden zur Mitte
- Kurze, stabile Schneidenlänge
- 2 Baulängen verfügbar

- High performance tool
- Patented chisel edge
- With 6 and 8 flutes
- 2 centre cutting edges
- Short, stable flute length
- 2 lengths available



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Zur Bearbeitung harter Werkstoffe
- Zur Schlichtbearbeitung mit sehr guter Oberflächenqualität
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- For machining hard materials
- For finishing with very high surface quality
- Suitable for HSC finishing

#### TIALN

|   |          |
|---|----------|
| P | 3.1-5.1  |
| K | 1.1-4.2  |
| N | 2.3, 2.6 |
| S | 1.2-2.6  |
| H | 1.1-1.5  |

#### TIALN

|   |          |
|---|----------|
| P | 3.1-5.1  |
| K | 1.1-4.2  |
| N | 2.3, 2.6 |
| S | 1.2-2.6  |
| H | 1.1-1.5  |

#### Kurze Ausführung · Short design

##### Bestell-Code · Order code

| $\emptyset d_1$<br>$\pm 0,01$ | $r$<br>$\pm 0,005$ | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $\emptyset d_2$<br>h5 | Z<br>(Flutes) | Dimens.-<br>Code | 2836A |  |
|-------------------------------|--------------------|-------|-------|-------|-----------------|-----------------------|---------------|------------------|-------|--|
| 10                            | 5                  | 6     | 30    | 72    | 9,6             | 10                    | 6             | .010             | ●     |  |
| 12                            | 6                  | 7     | 35    | 83    | 11,5            | 12                    | 8             | .012             | ●     |  |

#### Lange Ausführung · Long design

##### Bestell-Code · Order code

| $\emptyset d_1$<br>$\pm 0,01$ | $r$<br>$\pm 0,005$ | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $\emptyset d_2$<br>h5 | Z<br>(Flutes) | Dimens.-<br>Code |  | 2837A |
|-------------------------------|--------------------|-------|-------|-------|-----------------|-----------------------|---------------|------------------|--|-------|
| 10                            | 5                  | 6     | 45    | 100   | 9,6             | 10                    | 6             | .010             |  | ●     |
| 12                            | 6                  | 7     | 50    | 100   | 11,5            | 12                    | 8             | .012             |  | ●     |
| 16                            | 8                  | 8     | 60    | 120   | 15,5            | 16                    | 8             | .016             |  | ●     |

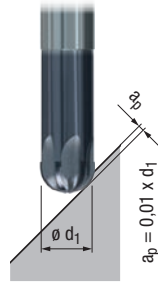


15-90° Alle Schneiden effektiv im Einsatz  
All cutting edges in operation

0-15° 2 Schneiden effektiv im Einsatz  
2 cutting edges in operation


**Hartmetall-Kugelfräser – kurze und lange Ausführung (6-8 Schneiden)**  
 Solid carbide ball nose end mills – short and long design (6-8 flutes)

H

Schlichten  
Finishing
 Gültig für · Valid for  
 2836A  
 2837A

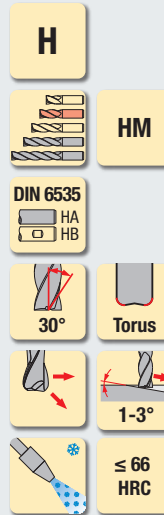
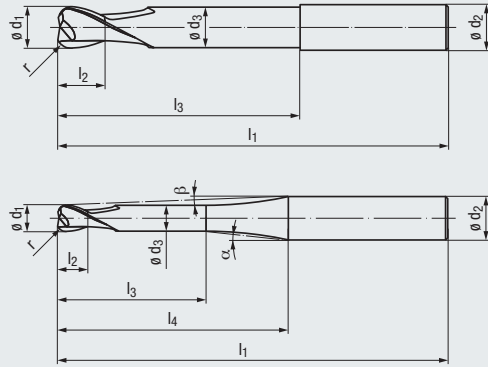
|                                          | $V_c$<br>[m/min]                                                                      | $f_z$<br>[mm]                     |  |  | MMS<br>MQL                          |  |                                     |
|------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|
| P                                        | Stahlwerkstoffe · Steel materials                                                     |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 3.1                                                                                   | 270                               | 0,007 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
|                                          | 4.1                                                                                   | 220                               | 0,006 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
|                                          | 5.1                                                                                   | 180                               | 0,0054 x d <sub>1</sub>                                                             | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
| M                                        | Nichtrostende Stahlwerkstoffe · Stainless steel materials                             |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 3.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 4.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
| K                                        | Gusswerkstoffe · Cast materials                                                       |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.1                                                                                   | 360                               | 0,008 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
|                                          | 1.2                                                                                   | 360                               | 0,008 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
|                                          | 2.1                                                                                   | 320                               | 0,006 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
|                                          | 2.2                                                                                   | 320                               | 0,006 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                                                            |                                     |
|                                          | 3.1                                                                                   | 270                               | 0,006 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
|                                          | 3.2                                                                                   | 270                               | 0,006 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
|                                          | 4.1                                                                                   | 220                               | 0,005 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
|                                          | 4.2                                                                                   | 180                               | 0,005 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
| N                                        | Nichteisenwerkstoffe · Non-ferrous materials                                          |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | Aluminium-Legierungen · Aluminium alloys                                              |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.2                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.3                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.4                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.5                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.6                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | Kupfer-Legierungen · Copper alloys                                                    |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.2                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.3                                                                                   | 320                               | 0,008 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input type="checkbox"/>            | <input type="checkbox"/>                                                            |                                     |
|                                          | 2.4                                                                                   |                                   |                                                                                     |                                                                                     |                                     | <input checked="" type="checkbox"/>                                                 |                                     |
|                                          | 2.5                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.6                                                                                   | 270                               | 0,007 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input type="checkbox"/>            | <input type="checkbox"/>                                                            |                                     |
|                                          | 2.7                                                                                   |                                   |                                                                                     |                                                                                     |                                     | <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                                      |                                                                                       |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
| S                                        | Spezialwerkstoffe · Special materials                                                 |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | Titan-Legierungen · Titanium alloys                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.1                                                                                   |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 1.2                                                                                   | 120                               | 0,006 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | 1.3                                                                                   | 70                                | 0,005 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                                   |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
|                                          | 2.1                                                                                   | 110                               | 0,006 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | 2.2                                                                                   | 50                                | 0,004 x d <sub>1</sub>                                                              |                                                                                     |                                     |                                                                                     | <input checked="" type="checkbox"/> |
|                                          | 2.3                                                                                   | 40                                | 0,004 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | 2.4                                                                                   | 40                                | 0,004 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | 2.5                                                                                   | 30                                | 0,004 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | 2.6                                                                                   | 40                                | 0,004 x d <sub>1</sub>                                                              |                                                                                     |                                     | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |
|                                          | H                                                                                     | Harte Werkstoffe · Hard materials |                                                                                     |                                                                                     |                                     |                                                                                     |                                     |
| 1.1                                      |                                                                                       | 180                               | 0,006 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
| 1.2                                      |                                                                                       | 160                               | 0,005 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
| 1.3                                      |                                                                                       | 140                               | 0,005 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
| 1.4                                      |                                                                                       | 110                               | 0,004 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |
| 1.5                                      |                                                                                       | 90                                | 0,003 x d <sub>1</sub>                                                              | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/> |                                                                                     |                                     |

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

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

- Hochleistungswerkzeug
- 5 zylindrische Halslängen bis 12 x d<sub>1</sub> verfügbar
- Hochgenauer Eckenradius

- High performance tool
- 5 cylindrical neck lengths up to 12 x d<sub>1</sub> available
- High-precision corner radius



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

**l<sub>3</sub> = 3 x d<sub>1</sub> – Kurze Ausführung · Short design**

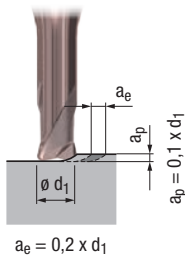
Bestell-Code · Order code

| Ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | Ø d <sub>3</sub> | l <sub>4</sub> | Ø d <sub>2</sub> | α     | β     | Z<br>(Flutes) | Dimens.-<br>Code | 3867A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------|-------|-------|---------------|------------------|-------|--|
| -0,015           | ±0,005 |                |                |                |                  |                | h5               |       |       |               |                  |       |  |
| 0,5              | 0,05   | 0,5            | 1,5            | 57             | 0,45             | 8,5            | 6                | 22,5° | 18,5° | 2             | .00050E          | ●     |  |
| 0,5              | 0,1    | 0,5            | 1,5            | 57             | 0,45             | 8,5            | 6                | 22,5° | 18,5° | 2             | .000501          | ●     |  |
| 0,8              | 0,05   | 0,8            | 2,4            | 57             | 0,75             | 9              | 6                | 22,5° | 17°   | 2             | .00080E          | ●     |  |
| 0,8              | 0,1    | 0,8            | 2,4            | 57             | 0,75             | 9              | 6                | 22,5° | 17°   | 2             | .000801          | ●     |  |
| 1                | 0,05   | 1              | 3              | 57             | 0,95             | 9,5            | 6                | 22°   | 15,5° | 2             | .00100E          | ●     |  |
| 1                | 0,1    | 1              | 3              | 57             | 0,95             | 9,5            | 6                | 22°   | 15,5° | 2             | .001001          | ●     |  |
| 1                | 0,2    | 1              | 3              | 57             | 0,95             | 9,5            | 6                | 22°   | 15,5° | 2             | .001002          | ●     |  |
| 1,2              | 0,1    | 1,2            | 3,6            | 57             | 1,1              | 10             | 6                | 21,5° | 14°   | 2             | .001201          | ●     |  |
| 1,2              | 0,3    | 1,2            | 3,6            | 57             | 1,1              | 10             | 6                | 21,5° | 14°   | 2             | .001203          | ●     |  |
| 1,5              | 0,1    | 1,25           | 4,5            | 57             | 1,4              | 10,5           | 6                | 21,5° | 12,5° | 2             | .001501          | ●     |  |
| 1,5              | 0,3    | 1,25           | 4,5            | 57             | 1,4              | 10,5           | 6                | 21,5° | 12,5° | 2             | .001503          | ●     |  |
| 1,8              | 0,1    | 1,5            | 5,4            | 57             | 1,7              | 11             | 6                | 21,5° | 11,5° | 2             | .001801          | ●     |  |
| 1,8              | 0,3    | 1,5            | 5,4            | 57             | 1,7              | 11             | 6                | 21,5° | 11,5° | 2             | .001803          | ●     |  |
| 2                | 0,1    | 1,5            | 6              | 57             | 1,9              | 11,5           | 6                | 21°   | 10,5° | 2             | .002001          | ●     |  |
| 2                | 0,3    | 1,5            | 6              | 57             | 1,9              | 11,5           | 6                | 21°   | 10,5° | 2             | .002003          | ●     |  |
| 2                | 0,4    | 1,5            | 6              | 57             | 1,9              | 11,5           | 6                | 21°   | 10,5° | 2             | .002004          | ●     |  |
| 2                | 0,5    | 1,5            | 6              | 57             | 1,9              | 11,5           | 6                | 21°   | 10,5° | 2             | .002005          | ●     |  |
| 3                | 0,1    | 2              | 9              | 57             | 2,9              | 14,5           | 6                | 16,5° | 6,5°  | 2             | .003001          | ●     |  |
| 3                | 0,3    | 2              | 9              | 57             | 2,9              | 14,5           | 6                | 16,5° | 6,5°  | 2             | .003003          | ●     |  |
| 3                | 0,5    | 2              | 9              | 57             | 2,9              | 14,5           | 6                | 16,5° | 6,5°  | 2             | .003005          | ●     |  |
| 4                | 0,1    | 2,5            | 12             | 57             | 3,9              | 16             | 6                | 15,5° | 4°    | 2             | .004001          | ●     |  |
| 4                | 0,3    | 2,5            | 12             | 57             | 3,9              | 16             | 6                | 15,5° | 4°    | 2             | .004003          | ●     |  |
| 4                | 0,5    | 2,5            | 12             | 57             | 3,9              | 16             | 6                | 15,5° | 4°    | 2             | .004005          | ●     |  |
| 4                | 0,6    | 2,5            | 12             | 57             | 3,9              | 16             | 6                | 15,5° | 4°    | 2             | .004006          | ●     |  |
| 5                | 0,1    | 3              | 15             | 57             | 4,9              | 18             | 6                | 11°   | 2°    | 2             | .005001          | ●     |  |
| 5                | 0,3    | 3              | 15             | 57             | 4,9              | 18             | 6                | 11°   | 2°    | 2             | .005003          | ●     |  |
| 5                | 0,5    | 3              | 15             | 57             | 4,9              | 18             | 6                | 11°   | 2°    | 2             | .005005          | ●     |  |
| 5                | 0,8    | 3              | 15             | 57             | 4,9              | 18             | 6                | 11°   | 2°    | 2             | .005008          | ●     |  |
| 6                | 0,3    | 3,5            | 20             | 57             | 5,9              | —              | 6                | —     | —     | 2             | .006003          | ●     |  |
| 6                | 0,5    | 3,5            | 20             | 57             | 5,9              | —              | 6                | —     | —     | 2             | .006005          | ●     |  |
| 6                | 1      | 3,5            | 20             | 57             | 5,9              | —              | 6                | —     | —     | 2             | .006010          | ●     |  |

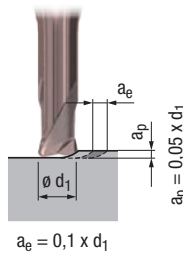

**Hartmetall-Torusfräser – kurze Ausführung (2 Schneiden)**  
 Solid carbide torus end mills – short design (2 flutes)

H

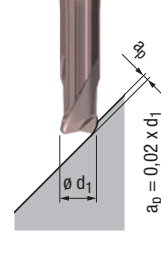
$$l_3 = 3 \times d_1$$

 Schruppen  
 Roughing


$$a_e = 0,2 \times d_1$$

 Vorschlichten  
 Pre-finishing


$$a_e = 0,1 \times d_1$$

 Schlichten  
 Finishing

 Gültig für · Valid for  
 3867A

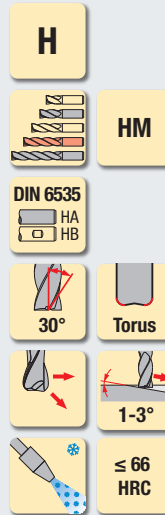
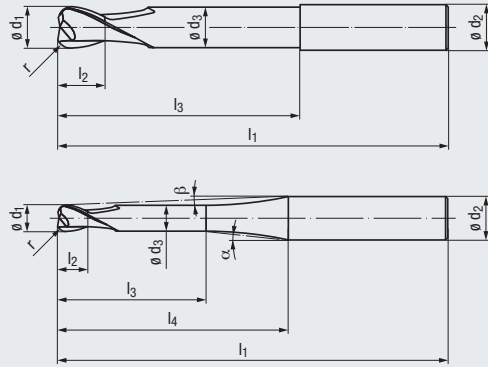

|   |                                                                                       | Stahlwerkstoffe · Steel materials                         |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|---|---------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------|-----|------------------------|-----|------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P | 1.1                                                                                   | 260                                                       | 0,013 x d <sub>1</sub> | 320 | 0,015 x d <sub>1</sub> | 360 | 0,013 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 2.1                                                                                   | 240                                                       | 0,012 x d <sub>1</sub> | 280 | 0,014 x d <sub>1</sub> | 320 | 0,012 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|   | 3.1                                                                                   | 220                                                       | 0,011 x d <sub>1</sub> | 240 | 0,013 x d <sub>1</sub> | 280 | 0,011 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|   | 4.1                                                                                   | 200                                                       | 0,010 x d <sub>1</sub> | 220 | 0,012 x d <sub>1</sub> | 240 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|   | 5.1                                                                                   | 180                                                       | 0,009 x d <sub>1</sub> | 200 | 0,010 x d <sub>1</sub> | 220 | 0,009 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|   |                                                                                       | Nichtrostende Stahlwerkstoffe · Stainless steel materials |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| M | 1.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 3.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 4.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   |                                                                                       | Gusswerkstoffe · Cast materials                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| K | 1.1                                                                                   | 260                                                       | 0,011 x d <sub>1</sub> | 320 | 0,013 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 1.2                                                                                   | 260                                                       | 0,011 x d <sub>1</sub> | 320 | 0,013 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 2.1                                                                                   | 240                                                       | 0,011 x d <sub>1</sub> | 280 | 0,013 x d <sub>1</sub> | 320 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 2.2                                                                                   | 240                                                       | 0,011 x d <sub>1</sub> | 280 | 0,013 x d <sub>1</sub> | 320 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|   | 3.1                                                                                   | 220                                                       | 0,010 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 3.2                                                                                   | 220                                                       | 0,010 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 4.1                                                                                   | 200                                                       | 0,008 x d <sub>1</sub> | 220 | 0,009 x d <sub>1</sub> | 240 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 4.2                                                                                   | 180                                                       | 0,008 x d <sub>1</sub> | 200 | 0,009 x d <sub>1</sub> | 220 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   |                                                                                       | Nichteisenwerkstoffe · Non-ferrous materials              |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| N | Aluminium-Legierungen · Aluminium alloys                                              |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.4                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.5                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.6                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 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                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 5.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 5.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   |                                                                                       | Spezialwerkstoffe · Special materials                     |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| S | Titan-Legierungen · Titanium alloys                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 1.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.1                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.2                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.3                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.4                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.5                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   | 2.6                                                                                   |                                                           |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|   |                                                                                       | Harte Werkstoffe · Hard materials                         |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| H | 1.1                                                                                   | 160                                                       | 0,008 x d <sub>1</sub> | 200 | 0,009 x d <sub>1</sub> | 220 | 0,009 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.2                                                                                   | 120                                                       | 0,007 x d <sub>1</sub> | 180 | 0,008 x d <sub>1</sub> | 200 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.3                                                                                   |                                                           |                        | 160 | 0,008 x d <sub>1</sub> | 180 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.4                                                                                   |                                                           |                        | 140 | 0,007 x d <sub>1</sub> | 160 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|   | 1.5                                                                                   |                                                           |                        | 120 | 0,006 x d <sub>1</sub> | 140 | 0,006 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 5 zylindrische Halslängen bis 12 x d<sub>1</sub> verfügbar
- Hochgenauer Eckenradius

- High performance tool
- 5 cylindrical neck lengths up to 12 x d<sub>1</sub> available
- High-precision corner radius



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

**l<sub>3</sub> = 5 x d<sub>1</sub> – Lange Ausführung · Long design**

Bestell-Code · Order code

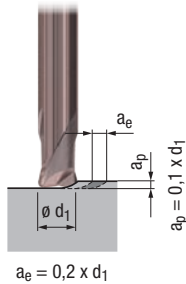
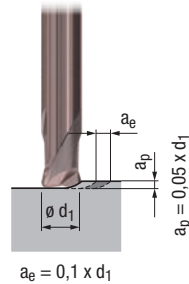
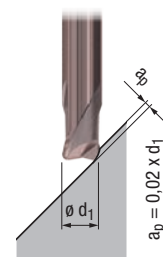
| ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | ø d <sub>3</sub> | l <sub>4</sub> | ø d <sub>2</sub> | α     | β     | Z        | Dimens.-Code | 3868A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------|-------|-------|----------|--------------|-------|--|
| -0,015           | ±0,005 |                |                |                |                  |                | h5               |       |       | (Flutes) |              |       |  |
| 0,5              | 0,05   | 0,5            | 2,5            | 57             | 0,45             | 9,5            | 6                | 22,5° | 17°   | 2        | .00050E      | ●     |  |
| 0,5              | 0,1    | 0,5            | 2,5            | 57             | 0,45             | 9,5            | 6                | 22,5° | 17°   | 2        | .000501      | ●     |  |
| 0,8              | 0,05   | 0,8            | 4              | 57             | 0,75             | 10,5           | 6                | 22,5° | 14,5° | 2        | .00080E      | ●     |  |
| 0,8              | 0,1    | 0,8            | 4              | 57             | 0,75             | 10,5           | 6                | 22,5° | 14,5° | 2        | .000801      | ●     |  |
| 1                | 0,05   | 1              | 5              | 57             | 0,95             | 11,5           | 6                | 22°   | 13°   | 2        | .00100E      | ●     |  |
| 1                | 0,1    | 1              | 5              | 57             | 0,95             | 11,5           | 6                | 22°   | 13°   | 2        | .001001      | ●     |  |
| 1                | 0,2    | 1              | 5              | 57             | 0,95             | 11,5           | 6                | 22°   | 13°   | 2        | .001002      | ●     |  |
| 1,2              | 0,1    | 1,2            | 6              | 57             | 1,1              | 12             | 6                | 22,5° | 12°   | 2        | .001201      | ●     |  |
| 1,2              | 0,3    | 1,2            | 6              | 57             | 1,1              | 12             | 6                | 22,5° | 12°   | 2        | .001203      | ●     |  |
| 1,5              | 0,1    | 1,25           | 7,5            | 57             | 1,4              | 13,5           | 6                | 21,5° | 10°   | 2        | .001501      | ●     |  |
| 1,5              | 0,3    | 1,25           | 7,5            | 57             | 1,4              | 13,5           | 6                | 21,5° | 10°   | 2        | .001503      | ●     |  |
| 1,8              | 0,1    | 1,5            | 9              | 57             | 1,7              | 14             | 6                | 24°   | 9°    | 2        | .001801      | ●     |  |
| 1,8              | 0,3    | 1,5            | 9              | 57             | 1,7              | 14             | 6                | 24°   | 9°    | 2        | .001803      | ●     |  |
| 2                | 0,1    | 1,5            | 10             | 57             | 1,9              | 14             | 6                | 28°   | 9°    | 2        | .002001      | ●     |  |
| 2                | 0,3    | 1,5            | 10             | 57             | 1,9              | 14             | 6                | 28°   | 9°    | 2        | .002003      | ●     |  |
| 2                | 0,4    | 1,5            | 10             | 57             | 1,9              | 14             | 6                | 28°   | 9°    | 2        | .002004      | ●     |  |
| 2                | 0,5    | 1,5            | 10             | 57             | 1,9              | 14             | 6                | 28°   | 9°    | 2        | .002005      | ●     |  |
| 3                | 0,1    | 2              | 15             | 57             | 2,9              | 20,5           | 6                | 16,5° | 5°    | 2        | .003001      | ●     |  |
| 3                | 0,3    | 2              | 15             | 57             | 2,9              | 20,5           | 6                | 16,5° | 5°    | 2        | .003003      | ●     |  |
| 3                | 0,5    | 2              | 15             | 57             | 2,9              | 20,5           | 6                | 16,5° | 5°    | 2        | .003005      | ●     |  |
| 4                | 0,1    | 2,5            | 20             | 63             | 3,9              | 24             | 6                | 15,5° | 3°    | 2        | .004001      | ●     |  |
| 4                | 0,3    | 2,5            | 20             | 63             | 3,9              | 24             | 6                | 15,5° | 3°    | 2        | .004003      | ●     |  |
| 4                | 0,5    | 2,5            | 20             | 63             | 3,9              | 24             | 6                | 15,5° | 3°    | 2        | .004005      | ●     |  |
| 4                | 0,6    | 2,5            | 20             | 63             | 3,9              | 24             | 6                | 15,5° | 3°    | 2        | .004006      | ●     |  |
| 5                | 0,1    | 3              | 25             | 72             | 4,9              | 35             | 6                | 4°    | 1,5°  | 2        | .005001      | ●     |  |
| 5                | 0,3    | 3              | 25             | 72             | 4,9              | 35             | 6                | 4°    | 1,5°  | 2        | .005003      | ●     |  |
| 5                | 0,5    | 3              | 25             | 72             | 4,9              | 35             | 6                | 4°    | 1,5°  | 2        | .005005      | ●     |  |
| 5                | 0,8    | 3              | 25             | 72             | 4,9              | 35             | 6                | 4°    | 1,5°  | 2        | .005008      | ●     |  |
| 6                | 0,3    | 3,5            | 30             | 72             | 5,9              | —              | 6                | —     | —     | 2        | .006003      | ●     |  |
| 6                | 0,5    | 3,5            | 30             | 72             | 5,9              | —              | 6                | —     | —     | 2        | .006005      | ●     |  |
| 6                | 1      | 3,5            | 30             | 72             | 5,9              | —              | 6                | —     | —     | 2        | .006010      | ●     |  |


**Hartmetall-Torusfräser – lange Ausführung (2 Schneiden)**  
 Solid carbide torus end mills – long design (2 flutes)

 Gültig für · Valid for  
 3868A

H

$$l_3 = 5 \times d_1$$

 Schruppen  
 Roughing

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing


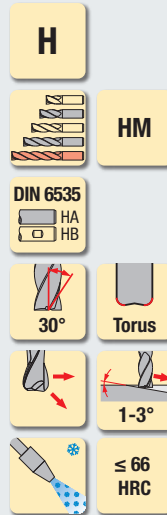
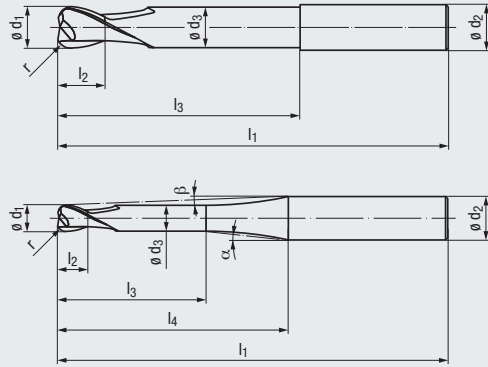
|     |                                                                                       | $v_c$<br>[m/min] | $f_z$<br>[mm]          | $v_c$<br>[m/min] | $f_z$<br>[mm]          | $v_c$<br>[m/min] | $f_z$<br>[mm]          |  |  |  |  |
|-----|---------------------------------------------------------------------------------------|------------------|------------------------|------------------|------------------------|------------------|------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| P   | Stahlwerkstoffe · Steel materials                                                     |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.1                                                                                   | 240              | 0,013 x d <sub>1</sub> | 300              | 0,015 x d <sub>1</sub> | 340              | 0,013 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |
|     | 2.1                                                                                   | 220              | 0,012 x d <sub>1</sub> | 260              | 0,014 x d <sub>1</sub> | 340              | 0,012 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |
|     | 3.1                                                                                   | 200              | 0,011 x d <sub>1</sub> | 220              | 0,013 x d <sub>1</sub> | 260              | 0,011 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            |                                                                                     |
|     | 4.1                                                                                   | 180              | 0,010 x d <sub>1</sub> | 200              | 0,012 x d <sub>1</sub> | 220              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            |                                                                                     |
|     | 5.1                                                                                   | 160              | 0,009 x d <sub>1</sub> | 180              | 0,010 x d <sub>1</sub> | 200              | 0,009 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 | <input type="checkbox"/>                                                            |                                                                                     |
| M   | Nichtrostende Stahlwerkstoffe · Stainless steel materials                             |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 2.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 3.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 4.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| K   | Gusswerkstoffe · Cast materials                                                       |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.1                                                                                   | 240              | 0,011 x d <sub>1</sub> | 300              | 0,013 x d <sub>1</sub> | 340              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|     | 1.2                                                                                   | 240              | 0,011 x d <sub>1</sub> | 300              | 0,013 x d <sub>1</sub> | 340              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 2.1                                                                                   | 220              | 0,011 x d <sub>1</sub> | 260              | 0,013 x d <sub>1</sub> | 300              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|     | 2.2                                                                                   | 220              | 0,011 x d <sub>1</sub> | 260              | 0,013 x d <sub>1</sub> | 300              | 0,010 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     | <input type="checkbox"/>                                                            |
|     | 3.1                                                                                   | 200              | 0,010 x d <sub>1</sub> | 220              | 0,011 x d <sub>1</sub> | 250              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 3.2                                                                                   | 200              | 0,010 x d <sub>1</sub> | 220              | 0,011 x d <sub>1</sub> | 250              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 4.1                                                                                   | 180              | 0,008 x d <sub>1</sub> | 200              | 0,009 x d <sub>1</sub> | 220              | 0,007 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 4.2                                                                                   | 160              | 0,008 x d <sub>1</sub> | 180              | 0,009 x d <sub>1</sub> | 200              | 0,007 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
| N   | Nichteisenwerkstoffe · Non-ferrous materials                                          |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | Aluminium-Legierungen · Aluminium alloys                                              |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.2                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.3                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.4                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.5                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.6                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 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                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 5.2                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 5.3 |                                                                                       |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| S   | Spezialwerkstoffe · Special materials                                                 |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | Titan-Legierungen · Titanium alloys                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.2                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.3                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 2.1                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 2.2                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 2.3                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 2.4                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 2.5                                                                                   |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 2.6 |                                                                                       |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| H   | Harte Werkstoffe · Hard materials                                                     |                  |                        |                  |                        |                  |                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|     | 1.1                                                                                   | 140              | 0,008 x d <sub>1</sub> | 180              | 0,009 x d <sub>1</sub> | 200              | 0,009 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 1.2                                                                                   | 110              | 0,007 x d <sub>1</sub> | 160              | 0,008 x d <sub>1</sub> | 180              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 1.3                                                                                   |                  |                        | 140              | 0,008 x d <sub>1</sub> | 160              | 0,008 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 1.4                                                                                   |                  |                        | 130              | 0,007 x d <sub>1</sub> | 140              | 0,007 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |
|     | 1.5                                                                                   |                  |                        | 110              | 0,006 x d <sub>1</sub> | 130              | 0,006 x d <sub>1</sub> | <input type="checkbox"/>                                                            | <input checked="" type="checkbox"/>                                                 |                                                                                     |                                                                                     |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 5 zylindrische Halslängen bis 12 x d<sub>1</sub> verfügbar
- Hochgenauer Eckenradius

- High performance tool
- 5 cylindrical neck lengths up to 12 x d<sub>1</sub> available
- High-precision corner radius



new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

**l<sub>3</sub> = 8 x d<sub>1</sub> – Extra lange Ausführung · Extra long design**

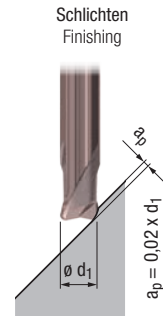
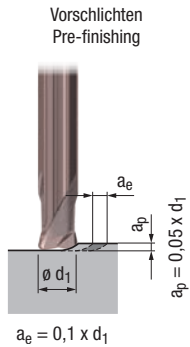
Bestell-Code · Order code

| Ø d <sub>1</sub> | r      | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | Ø d <sub>3</sub> | l <sub>4</sub> | Ø d <sub>2</sub> | α     | β     | Z        | Dimens.-Code | 3869A |  |
|------------------|--------|----------------|----------------|----------------|------------------|----------------|------------------|-------|-------|----------|--------------|-------|--|
| -0,015           | ±0,005 |                |                |                |                  |                | h5               |       |       | (Flutes) |              |       |  |
| 0,5              | 0,05   | 0,5            | 4              | 57             | 0,45             | 11             | 6                | 22,5° | 14,5° | 2        | .00050E      | ●     |  |
| 0,5              | 0,1    | 0,5            | 4              | 57             | 0,45             | 11             | 6                | 22,5° | 14,5° | 2        | .000501      | ●     |  |
| 0,8              | 0,05   | 0,8            | 6,4            | 57             | 0,75             | 13             | 6                | 22,5° | 12°   | 2        | .00080E      | ●     |  |
| 0,8              | 0,1    | 0,8            | 6,4            | 57             | 0,75             | 13             | 6                | 22,5° | 12°   | 2        | .000801      | ●     |  |
| 1                | 0,05   | 1              | 8              | 57             | 0,95             | 14,5           | 6                | 22°   | 10,5° | 2        | .00100E      | ●     |  |
| 1                | 0,1    | 1              | 8              | 57             | 0,95             | 14,5           | 6                | 22°   | 10,5° | 2        | .001001      | ●     |  |
| 1                | 0,2    | 1              | 8              | 57             | 0,95             | 14,5           | 6                | 22°   | 10,5° | 2        | .001002      | ●     |  |
| 1,2              | 0,1    | 1,2            | 9,6            | 57             | 1,1              | 16             | 6                | 21,5° | 9°    | 2        | .001201      | ●     |  |
| 1,2              | 0,3    | 1,2            | 9,6            | 57             | 1,1              | 16             | 6                | 21,5° | 9°    | 2        | .001203      | ●     |  |
| 1,5              | 0,1    | 1,25           | 12             | 57             | 1,4              | 18             | 6                | 21,5° | 8°    | 2        | .001501      | ●     |  |
| 1,5              | 0,3    | 1,25           | 12             | 57             | 1,4              | 18             | 6                | 21,5° | 8°    | 2        | .001503      | ●     |  |
| 1,8              | 0,1    | 1,5            | 14,4           | 57             | 1,7              | 20             | 6                | 21,5° | 6,5°  | 2        | .001801      | ●     |  |
| 1,8              | 0,3    | 1,5            | 14,4           | 57             | 1,7              | 20             | 6                | 21,5° | 6,5°  | 2        | .001803      | ●     |  |
| 2                | 0,1    | 1,5            | 16             | 57             | 1,9              | 20             | 6                | 28°   | 6,5°  | 2        | .002001      | ●     |  |
| 2                | 0,3    | 1,5            | 16             | 57             | 1,9              | 20             | 6                | 28°   | 6,5°  | 2        | .002003      | ●     |  |
| 2                | 0,4    | 1,5            | 16             | 57             | 1,9              | 20             | 6                | 28°   | 6,5°  | 2        | .002004      | ●     |  |
| 2                | 0,5    | 1,5            | 16             | 57             | 1,9              | 20             | 6                | 28°   | 6,5°  | 2        | .002005      | ●     |  |
| 3                | 0,1    | 2              | 24             | 68             | 2,9              | 30             | 6                | 15°   | 3,5°  | 2        | .003001      | ●     |  |
| 3                | 0,3    | 2              | 24             | 68             | 2,9              | 30             | 6                | 15°   | 3,5°  | 2        | .003003      | ●     |  |
| 3                | 0,5    | 2              | 24             | 68             | 2,9              | 30             | 6                | 15°   | 3,5°  | 2        | .003005      | ●     |  |
| 4                | 0,1    | 2,5            | 32             | 80             | 3,9              | 42             | 6                | 6°    | 2°    | 2        | .004001      | ●     |  |
| 4                | 0,3    | 2,5            | 32             | 80             | 3,9              | 42             | 6                | 6°    | 2°    | 2        | .004003      | ●     |  |
| 4                | 0,5    | 2,5            | 32             | 80             | 3,9              | 42             | 6                | 6°    | 2°    | 2        | .004005      | ●     |  |
| 4                | 0,6    | 2,5            | 32             | 80             | 3,9              | 42             | 6                | 6°    | 2°    | 2        | .004006      | ●     |  |
| 5                | 0,1    | 3              | 40             | 80             | 4,9              | 43             | 6                | 11°   | 1,5°  | 2        | .005001      | ●     |  |
| 5                | 0,3    | 3              | 40             | 80             | 4,9              | 43             | 6                | 11°   | 1,5°  | 2        | .005003      | ●     |  |
| 5                | 0,5    | 3              | 40             | 80             | 4,9              | 43             | 6                | 11°   | 1,5°  | 2        | .005005      | ●     |  |
| 5                | 0,8    | 3              | 40             | 80             | 4,9              | 43             | 6                | 11°   | 1,5°  | 2        | .005008      | ●     |  |
| 6                | 0,3    | 3,5            | 48             | 86             | 5,9              | —              | 6                | —     | —     | 2        | .006003      | ●     |  |
| 6                | 0,5    | 3,5            | 48             | 86             | 5,9              | —              | 6                | —     | —     | 2        | .006005      | ●     |  |
| 6                | 1      | 3,5            | 48             | 86             | 5,9              | —              | 6                | —     | —     | 2        | .006010      | ●     |  |


**Hartmetall-Torusfräser – extra lange Ausführung (2 Schneiden)**  
 Solid carbide torus end mills – extra long design (2 flutes)

H

$$l_3 = 8 \times d_1$$


 Gültig für · Valid for  
 3869A

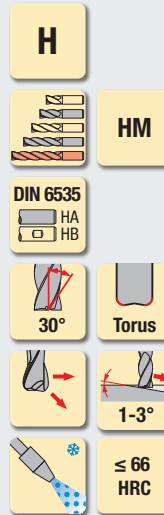
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| P                                                                | 1.1                                                                                          | 240           | 0,013 x $d_1$    | 280           | 0,013 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,012 x $d_1$    | 260           | 0,012 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,011 x $d_1$    | 240           | 0,011 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,010 x $d_1$    | 210           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 160           | 0,009 x $d_1$    | 190           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| M                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| K                                                                | 1.1                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,008 x $d_1$    | 210           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 160           | 0,008 x $d_1$    | 190           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| N                                                                | <b>Aluminium-Legierungen · Aluminium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| S                                                                | <b>Titan-Legierungen · Titanium alloys</b>                                                   |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| H                                                                | <b>Harte Werkstoffe · Hard materials</b>                                                     |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          | 140           | 0,008 x $d_1$    | 180           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 120           | 0,007 x $d_1$    | 160           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 110           | 0,008 x $d_1$    | 140           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 100           | 0,007 x $d_1$    | 120           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 80            | 0,006 x $d_1$    | 100           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

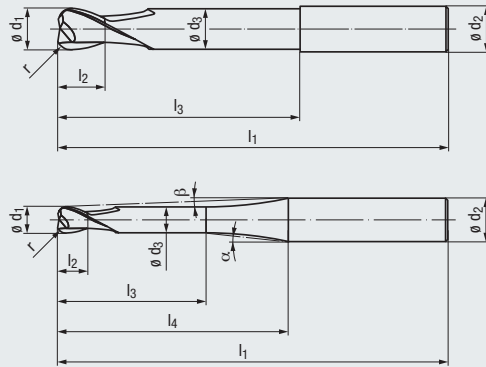
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 5 zylindrische Halslängen bis 12 x d<sub>1</sub> verfügbar
- Hochgenauer Eckenradius

- High performance tool
- 5 cylindrical neck lengths up to 12 x d<sub>1</sub> available
- High-precision corner radius



new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zum Fräsen von zylindrischen Kavitäten
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For milling of cylindrical cavities
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

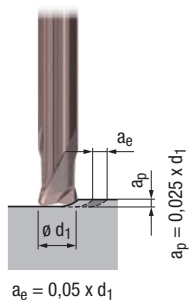
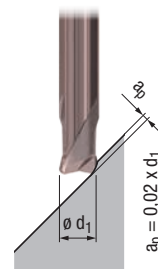
#### l<sub>3</sub> = 10 x d<sub>1</sub> – Extra lange Ausführung · Extra long design

| Bestell-Code · Order code  |             |                |                |                |                  |                |                        |       |       |               |                  | 3870A |  |
|----------------------------|-------------|----------------|----------------|----------------|------------------|----------------|------------------------|-------|-------|---------------|------------------|-------|--|
| ø d <sub>1</sub><br>-0,015 | r<br>±0,005 | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | ø d <sub>3</sub> | l <sub>4</sub> | ø d <sub>2</sub><br>h5 | α     | β     | Z<br>(Flutes) | Dimens.-<br>Code |       |  |
| 0,5                        | 0,05        | 0,5            | 5              | 57             | 0,45             | 12             | 6                      | 22,5° | 13,5° | 2             | .00050E          | ●     |  |
| 0,5                        | 0,1         | 0,5            | 5              | 57             | 0,45             | 12             | 6                      | 22,5° | 13,5° | 2             | .000501          | ●     |  |
| 0,8                        | 0,05        | 0,8            | 8              | 57             | 0,75             | 14,5           | 6                      | 22,5° | 11°   | 2             | .00080E          | ●     |  |
| 0,8                        | 0,1         | 0,8            | 8              | 57             | 0,75             | 14,5           | 6                      | 22,5° | 11°   | 2             | .000801          | ●     |  |
| 1                          | 0,05        | 1              | 10             | 57             | 0,95             | 16,5           | 6                      | 22°   | 9,5°  | 2             | .00100E          | ●     |  |
| 1                          | 0,1         | 1              | 10             | 57             | 0,95             | 16,5           | 6                      | 22°   | 9,5°  | 2             | .001001          | ●     |  |
| 1                          | 0,2         | 1              | 10             | 57             | 0,95             | 16,5           | 6                      | 22°   | 9,5°  | 2             | .001002          | ●     |  |
| 1,2                        | 0,1         | 1,2            | 12             | 57             | 1,1              | 18,5           | 6                      | 21°   | 8°    | 2             | .001201          | ●     |  |
| 1,2                        | 0,3         | 1,2            | 12             | 57             | 1,1              | 18,5           | 6                      | 21°   | 8°    | 2             | .001203          | ●     |  |
| 1,5                        | 0,1         | 1,25           | 15             | 57             | 1,4              | 20             | 6                      | 25,5° | 7°    | 2             | .001501          | ●     |  |
| 1,5                        | 0,3         | 1,25           | 15             | 57             | 1,4              | 20             | 6                      | 25,5° | 7°    | 2             | .001503          | ●     |  |
| 1,8                        | 0,1         | 1,5            | 18             | 63             | 1,7              | 22             | 6                      | 28,5° | 6°    | 2             | .001801          | ●     |  |
| 1,8                        | 0,3         | 1,5            | 18             | 63             | 1,7              | 22             | 6                      | 28,5° | 6°    | 2             | .001803          | ●     |  |
| 2                          | 0,1         | 1,5            | 20             | 63             | 1,9              | 24             | 6                      | 28°   | 5,5°  | 2             | .002001          | ●     |  |
| 2                          | 0,3         | 1,5            | 20             | 63             | 1,9              | 24             | 6                      | 28°   | 5,5°  | 2             | .002003          | ●     |  |
| 2                          | 0,4         | 1,5            | 20             | 63             | 1,9              | 24             | 6                      | 28°   | 5,5°  | 2             | .002004          | ●     |  |
| 2                          | 0,5         | 1,5            | 20             | 63             | 1,9              | 24             | 6                      | 28°   | 5,5°  | 2             | .002005          | ●     |  |
| 3                          | 0,1         | 2              | 30             | 72             | 2,9              | 35             | 6                      | 18°   | 3°    | 2             | .003001          | ●     |  |
| 3                          | 0,3         | 2              | 30             | 72             | 2,9              | 35             | 6                      | 18°   | 3°    | 2             | .003003          | ●     |  |
| 3                          | 0,5         | 2              | 30             | 72             | 2,9              | 35             | 6                      | 18°   | 3°    | 2             | .003005          | ●     |  |
| 4                          | 0,1         | 2,5            | 40             | 80             | 3,9              | 44             | 6                      | 15,5° | 2°    | 2             | .004001          | ●     |  |
| 4                          | 0,3         | 2,5            | 40             | 80             | 3,9              | 44             | 6                      | 15,5° | 2°    | 2             | .004003          | ●     |  |
| 4                          | 0,5         | 2,5            | 40             | 80             | 3,9              | 44             | 6                      | 15,5° | 2°    | 2             | .004005          | ●     |  |
| 4                          | 0,6         | 2,5            | 40             | 80             | 3,9              | 44             | 6                      | 15,5° | 2°    | 2             | .004006          | ●     |  |
| 5                          | 0,1         | 3              | 50             | 100            | 4,9              | 53             | 6                      | 11°   | 1°    | 2             | .005001          | ●     |  |
| 5                          | 0,3         | 3              | 50             | 100            | 4,9              | 53             | 6                      | 11°   | 1°    | 2             | .005003          | ●     |  |
| 5                          | 0,5         | 3              | 50             | 100            | 4,9              | 53             | 6                      | 11°   | 1°    | 2             | .005005          | ●     |  |
| 5                          | 0,8         | 3              | 50             | 100            | 4,9              | 53             | 6                      | 11°   | 1°    | 2             | .005008          | ●     |  |
| 6                          | 0,3         | 3,5            | 60             | 100            | 5,9              | —              | 6                      | —     | —     | 2             | .006003          | ●     |  |
| 6                          | 0,5         | 3,5            | 60             | 100            | 5,9              | —              | 6                      | —     | —     | 2             | .006005          | ●     |  |
| 6                          | 1           | 3,5            | 60             | 100            | 5,9              | —              | 6                      | —     | —     | 2             | .006010          | ●     |  |


**Hartmetall-Torusfräser – extra lange Ausführung (2 Schneiden)**  
 Solid carbide torus end mills – extra long design (2 flutes)

H

$$l_3 = 10 \times d_1$$

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing

 Gültig für · Valid for  
 3870A

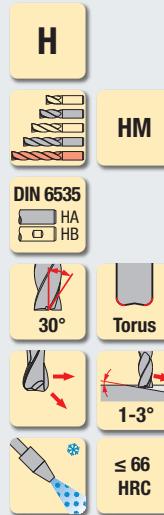

|                                                           |                                                                                       | Stahlwerkstoffe · Steel materials |                        |     |                        |                          |                                     |                          |                                     |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------|------------------------|-----|------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P                                                         | 1.1                                                                                   | 240                               | 0,013 x d <sub>1</sub> | 280 | 0,013 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.1                                                                                   | 220                               | 0,012 x d <sub>1</sub> | 260 | 0,012 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 3.1                                                                                   | 200                               | 0,011 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|                                                           | 4.1                                                                                   | 180                               | 0,010 x d <sub>1</sub> | 210 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|                                                           | 5.1                                                                                   | 160                               | 0,009 x d <sub>1</sub> | 190 | 0,009 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
| Nichtrostende Stahlwerkstoffe · Stainless steel materials |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| M                                                         | 1.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 3.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 4.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
| Gusswerkstoffe · Cast materials                           |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| K                                                         | 1.1                                                                                   | 240                               | 0,011 x d <sub>1</sub> | 280 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 1.2                                                                                   | 240                               | 0,011 x d <sub>1</sub> | 280 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 2.1                                                                                   | 220                               | 0,011 x d <sub>1</sub> | 260 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 2.2                                                                                   | 220                               | 0,011 x d <sub>1</sub> | 260 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 3.1                                                                                   | 200                               | 0,010 x d <sub>1</sub> | 240 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 3.2                                                                                   | 200                               | 0,010 x d <sub>1</sub> | 240 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 4.1                                                                                   | 180                               | 0,008 x d <sub>1</sub> | 210 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 4.2                                                                                   | 160                               | 0,008 x d <sub>1</sub> | 190 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
| Nichteisenwerkstoffe · Non-ferrous materials              |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| Aluminium-Legierungen · Aluminium alloys                  |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| N                                                         | 1.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.2                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.3                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.4                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.5                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.6                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 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                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 5.2                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 5.3                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
| Spezialwerkstoffe · Special materials                     |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| Titan-Legierungen · Titanium alloys                       |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| S                                                         | 1.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.2                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.3                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.1                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.2                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.3                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.4                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.5                                                                                   |                                   |                        |     |                        |                          |                                     |                          |                                     |
| 2.6                                                       |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| Harte Werkstoffe · Hard materials                         |                                                                                       |                                   |                        |     |                        |                          |                                     |                          |                                     |
| H                                                         | 1.1                                                                                   | 140                               | 0,008                  | 180 | 0,009                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.2                                                                                   | 120                               | 0,007                  | 160 | 0,008                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.3                                                                                   | 110                               | 0,008                  | 140 | 0,008                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.4                                                                                   | 100                               | 0,007                  | 120 | 0,007                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.5                                                                                   | 80                                | 0,006                  | 100 | 0,006                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |

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

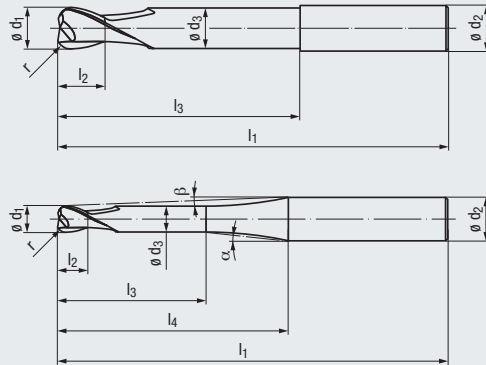
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- 5 zylindrische Halslängen bis 12 x d<sub>1</sub> verfügbar
- Hochgenauer Eckenradius

- High performance tool
- 5 cylindrical neck lengths up to 12 x d<sub>1</sub> available
- High-precision corner radius



new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- In gehärteten Werkstoffen einsetzbar
- Fräsen von zylindrischen Kavitäten bis 12 x d<sub>1</sub>
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- For hardened materials
- Milling of cylindrical cavities up to 12 x d<sub>1</sub>
- Suitable for HSC finishing

TIALN

|   |         |         |
|---|---------|---------|
| P | 3.1-5.1 | 1.1-2.1 |
| K | 1.1-4.2 |         |
| H | 1.1-1.5 |         |

#### l<sub>3</sub> = 12 x d<sub>1</sub> – Extra lange Ausführung · Extra long design

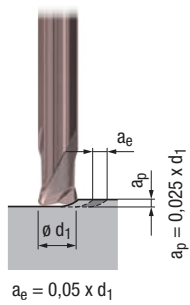
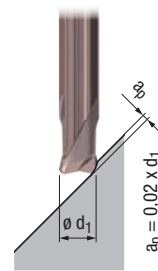
| Bestell-Code · Order code  |             |                |                |                |                  |                |                        |       |       |               |                  | 3871A |  |
|----------------------------|-------------|----------------|----------------|----------------|------------------|----------------|------------------------|-------|-------|---------------|------------------|-------|--|
| ø d <sub>1</sub><br>-0,015 | r<br>±0,005 | l <sub>2</sub> | l <sub>3</sub> | l <sub>1</sub> | ø d <sub>3</sub> | l <sub>4</sub> | ø d <sub>2</sub><br>h5 | α     | β     | Z<br>(Flutes) | Dimens.-<br>Code |       |  |
| 0,5                        | 0,05        | 0,5            | 6              | 57             | 0,45             | 13             | 6                      | 22,5° | 12,5° | 2             | .00050E          | ●     |  |
| 0,5                        | 0,1         | 0,5            | 6              | 57             | 0,45             | 13             | 6                      | 22,5° | 12,5° | 2             | .000501          | ●     |  |
| 0,8                        | 0,05        | 0,8            | 9,6            | 57             | 0,75             | 16             | 6                      | 23°   | 10°   | 2             | .00080E          | ●     |  |
| 0,8                        | 0,1         | 0,8            | 9,6            | 57             | 0,75             | 16             | 6                      | 23°   | 10°   | 2             | .000801          | ●     |  |
| 1                          | 0,05        | 1              | 12             | 57             | 0,95             | 18,5           | 6                      | 22°   | 8,5°  | 2             | .00100E          | ●     |  |
| 1                          | 0,1         | 1              | 12             | 57             | 0,95             | 18,5           | 6                      | 22°   | 8,5°  | 2             | .001001          | ●     |  |
| 1                          | 0,2         | 1              | 12             | 57             | 0,95             | 18,5           | 6                      | 22°   | 8,5°  | 2             | .001002          | ●     |  |
| 1,2                        | 0,1         | 1,2            | 14,4           | 57             | 1,1              | 21             | 6                      | 21°   | 7°    | 2             | .001201          | ●     |  |
| 1,2                        | 0,3         | 1,2            | 14,4           | 57             | 1,1              | 21             | 6                      | 21°   | 7°    | 2             | .001203          | ●     |  |
| 1,5                        | 0,1         | 1,25           | 18             | 63             | 1,4              | 24             | 6                      | 21,5° | 6°    | 2             | .001501          | ●     |  |
| 1,5                        | 0,3         | 1,25           | 18             | 63             | 1,4              | 24             | 6                      | 21,5° | 6°    | 2             | .001503          | ●     |  |
| 1,8                        | 0,1         | 1,5            | 21,6           | 66             | 1,7              | 26             | 6                      | 28°   | 5,5°  | 2             | .001801          | ●     |  |
| 1,8                        | 0,3         | 1,5            | 21,6           | 66             | 1,7              | 26             | 6                      | 28°   | 5,5°  | 2             | .001803          | ●     |  |
| 2                          | 0,1         | 1,5            | 24             | 66             | 1,9              | 28             | 6                      | 28°   | 4,5°  | 2             | .002001          | ●     |  |
| 2                          | 0,3         | 1,5            | 24             | 66             | 1,9              | 28             | 6                      | 28°   | 4,5°  | 2             | .002003          | ●     |  |
| 2                          | 0,4         | 1,5            | 24             | 66             | 1,9              | 28             | 6                      | 28°   | 4,5°  | 2             | .002004          | ●     |  |
| 2                          | 0,5         | 1,5            | 24             | 66             | 1,9              | 28             | 6                      | 28°   | 4,5°  | 2             | .002005          | ●     |  |
| 3                          | 0,1         | 2              | 36             | 80             | 2,9              | 42,5           | 6                      | 14°   | 2,5°  | 2             | .003001          | ●     |  |
| 3                          | 0,3         | 2              | 36             | 80             | 2,9              | 42,5           | 6                      | 14°   | 2,5°  | 2             | .003003          | ●     |  |
| 3                          | 0,5         | 2              | 36             | 80             | 2,9              | 42,5           | 6                      | 14°   | 2,5°  | 2             | .003005          | ●     |  |
| 4                          | 0,1         | 2,5            | 48             | 100            | 3,9              | 61             | 6                      | 5,5°  | 1,5°  | 2             | .004001          | ●     |  |
| 4                          | 0,3         | 2,5            | 48             | 100            | 3,9              | 61             | 6                      | 5,5°  | 1,5°  | 2             | .004003          | ●     |  |
| 4                          | 0,5         | 2,5            | 48             | 100            | 3,9              | 61             | 6                      | 5,5°  | 1,5°  | 2             | .004005          | ●     |  |
| 4                          | 0,6         | 2,5            | 48             | 100            | 3,9              | 61             | 6                      | 5,5°  | 1,5°  | 2             | .004006          | ●     |  |
| 5                          | 0,1         | 3              | 60             | 100            | 4,9              | 63             | 6                      | 11°   | 1°    | 2             | .005001          | ●     |  |
| 5                          | 0,3         | 3              | 60             | 100            | 4,9              | 63             | 6                      | 11°   | 1°    | 2             | .005003          | ●     |  |
| 5                          | 0,5         | 3              | 60             | 100            | 4,9              | 63             | 6                      | 11°   | 1°    | 2             | .005005          | ●     |  |
| 5                          | 0,8         | 3              | 60             | 100            | 4,9              | 63             | 6                      | 11°   | 1°    | 2             | .005008          | ●     |  |
| 6                          | 0,3         | 3,5            | 72             | 110            | 5,9              | —              | 6                      | —     | —     | 2             | .006003          | ●     |  |
| 6                          | 0,5         | 3,5            | 72             | 110            | 5,9              | —              | 6                      | —     | —     | 2             | .006005          | ●     |  |
| 6                          | 1           | 3,5            | 72             | 110            | 5,9              | —              | 6                      | —     | —     | 2             | .006010          | ●     |  |


**Hartmetall-Torusfräser – extra lange Ausführung (2 Schneiden)**  
 Solid carbide torus end mills – extra long design (2 flutes)

 Gültig für · Valid for  
 3871A

H

$$l_3 = 12 \times d_1$$

 Vorschlichten  
 Pre-finishing

 Schlichten  
 Finishing


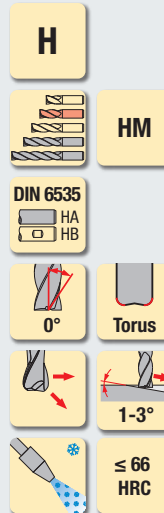
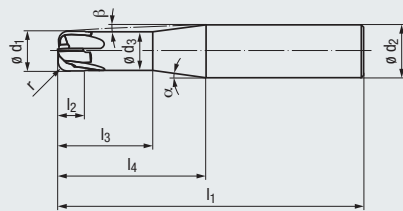
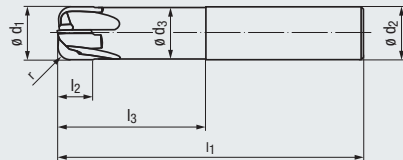
|                                                                  | $V_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $V_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| P                                                                | 1.1                                                                                          | 240           | 0,013 x $d_1$    | 280           | 0,013 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,012 x $d_1$    | 260           | 0,012 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,011 x $d_1$    | 240           | 0,011 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,010 x $d_1$    | 210           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 160           | 0,009 x $d_1$    | 190           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| M                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| K                                                                | 1.1                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 240           | 0,011 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 220           | 0,011 x $d_1$    | 260           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 200           | 0,010 x $d_1$    | 240           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 180           | 0,008 x $d_1$    | 210           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 160           | 0,008 x $d_1$    | 190           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| N                                                                | <b>Aluminium-Legierungen · Aluminium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.7                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.8                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| S                                                                | <b>Titan-Legierungen · Titanium alloys</b>                                                   |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Harte Werkstoffe · Hard materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| H                                                                | 1.1                                                                                          | 140           | 0,008 x $d_1$    | 180           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 120           | 0,007 x $d_1$    | 160           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 110           | 0,008 x $d_1$    | 140           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 100           | 0,007 x $d_1$    | 120           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 80            | 0,006 x $d_1$    | 100           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Mit 4 Schneiden
- Hochgenauer Eckenradius
- Kurze, stabile Schneidenlänge
- 3 Baulängen verfügbar

- High-performance tool
- With 4 flutes
- High-precision corner radius
- Short, stable flute length
- 3 length available



new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zur Schlichtbearbeitung mit sehr guter Oberflächenqualität
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For finishing with very high surface quality
- Suitable for HSC finishing

|   |              |
|---|--------------|
| P | 1.1-5.1      |
| K | 1.1-4.2      |
| N | 2.3, 2.6-2.8 |
| N | 2.2, 2.4-2.5 |
| H | 1.1-1.5      |

#### $l_3 = 3 \times d_1$ – Kurze Ausführung · Short design

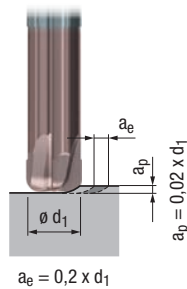
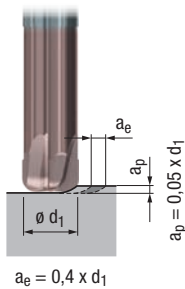
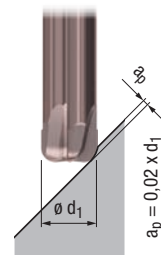
#### Bestell-Code · Order code

| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code | 3874A |  |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|---------------|------------------|-------|--|
| -0,015          | ±0,005 |       |       |       |                 |       | h5              |          |         |               |                  |       |  |
| 2               | 0,1    | 1,5   | 8     | 57    | 1,8             | 19,9  | 6               | 10°      | 6,5°    | 4             | .002001          | ●     |  |
| 2               | 0,3    | 1,5   | 8     | 57    | 1,8             | 19,9  | 6               | 10°      | 6,5°    | 4             | .002003          | ●     |  |
| 2               | 0,5    | 1,5   | 8     | 57    | 1,8             | 19,9  | 6               | 10°      | 6,5°    | 4             | .002005          | ●     |  |
| 3               | 0,1    | 2     | 10    | 57    | 2,8             | 19    | 6               | 10°      | 5,5°    | 4             | .003001          | ●     |  |
| 3               | 0,3    | 2     | 10    | 57    | 2,8             | 19    | 6               | 10°      | 5,5°    | 4             | .003003          | ●     |  |
| 3               | 0,5    | 2     | 10    | 57    | 2,8             | 19    | 6               | 10°      | 5,5°    | 4             | .003005          | ●     |  |
| 3               | 0,75   | 2     | 10    | 57    | 2,8             | 19    | 6               | 10°      | 5,5°    | 4             | .003007          | ●     |  |
| 4               | 0,1    | 2,5   | 12    | 57    | 3,8             | 18,2  | 6               | 10°      | 3,5°    | 4             | .004001          | ●     |  |
| 4               | 0,3    | 2,5   | 12    | 57    | 3,8             | 18,2  | 6               | 10°      | 3,5°    | 4             | .004003          | ●     |  |
| 4               | 0,5    | 2,5   | 12    | 57    | 3,8             | 18,2  | 6               | 10°      | 3,5°    | 4             | .004005          | ●     |  |
| 4               | 1      | 2,5   | 12    | 57    | 3,8             | 18,2  | 6               | 10°      | 3,5°    | 4             | .004010          | ●     |  |
| 5               | 0,1    | 3     | 15    | 57    | 4,7             | 18,6  | 6               | 10°      | 2°      | 4             | .005001          | ●     |  |
| 5               | 0,3    | 3     | 15    | 57    | 4,7             | 18,6  | 6               | 10°      | 2°      | 4             | .005003          | ●     |  |
| 5               | 0,5    | 3     | 15    | 57    | 4,7             | 18,6  | 6               | 10°      | 2°      | 4             | .005005          | ●     |  |
| 5               | 1,25   | 3     | 15    | 57    | 4,7             | 18,6  | 6               | 10°      | 2°      | 4             | .005012          | ●     |  |
| 6               | 0,3    | 4     | 20    | 57    | 5,6             | —     | 6               | —        | —       | 4             | .006003          | ●     |  |
| 6               | 0,5    | 4     | 20    | 57    | 5,6             | —     | 6               | —        | —       | 4             | .006005          | ●     |  |
| 6               | 1      | 4     | 20    | 57    | 5,6             | —     | 6               | —        | —       | 4             | .006010          | ●     |  |
| 6               | 1,5    | 4     | 20    | 57    | 5,6             | —     | 6               | —        | —       | 4             | .006015          | ●     |  |
| 8               | 0,3    | 5     | 25    | 63    | 7,6             | —     | 8               | —        | —       | 4             | .008003          | ●     |  |
| 8               | 0,5    | 5     | 25    | 63    | 7,6             | —     | 8               | —        | —       | 4             | .008005          | ●     |  |
| 8               | 1      | 5     | 25    | 63    | 7,6             | —     | 8               | —        | —       | 4             | .008010          | ●     |  |
| 8               | 2      | 5     | 25    | 63    | 7,6             | —     | 8               | —        | —       | 4             | .008020          | ●     |  |
| 10              | 0,3    | 6     | 30    | 72    | 9,6             | —     | 10              | —        | —       | 4             | .010003          | ●     |  |
| 10              | 0,5    | 6     | 30    | 72    | 9,6             | —     | 10              | —        | —       | 4             | .010005          | ●     |  |
| 10              | 1      | 6     | 30    | 72    | 9,6             | —     | 10              | —        | —       | 4             | .010010          | ●     |  |
| 10              | 2      | 6     | 30    | 72    | 9,6             | —     | 10              | —        | —       | 4             | .010020          | ●     |  |
| 10              | 2,5    | 6     | 30    | 72    | 9,6             | —     | 10              | —        | —       | 4             | .010025          | ●     |  |
| 12              | 0,5    | 7     | 36    | 83    | 11,5            | —     | 12              | —        | —       | 4             | .012005          | ●     |  |
| 12              | 1      | 7     | 36    | 83    | 11,5            | —     | 12              | —        | —       | 4             | .012010          | ●     |  |
| 12              | 2      | 7     | 36    | 83    | 11,5            | —     | 12              | —        | —       | 4             | .012020          | ●     |  |
| 12              | 3      | 7     | 36    | 83    | 11,5            | —     | 12              | —        | —       | 4             | .012030          | ●     |  |
| 12              | 4      | 7     | 36    | 83    | 11,5            | —     | 12              | —        | —       | 4             | .012040          | ●     |  |
| 16              | 4      | 8     | 48    | 96    | 15,5            | —     | 16              | —        | —       | 4             | .016040          | ●     |  |


**Hartmetall-Torusfräser – kurze Ausführung (4 Schneiden)**  
 Solid carbide torus end mills – short design (4 flutes)

H

$$l_3 = 3 \times d_1$$

 Schruppen  
 Roughing

 Schlichten  
 Finishing

 Gültig für · Valid for  
 3874A

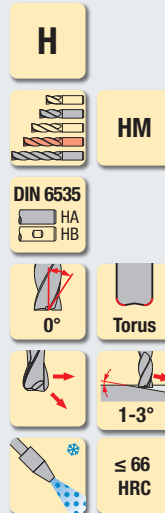
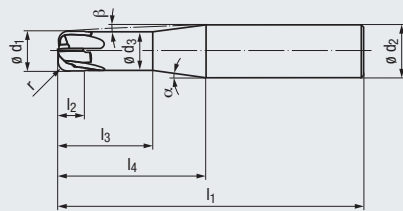
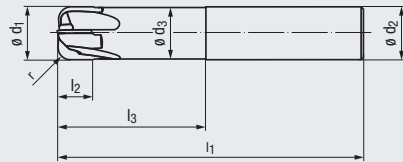

|                                                           |                                                                                       | Stahlwerkstoffe · Steel materials |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------|------------------------|-----|------------------------|-----|------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| P                                                         | 1.1                                                                                   | 280                               | 0,013 x d <sub>1</sub> | 320 | 0,013 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.1                                                                                   | 240                               | 0,012 x d <sub>1</sub> | 280 | 0,012 x d <sub>1</sub> | 320 | 0,009 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 3.1                                                                                   | 210                               | 0,01 x d <sub>1</sub>  | 240 | 0,01 x d <sub>1</sub>  | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|                                                           | 4.1                                                                                   | 170                               | 0,009 x d <sub>1</sub> | 200 | 0,009 x d <sub>1</sub> | 220 | 0,007 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
|                                                           | 5.1                                                                                   | 140                               | 0,008 x d <sub>1</sub> | 160 | 0,008 x d <sub>1</sub> | 180 | 0,006 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
| Nichtrostende Stahlwerkstoffe · Stainless steel materials |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| M                                                         | 1.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 3.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 4.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| Gusswerkstoffe · Cast materials                           |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| K                                                         | 1.1                                                                                   | 280                               | 0,014 x d <sub>1</sub> | 320 | 0,014 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 1.2                                                                                   | 280                               | 0,014 x d <sub>1</sub> | 320 | 0,014 x d <sub>1</sub> | 360 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 2.1                                                                                   | 250                               | 0,011 x d <sub>1</sub> | 280 | 0,011 x d <sub>1</sub> | 320 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 2.2                                                                                   | 250                               | 0,011 x d <sub>1</sub> | 280 | 0,011 x d <sub>1</sub> | 320 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          | <input type="checkbox"/>            |
|                                                           | 3.1                                                                                   | 210                               | 0,011 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 3.2                                                                                   | 210                               | 0,011 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 4.1                                                                                   | 170                               | 0,008 x d <sub>1</sub> | 200 | 0,008 x d <sub>1</sub> | 220 | 0,006 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 4.2                                                                                   | 150                               | 0,008 x d <sub>1</sub> | 160 | 0,008 x d <sub>1</sub> | 180 | 0,006 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
| Nichteisenwerkstoffe · Non-ferrous materials              |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| Aluminium-Legierungen · Aluminium alloys                  |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| N                                                         | 1.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.2                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.3                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.4                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.5                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.6                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | Kupfer-Legierungen · Copper alloys                                                    |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.2                                                                                   | 250                               | 0,014 x d <sub>1</sub> | 280 | 0,014 x d <sub>1</sub> | 320 | 0,010 x d <sub>1</sub> |                          |                                     | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.3                                                                                   | 250                               | 0,014 x d <sub>1</sub> | 280 | 0,014 x d <sub>1</sub> | 320 | 0,010 x d <sub>1</sub> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.4                                                                                   | 210                               | 0,011 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> |                          |                                     | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.5                                                                                   | 210                               | 0,011 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> |                          |                                     | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.6                                                                                   | 210                               | 0,011 x d <sub>1</sub> | 240 | 0,011 x d <sub>1</sub> | 270 | 0,008 x d <sub>1</sub> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.7                                                                                   | 130                               | 0,008 x d <sub>1</sub> | 150 | 0,008 x d <sub>1</sub> | 170 | 0,006 x d <sub>1</sub> |                          |                                     | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 2.8                                                                                   | 130                               | 0,008 x d <sub>1</sub> | 150 | 0,008 x d <sub>1</sub> | 170 | 0,006 x d <sub>1</sub> |                          |                                     | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                                           | 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                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| Spezialwerkstoffe · Special materials                     |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| Titan-Legierungen · Titanium alloys                       |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| S                                                         | 1.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.2                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 1.3                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.1                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.2                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.3                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.4                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.5                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
|                                                           | 2.6                                                                                   |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| Harte Werkstoffe · Hard materials                         |                                                                                       |                                   |                        |     |                        |     |                        |                          |                                     |                          |                                     |
| H                                                         | 1.1                                                                                   | 130                               | 0,008 x d <sub>1</sub> | 150 | 0,008 x d <sub>1</sub> | 180 | 0,006 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.2                                                                                   | 120                               | 0,007 x d <sub>1</sub> | 140 | 0,007 x d <sub>1</sub> | 160 | 0,005 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.3                                                                                   |                                   |                        | 120 | 0,006 x d <sub>1</sub> | 140 | 0,005 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.4                                                                                   |                                   |                        | 90  | 0,005 x d <sub>1</sub> | 110 | 0,004 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |
|                                                           | 1.5                                                                                   |                                   |                        | 70  | 0,004 x d <sub>1</sub> | 90  | 0,003 x d <sub>1</sub> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |                          |                                     |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Mit 4 Schneiden
- Hochgenauer Eckenradius
- Kurze, stabile Schneidenlänge
- 3 Baulängen verfügbar

- High-performance tool
- With 4 flutes
- High-precision corner radius
- Short, stable flute length
- 3 length available



new



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zur Schlichtbearbeitung mit sehr guter Oberflächenqualität
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For finishing with very high surface quality
- Suitable for HSC finishing

|   |              |
|---|--------------|
| P | 1.1-5.1      |
| K | 1.1-4.2      |
| N | 2.3, 2.6-2.8 |
| N | 2.2, 2.4-2.5 |
| H | 1.1-1.5      |

#### $l_3 = 5 \times d_1$ – Lange Ausführung · Long design

#### Bestell-Code · Order code

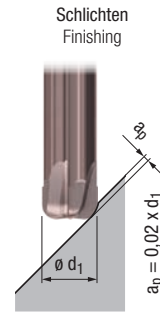
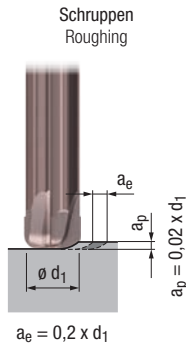
| $\emptyset d_1$ | r      | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$ | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code | 3875A |
|-----------------|--------|-------|-------|-------|-----------------|-------|-----------------|----------|---------|---------------|------------------|-------|
| -0,015          | ±0,005 |       |       |       |                 |       | h5              |          |         |               |                  |       |
| 2               | 0,1    | 1,5   | 10    | 63    | 1,8             | 21,9  | 6               | 10°      | 5,5°    | 4             | .002001          | ●     |
| 2               | 0,3    | 1,5   | 10    | 63    | 1,8             | 21,9  | 6               | 10°      | 5,5°    | 4             | .002003          | ●     |
| 2               | 0,5    | 1,5   | 10    | 63    | 1,8             | 21,9  | 6               | 10°      | 5,5°    | 4             | .002005          | ●     |
| 3               | 0,1    | 2     | 15    | 63    | 2,8             | 24    | 6               | 10°      | 4°      | 4             | .003001          | ●     |
| 3               | 0,3    | 2     | 15    | 63    | 2,8             | 24    | 6               | 10°      | 4°      | 4             | .003003          | ●     |
| 3               | 0,5    | 2     | 15    | 63    | 2,8             | 24    | 6               | 10°      | 4°      | 4             | .003005          | ●     |
| 4               | 0,1    | 2,5   | 20    | 63    | 3,8             | 26,2  | 6               | 10°      | 2,5°    | 4             | .004001          | ●     |
| 4               | 0,3    | 2,5   | 20    | 63    | 3,8             | 26,2  | 6               | 10°      | 2,5°    | 4             | .004003          | ●     |
| 4               | 0,5    | 2,5   | 20    | 63    | 3,8             | 26,2  | 6               | 10°      | 2,5°    | 4             | .004005          | ●     |
| 5               | 0,1    | 3     | 25    | 66    | 4,7             | 28,6  | 6               | 10°      | 1,5°    | 4             | .005001          | ●     |
| 5               | 0,3    | 3     | 25    | 66    | 4,7             | 28,6  | 6               | 10°      | 1,5°    | 4             | .005003          | ●     |
| 5               | 0,5    | 3     | 25    | 66    | 4,7             | 28,6  | 6               | 10°      | 1,5°    | 4             | .005005          | ●     |
| 6               | 0,3    | 4     | 30    | 66    | 5,6             | —     | 6               | —        | —       | 4             | .006003          | ●     |
| 6               | 0,5    | 4     | 30    | 66    | 5,6             | —     | 6               | —        | —       | 4             | .006005          | ●     |
| 6               | 1      | 4     | 30    | 66    | 5,6             | —     | 6               | —        | —       | 4             | .006010          | ●     |
| 6               | 1,5    | 4     | 30    | 66    | 5,6             | —     | 6               | —        | —       | 4             | .006015          | ●     |
| 8               | 0,3    | 5     | 40    | 78    | 7,6             | —     | 8               | —        | —       | 4             | .008003          | ●     |
| 8               | 0,5    | 5     | 40    | 78    | 7,6             | —     | 8               | —        | —       | 4             | .008005          | ●     |
| 8               | 1      | 5     | 40    | 78    | 7,6             | —     | 8               | —        | —       | 4             | .008010          | ●     |
| 8               | 2      | 5     | 40    | 78    | 7,6             | —     | 8               | —        | —       | 4             | .008020          | ●     |
| 10              | 0,3    | 6     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 4             | .010003          | ●     |
| 10              | 0,5    | 6     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 4             | .010005          | ●     |
| 10              | 1      | 6     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 4             | .010010          | ●     |
| 10              | 2      | 6     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 4             | .010020          | ●     |
| 10              | 2,5    | 6     | 50    | 92    | 9,6             | —     | 10              | —        | —       | 4             | .010025          | ●     |
| 12              | 0,5    | 7     | 60    | 106   | 11,5            | —     | 12              | —        | —       | 4             | .012005          | ●     |
| 12              | 1      | 7     | 60    | 106   | 11,5            | —     | 12              | —        | —       | 4             | .012010          | ●     |
| 12              | 2      | 7     | 60    | 106   | 11,5            | —     | 12              | —        | —       | 4             | .012020          | ●     |
| 12              | 3      | 7     | 60    | 106   | 11,5            | —     | 12              | —        | —       | 4             | .012030          | ●     |
| 12              | 4      | 7     | 60    | 106   | 11,5            | —     | 12              | —        | —       | 4             | .012040          | ●     |
| 16              | 4      | 8     | 80    | 130   | 15,5            | —     | 16              | —        | —       | 4             | .016040          | ●     |


**Hartmetall-Torusfräser – lange Ausführung (4 Schneiden)**  
 Solid carbide torus end mills – long design (4 flutes)

 Gültig für · Valid for  
 3875A

H

$$l_3 = 5 \times d_1$$



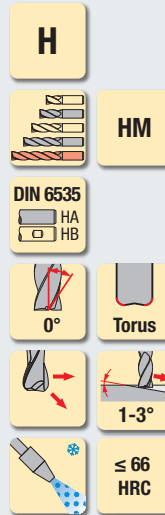
|                                                                  | $v_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $v_c$<br>[m/min]   | $f_z$<br>[mm] |                    |                          |                                     |                                     |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|--------------------|---------------|--------------------|--------------------------|-------------------------------------|-------------------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| P                                                                | 1.1                                                                                          | 320           | $0,013 \times d_1$ | 360           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 2.1                                                                                          | 280           | $0,012 \times d_1$ | 320           | $0,009 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 3.1                                                                                          | 240           | $0,01 \times d_1$  | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 4.1                                                                                          | 200           | $0,009 \times d_1$ | 220           | $0,007 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 5.1                                                                                          | 160           | $0,008 \times d_1$ | 180           | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| M                                                                | 1.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 3.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 4.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| K                                                                | 1.1                                                                                          | 320           | $0,014 \times d_1$ | 360           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 1.2                                                                                          | 320           | $0,014 \times d_1$ | 360           | $0,010 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 2.1                                                                                          | 280           | $0,011 \times d_1$ | 320           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 2.2                                                                                          | 280           | $0,011 \times d_1$ | 320           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 3.1                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 3.2                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 4.1                                                                                          | 200           | $0,008 \times d_1$ | 220           | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 4.2                                                                                          | 160           | $0,008 \times d_1$ | 180           | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| <b>Aluminium-Legierungen · Aluminium alloys</b>                  |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| N                                                                | 1.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.2                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.3                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.4                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.5                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.6                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.2                                                                                          | 280           | $0,014 \times d_1$ | 320           | $0,010 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | 2.3                                                                                          | 280           | $0,014 \times d_1$ | 320           | $0,010 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | 2.4                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | 2.5                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | 2.6                                                                                          | 240           | $0,011 \times d_1$ | 270           | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | 2.7                                                                                          | 150           | $0,008 \times d_1$ | 170           | $0,006 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | 2.8                                                                                          | 150           | $0,008 \times d_1$ | 170           | $0,006 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 3.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 3.2                                                                                          |               |                    |               |                    |                          |                                     |                                     |
| <b>Kunststoffe · Synthetics</b>                                  |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| N                                                                | 4.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 4.2                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 4.3                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 4.4                                                                                          |               |                    |               |                    |                          |                                     |                                     |
| <b>Besondere Werkstoffe · Special materials</b>                  |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| N                                                                | 5.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 5.2                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 5.3                                                                                          |               |                    |               |                    |                          |                                     |                                     |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| <b>Titan-Legierungen · Titanium alloys</b>                       |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| S                                                                | 1.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.2                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 1.3                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.1                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.2                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.3                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.4                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.5                                                                                          |               |                    |               |                    |                          |                                     |                                     |
|                                                                  | 2.6                                                                                          |               |                    |               |                    |                          |                                     |                                     |
| <b>Harte Werkstoffe · Hard materials</b>                         |                                                                                              |               |                    |               |                    |                          |                                     |                                     |
| H                                                                | 1.1                                                                                          | 150           | $0,008 \times d_1$ | 180           | $0,006 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 1.2                                                                                          | 140           | $0,007 \times d_1$ | 160           | $0,005 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 1.3                                                                                          | 120           | $0,006 \times d_1$ | 140           | $0,005 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 1.4                                                                                          | 90            | $0,005 \times d_1$ | 110           | $0,004 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
|                                                                  | 1.5                                                                                          | 70            | $0,004 \times d_1$ | 90            | $0,003 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |

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

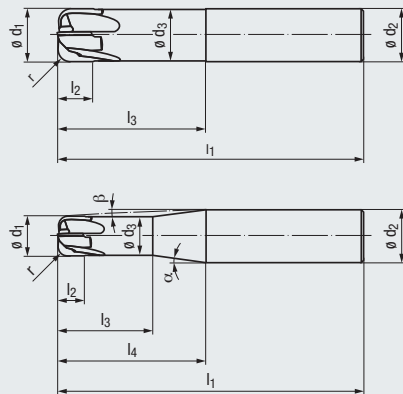
☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Mit 4 Schneiden
- Hochgenauer Eckenradius
- Kurze, stabile Schneidenlänge
- 3 Baulängen verfügbar

- High-performance tool
- With 4 flutes
- High-precision corner radius
- Short, stable flute length
- 3 length available



neu



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- Spezielle TIALN-Beschichtung zur Bearbeitung gehärteter Werkstoffe
- Zur Schlichtbearbeitung mit sehr guter Oberflächenqualität
- Zum HSC-Schlichten geeignet

Applications – material (see page 4)

- Special TIALN-coating for machining hardened materials
- For finishing with very high surface quality
- Suitable for HSC finishing

TIALN

|   |              |
|---|--------------|
| P | 1.1-5.1      |
| K | 1.1-4.2      |
| N | 2.3, 2.6-2.8 |
| N | 2.2, 2.4-2.5 |
| H | 1.1-1.5      |

$l_3 = 8 \times d_1$  – Extra lange Ausführung · Extra long design

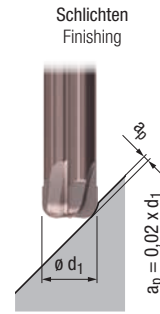
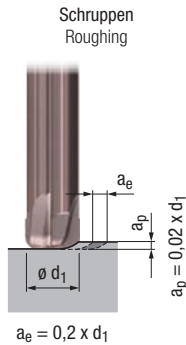
| Bestell-Code · Order code |             |       |       |       |                 |       |                       |          |         |               |                  | 3876A |  |
|---------------------------|-------------|-------|-------|-------|-----------------|-------|-----------------------|----------|---------|---------------|------------------|-------|--|
| $\emptyset d_1$<br>-0,015 | r<br>±0,005 | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $l_4$ | $\emptyset d_2$<br>h5 | $\alpha$ | $\beta$ | Z<br>(Flutes) | Dimens.-<br>Code |       |  |
| 2                         | 0,1         | 1,5   | 16    | 66    | 1,8             | 27,9  | 6                     | 10°      | 4,5°    | 4             | .002001          | ●     |  |
| 2                         | 0,3         | 1,5   | 16    | 66    | 1,8             | 27,9  | 6                     | 10°      | 4,5°    | 4             | .002003          | ●     |  |
| 2                         | 0,5         | 1,5   | 16    | 66    | 1,8             | 27,9  | 6                     | 10°      | 4,5°    | 4             | .002005          | ●     |  |
| 3                         | 0,1         | 2     | 24    | 72    | 2,8             | 33    | 6                     | 10°      | 3°      | 4             | .003001          | ●     |  |
| 3                         | 0,3         | 2     | 24    | 72    | 2,8             | 33    | 6                     | 10°      | 3°      | 4             | .003003          | ●     |  |
| 3                         | 0,5         | 2     | 24    | 72    | 2,8             | 33    | 6                     | 10°      | 3°      | 4             | .003005          | ●     |  |
| 4                         | 0,1         | 2,5   | 32    | 76    | 3,8             | 38,2  | 6                     | 10°      | 2°      | 4             | .004001          | ●     |  |
| 4                         | 0,3         | 2,5   | 32    | 76    | 3,8             | 38,2  | 6                     | 10°      | 2°      | 4             | .004003          | ●     |  |
| 4                         | 0,5         | 2,5   | 32    | 76    | 3,8             | 38,2  | 6                     | 10°      | 2°      | 4             | .004005          | ●     |  |
| 5                         | 0,1         | 3     | 40    | 80    | 4,7             | 43,6  | 6                     | 10°      | 1°      | 4             | .005001          | ●     |  |
| 5                         | 0,3         | 3     | 40    | 80    | 4,7             | 43,6  | 6                     | 10°      | 1°      | 4             | .005003          | ●     |  |
| 5                         | 0,5         | 3     | 40    | 80    | 4,7             | 43,6  | 6                     | 10°      | 1°      | 4             | .005005          | ●     |  |
| 6                         | 0,3         | 4     | 48    | 86    | 5,6             | —     | 6                     | —        | —       | 4             | .006003          | ●     |  |
| 6                         | 0,5         | 4     | 48    | 86    | 5,6             | —     | 6                     | —        | —       | 4             | .006005          | ●     |  |
| 6                         | 1           | 4     | 48    | 86    | 5,6             | —     | 6                     | —        | —       | 4             | .006010          | ●     |  |
| 8                         | 0,3         | 5     | 64    | 102   | 7,6             | —     | 8                     | —        | —       | 4             | .008003          | ●     |  |
| 8                         | 0,5         | 5     | 64    | 102   | 7,6             | —     | 8                     | —        | —       | 4             | .008005          | ●     |  |
| 8                         | 1           | 5     | 64    | 102   | 7,6             | —     | 8                     | —        | —       | 4             | .008010          | ●     |  |
| 8                         | 2           | 5     | 64    | 102   | 7,6             | —     | 8                     | —        | —       | 4             | .008020          | ●     |  |


**Hartmetall-Torusfräser – extra lange Ausführung (4 Schneiden)**  
 Solid carbide torus end mills – extra long design (4 flutes)

 Gültig für · Valid for  
 3876A

H

$$l_3 = 8 \times d_1$$



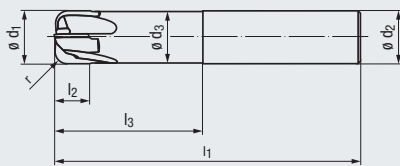
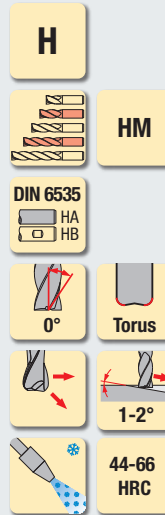
|                                                                  | $v_c$<br>[m/min]                                                                             | $f_z$<br>[mm] | $v_c$<br>[m/min] | $f_z$<br>[mm] |               |                          |                                     |                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|------------------|---------------|---------------|--------------------------|-------------------------------------|--------------------------|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| P                                                                | 1.1                                                                                          | 250           | 0,013 x $d_1$    | 300           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 230           | 0,012 x $d_1$    | 260           | 0,009 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 200           | 0,01 x $d_1$     | 230           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 170           | 0,009 x $d_1$    | 200           | 0,007 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 5.1                                                                                          | 150           | 0,008 x $d_1$    | 180           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |               |                  |               |               |                          |                                     |                          |
| M                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |               |                  |               |               |                          |                                     |                          |
| K                                                                | 1.1                                                                                          | 250           | 0,014 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 250           | 0,014 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.1                                                                                          | 230           | 0,011 x $d_1$    | 260           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.2                                                                                          | 230           | 0,011 x $d_1$    | 260           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.1                                                                                          | 190           | 0,011 x $d_1$    | 210           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 3.2                                                                                          | 190           | 0,011 x $d_1$    | 210           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.1                                                                                          | 160           | 0,008 x $d_1$    | 190           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 4.2                                                                                          | 140           | 0,008 x $d_1$    | 170           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>Aluminium-Legierungen · Aluminium alloys</b>                  |                                                                                              |               |                  |               |               |                          |                                     |                          |
| N                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.6                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          | 240           | 0,014 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.3                                                                                          | 240           | 0,014 x $d_1$    | 280           | 0,010 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.4                                                                                          | 200           | 0,011 x $d_1$    | 250           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.5                                                                                          | 200           | 0,011 x $d_1$    | 250           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.6                                                                                          | 200           | 0,011 x $d_1$    | 250           | 0,008 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.7                                                                                          | 140           | 0,008 x $d_1$    | 170           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 2.8                                                                                          | 140           | 0,008 x $d_1$    | 170           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 3.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 4.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 5.3                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |               |                  |               |               |                          |                                     |                          |
| <b>Titan-Legierungen · Titanium alloys</b>                       |                                                                                              |               |                  |               |               |                          |                                     |                          |
| S                                                                | 1.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 1.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.1                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.2                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.3                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.4                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.5                                                                                          |               |                  |               |               |                          |                                     |                          |
|                                                                  | 2.6                                                                                          |               |                  |               |               |                          |                                     |                          |
| <b>Harte Werkstoffe · Hard materials</b>                         |                                                                                              |               |                  |               |               |                          |                                     |                          |
| H                                                                | 1.1                                                                                          | 120           | 0,008 x $d_1$    | 150           | 0,006 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.2                                                                                          | 100           | 0,007 x $d_1$    | 130           | 0,005 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.3                                                                                          | 90            | 0,006 x $d_1$    | 110           | 0,005 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.4                                                                                          | 80            | 0,005 x $d_1$    | 90            | 0,004 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|                                                                  | 1.5                                                                                          | 70            | 0,004 x $d_1$    | 80            | 0,003 x $d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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

☒ = sehr gut geeignet · very suitable  
☐ = gut geeignet · suitable

- Hochleistungswerkzeug
- Mit 6 und 8 Schneiden
- Hochgenauer Eckenradius
- Kurze, stabile Schneidenlänge
- 2 Baulängen verfügbar

- High performance tool
- With 6 and 8 flutes
- High-precision corner radius
- Short, stable flute length
- 2 lengths available



#### Beschichtung · Coating

#### Einsatzgebiete – Material (siehe Seite 4)

- Zur Bearbeitung harter Werkstoffe
- Zur Schlichtbearbeitung mit sehr guter Oberflächenqualität
- Zum HSC-Schlichten geeignet

#### Applications – material (see page 4)

- For machining hard materials
- For finishing with very high surface quality
- Suitable for HSC finishing

#### TIALN

|   |          |
|---|----------|
| P | 3.1-5.1  |
| K | 1.1-4.2  |
| N | 2.3, 2.6 |
| S | 1.2-2.6  |
| H | 1.1-1.5  |

#### TIALN

|   |          |
|---|----------|
| P | 3.1-5.1  |
| K | 1.1-4.2  |
| N | 2.3, 2.6 |
| S | 1.2-2.6  |
| H | 1.1-1.5  |

#### Kurze Ausführung · Short design

##### Bestell-Code · Order code

| $\emptyset d_1$<br>$\pm 0,01$ | $r$<br>$\pm 0,005$ | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $\emptyset d_2$<br>h5 | Z<br>(Flutes) | Dimens.-<br>Code | 2876A |  |
|-------------------------------|--------------------|-------|-------|-------|-----------------|-----------------------|---------------|------------------|-------|--|
| 10                            | 1                  | 6     | 30    | 72    | 9,6             | 10                    | 6             | .010010          | ●     |  |
| 10                            | 2,5                | 6     | 30    | 72    | 9,6             | 10                    | 6             | .010             | ●     |  |
| 12                            | 1                  | 7     | 35    | 83    | 11,5            | 12                    | 8             | .012010          | ●     |  |
| 12                            | 3                  | 7     | 35    | 83    | 11,5            | 12                    | 8             | .012             | ●     |  |

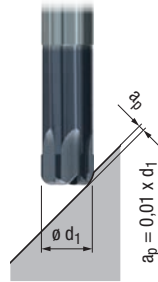
#### Lange Ausführung · Long design

##### Bestell-Code · Order code

| $\emptyset d_1$<br>$\pm 0,01$ | $r$<br>$\pm 0,005$ | $l_2$ | $l_3$ | $l_1$ | $\emptyset d_3$ | $\emptyset d_2$<br>h5 | Z<br>(Flutes) | Dimens.-<br>Code |  | 2877A |
|-------------------------------|--------------------|-------|-------|-------|-----------------|-----------------------|---------------|------------------|--|-------|
| 10                            | 1                  | 6     | 45    | 100   | 9,6             | 10                    | 6             | .010010          |  | ●     |
| 10                            | 2,5                | 6     | 45    | 100   | 9,6             | 10                    | 6             | .010             |  | ●     |
| 12                            | 1                  | 7     | 50    | 100   | 11,5            | 12                    | 8             | .012010          |  | ●     |
| 12                            | 3                  | 7     | 50    | 100   | 11,5            | 12                    | 8             | .012             |  | ●     |
| 16                            | 4                  | 8     | 60    | 120   | 15,5            | 16                    | 8             | .016             |  | ●     |


**Hartmetall-Torusfräser – kurze und lange Ausführung (6-8 Schneiden)**  
 Solid carbide torus end mills – short and long design (6-8 flutes)

H

Schlichten  
Finishing
 Gültig für · Valid for  
 2876A  
 2877A

|                                                                  |                                                                                              | $v_c$<br>[m/min] | $f_z$<br>[mm]      |   |   | MMS<br>MQL |   |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------|--------------------|---|---|------------|---|
| <b>Stahlwerkstoffe · Steel materials</b>                         |                                                                                              |                  |                    |   |   |            |   |
| P                                                                | 1.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 3.1                                                                                          | 270              | $0,007 \times d_1$ | □ | ■ | □          |   |
|                                                                  | 4.1                                                                                          | 220              | $0,006 \times d_1$ | □ | ■ | □          |   |
|                                                                  | 5.1                                                                                          | 180              | $0,005 \times d_1$ | □ | ■ | □          |   |
| <b>Nichtrostende Stahlwerkstoffe · Stainless steel materials</b> |                                                                                              |                  |                    |   |   |            |   |
| M                                                                | 1.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 3.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 4.1                                                                                          |                  |                    |   |   |            |   |
| <b>Gusswerkstoffe · Cast materials</b>                           |                                                                                              |                  |                    |   |   |            |   |
| K                                                                | 1.1                                                                                          | 360              | $0,008 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 1.2                                                                                          | 360              | $0,008 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 2.1                                                                                          | 320              | $0,006 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 2.2                                                                                          | 320              | $0,006 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 3.1                                                                                          | 270              | $0,006 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 3.2                                                                                          | 270              | $0,006 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 4.1                                                                                          | 220              | $0,005 \times d_1$ | □ | ■ |            | □ |
|                                                                  | 4.2                                                                                          | 180              | $0,005 \times d_1$ | □ | ■ |            | □ |
| <b>Nichteisenwerkstoffe · Non-ferrous materials</b>              |                                                                                              |                  |                    |   |   |            |   |
| <b>Aluminium-Legierungen · Aluminium alloys</b>                  |                                                                                              |                  |                    |   |   |            |   |
| N                                                                | 1.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 1.2                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 1.3                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 1.4                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 1.5                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 1.6                                                                                          |                  |                    |   |   |            |   |
|                                                                  | <b>Kupfer-Legierungen · Copper alloys</b>                                                    |                  |                    |   |   |            |   |
|                                                                  | 2.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.2                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.3                                                                                          | 320              | $0,008 \times d_1$ | □ | □ | □          | ■ |
|                                                                  | 2.4                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.5                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.6                                                                                          | 270              | $0,007 \times d_1$ | □ | □ | □          | ■ |
|                                                                  | 2.7                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 2.8                                                                                          |                  |                    |   |   |            |   |
|                                                                  | <b>Magnesium-Legierungen · Magnesium alloys</b>                                              |                  |                    |   |   |            |   |
|                                                                  | 3.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 3.2                                                                                          |                  |                    |   |   |            |   |
|                                                                  | <b>Kunststoffe · Synthetics</b>                                                              |                  |                    |   |   |            |   |
|                                                                  | 4.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 4.2                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 4.3                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 4.4                                                                                          |                  |                    |   |   |            |   |
|                                                                  | <b>Besondere Werkstoffe · Special materials</b>                                              |                  |                    |   |   |            |   |
|                                                                  | 5.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 5.2                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 5.3                                                                                          |                  |                    |   |   |            |   |
| <b>Spezialwerkstoffe · Special materials</b>                     |                                                                                              |                  |                    |   |   |            |   |
| <b>Titan-Legierungen · Titanium alloys</b>                       |                                                                                              |                  |                    |   |   |            |   |
| S                                                                | 1.1                                                                                          |                  |                    |   |   |            |   |
|                                                                  | 1.2                                                                                          | 120              | $0,006 \times d_1$ |   |   | □          | ■ |
|                                                                  | 1.3                                                                                          | 70               | $0,005 \times d_1$ |   |   | □          | ■ |
|                                                                  | <b>Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys</b> |                  |                    |   |   |            |   |
|                                                                  | 2.1                                                                                          | 110              | $0,006 \times d_1$ |   |   | □          | ■ |
|                                                                  | 2.2                                                                                          | 50               | $0,004 \times d_1$ |   |   | □          | ■ |
|                                                                  | 2.3                                                                                          | 40               | $0,004 \times d_1$ |   |   | □          | ■ |
|                                                                  | 2.4                                                                                          | 40               | $0,004 \times d_1$ |   |   | □          | ■ |
|                                                                  | 2.5                                                                                          | 30               | $0,004 \times d_1$ |   |   | □          | ■ |
|                                                                  | 2.6                                                                                          | 40               | $0,004 \times d_1$ |   |   | □          | ■ |
|                                                                  | <b>Harte Werkstoffe · Hard materials</b>                                                     |                  |                    |   |   |            |   |
| H                                                                | 1.1                                                                                          | 180              | $0,006 \times d_1$ | □ | ■ |            |   |
|                                                                  | 1.2                                                                                          | 160              | $0,005 \times d_1$ | □ | ■ |            |   |
|                                                                  | 1.3                                                                                          | 140              | $0,005 \times d_1$ | □ | ■ |            |   |
|                                                                  | 1.4                                                                                          | 110              | $0,004 \times d_1$ | □ | ■ |            |   |
|                                                                  | 1.5                                                                                          | 90               | $0,003 \times d_1$ | □ | ■ |            |   |

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

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

Durch die Verwendung von gekühlter Luft wird die Temperatur im Schneidenbereich herabgesetzt, wodurch höhere Schnittgeschwindigkeiten und Standzeiten erreicht werden können. Moderne Beschichtungen können durch diese Art der Kühlung erst alle Vorteile ausspielen, da eine Schädigung der Schneide durch Thermoschock vermieden wird.

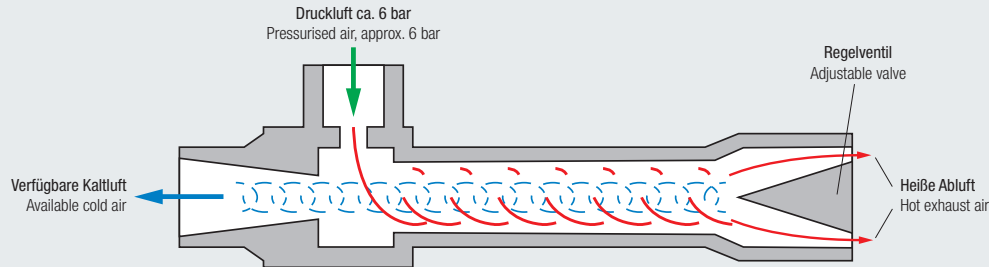
Darüber hinaus werden die beim Kopierfräsen anfallenden sehr leichten Späne auch aus tiefen Aussparungen oder Kavitäten mit Hilfe der Kaltluftdüse entfernt.

Die Wirkungsweise der Kaltluftdüse basiert auf dem Prinzip des Wirbelrohrs, in dem zwei gegenläufige, rotierende Luftströme (ohne bewegte Teile) erzeugt werden. An einem Ende tritt die innere Strömung als nutzbare Kaltluft mit bis zu -40 °C aus. Der Anschluss erfolgt über einen Druckluftanschluss.

Cooled air reduces temperatures in the cutting area, which in turn permits higher cutting speeds and longer tool life. This type of cooling enables modern coatings to achieve their full potential, as damage to the cutting edge resulting from thermal shock is avoided.

Moreover, the cold-air nozzle helps to remove the tiny chips produced in copy milling even from deep recesses or cavities.

The function of the cold-air nozzle is based on the principle of the vortex tube, in which two opposed, rotating air streams are generated (without any moving parts). The internal air stream exits from one end, in the form of useable cold air with a temperature as low as -40 °C. All that is required is a normal pressurised air connection.



**Temperatur gemessen am effektiven Austritt des Wirbelrohrs (nicht Düsenende)**  
Temperature, measured at the effective exit of the vortex tube (not the end of the nozzle)

| Zuluft-Druck<br>Supply air pressure<br>[bar] | Temperatur der Nutzluft in °C bei einem Kaltluftanteil von<br>Temperature of usable air in °C, with a cold air percentage of |     |     |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----|-----|
|                                              | 25%                                                                                                                          | 50% | 75% |
| 3                                            | -31                                                                                                                          | -22 | - 6 |
| 4                                            | -35                                                                                                                          | -35 | - 8 |
| 5                                            | -39                                                                                                                          | -28 | -10 |
| 6                                            | -42                                                                                                                          | -31 | -11 |
| 7                                            | -46                                                                                                                          | -34 | -13 |

**Luftverbrauch bei Eingangstemperatur von 21 °C**  
Air consumption, with supply air temperature of 21 °C

| Eingangsdruck<br>Input pressure<br>[bar] | Luftverbrauch<br>Air consumption      | Kapazität<br>Capacity  |
|------------------------------------------|---------------------------------------|------------------------|
| 6,9                                      | 7,08 l/s $\pm$ 25,5 m <sup>3</sup> /h | 226 kcal/h $\pm$ 263 W |

### Anwendungsbeispiel: Standzeiterhöhung durch den Einsatz der Kaltluftdüse

**Werkstück:** Formeinsatz gehärtet, Material K360 mit 63 HRC  
**Bearbeitung:** Schlichten des Formeinsatzes  
**Werkzeug:** FRANKEN Hard-Cut  
Schneidendurchmesser 10 mm, 2 Schneiden

**Schnittwerte:**  $v_c = 240 \text{ m/min} \cdot n = 7639 \text{ min}^{-1}$   
 $f_z = 0,12 \text{ mm} \cdot v_f = 1833 \text{ mm/min}$   
 $a_p = 0,2 \text{ mm} \cdot a_e = 0,2 \text{ mm}$

| Standzeit ohne Kühlung | Standzeit mit Kaltluftdüse |
|------------------------|----------------------------|
| 98 Minuten             | 130 Minuten                |

Durch den Einsatz der Kaltluftdüse konnte die Standzeit um 33% erhöht werden.

### Application example: Increased tool life using the cold-air nozzle

**Workpiece:** Hardened mould, material K360 with 63 HRC  
**Operation:** Finishing the mould  
**Tool:** FRANKEN Hard-Cut  
Cutting diameter 10 mm, 2 flutes  
**Cutting conditions:**  $v_c = 240 \text{ m/min} \cdot n = 7639 \text{ rpm}$   
 $f_z = 0,12 \text{ mm} \cdot v_f = 1833 \text{ mm/min}$   
 $a_p = 0,2 \text{ mm} \cdot a_e = 0,2 \text{ mm}$

| Tool life without coolant | Tool life with cold-air nozzle |
|---------------------------|--------------------------------|
| 98 minutes                | 130 minutes                    |

By using the cold-air nozzle, it was possible to increase the tool life by 33%.



**Kaltluftdüse**  
 Cold-Air Nozzle


## Lieferumfang:

- Mit biegsamem Schlauch (Länge ca. 300 mm) für kalte Nutzluft
- Schalldämpfer (SN14) für heiße Abluft
- Kugelhahn mit Anschlussstück (ST 1/4) für Zuluftschlauch (NW6) mit Schnellwechselkupplung (NW7.2)

## Delivery includes:

- With flexible hose (length approx. 300 mm) for cold air
- Silencer (SN14) for hot exhaust air
- Ball-valve with fitting (1/4") for inlet hose (6 mm) with quick-change attachment (7.2 mm)

| Bestell-Code · Order code                      |                  | 6910 |
|------------------------------------------------|------------------|------|
| Länge (ohne Schlauch)<br>Length (without hose) | Dimens.-<br>Code |      |
| 225 mm                                         | .15              | ●    |

**Ersatzschlauch**  
 Spare Hose


| Bestell-Code · Order code |                  | 6910 |
|---------------------------|------------------|------|
| Länge<br>Length           | Dimens.-<br>Code |      |
| ≈ 300 mm                  | .20              | ●    |
| ≈ 400 mm                  | .22              | ●    |
| ≈ 500 mm                  | .21              | ●    |

**Halterungen für die Kaltluftdüse**  
 Holders for the Cold-Air Nozzle

 Klemmarm mit Grundhalter  
 Socket with basic holder

 Klemmarm mit Magnethalter  
 Socket with magnetic shoe

 Klemmarm  
 Socket

 Grundhalter für Klemmarm  
 Basic holder for socket

 Magnethalter für Klemmarm  
 Magnetic shoe for socket


| Bestell-Code · Order code |                  | 6910 |   |   |   |   |
|---------------------------|------------------|------|---|---|---|---|
| Abmaße<br>Dimensions      | Dimens.-<br>Code |      |   |   |   |   |
| ø 45 x 68 mm              | .24              | ●    |   |   |   |   |
| ø 80 x 80 mm              | .25              |      | ● |   |   |   |
| ø 80 x 17 mm              | .26              |      |   |   |   | ● |
| ø 32 x 63 mm              | .27              |      |   | ● |   |   |
| ø 45 x 20 mm              | .32              |      |   |   | ● |   |

### Kaltluftdüsen-Anbauset

Cold-Air Nozzle Attachment Set



|                           |      |
|---------------------------|------|
| Bestell-Code · Order code | 6910 |
| Dimens.-Code              |      |
| .12                       | ●    |

#### Lieferumfang:

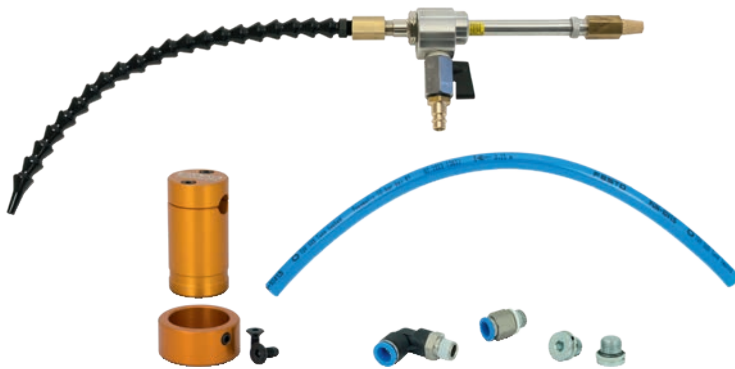
- 1 x Klemmarm mit Grundhalter (Art.-Nr.: 6910.24)
- 1 x Anschlussschlauch 300 mm
- 1 x Winkel-Verschraubung G 1/4
- 1 x Verschraubung G 1/4
- 2 x Blindstopfen G 1/4

#### Delivery includes:

- 1 x Socket with basic holder (art. No. 6910.24)
- 1 x Connecting hose 300 mm
- 1 x Elbow coupling G 1/4
- 1 x Screw G 1/4
- 2 x Sealing plugs G 1/4

### Kaltluftdüsen-Montageset 1

Cold-Air Nozzle Assembly Set 1



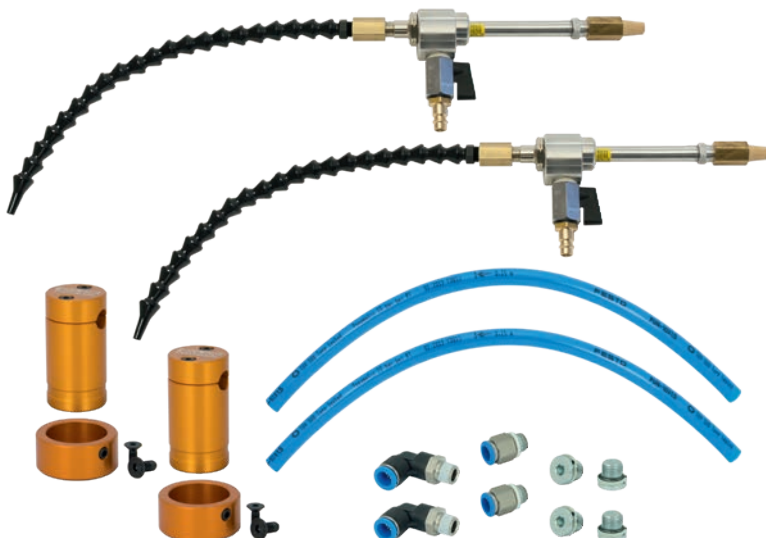
Bestehend aus 1 Kaltluftdüse (Art.-Nr.: 6910.15) und 1 Kaltluftdüsen-Anbauset (Art.-Nr.: 6910.12)  
Consists of 1 cold-air nozzle (art. no. 6910.15) and 1 cold-air nozzle attachment set (art. no. 6910.12)



|                           |      |
|---------------------------|------|
| Bestell-Code · Order code | 6910 |
| Dimens.-Code              |      |
| .11                       | ●    |

### Kaltluftdüsen-Montageset 2

Cold-Air Nozzle Assembly Set 2



Bestehend aus 2 Kaltluftdüsen (Art.-Nr.: 6910.15) und 2 Kaltluftdüsen-Anbausets (Art.-Nr.: 6910.12)  
Consists of 2 cold-air nozzles (art. no. 6910.15) and 2 cold-air nozzle attachment sets (art. no. 6910.12)



|                           |      |
|---------------------------|------|
| Bestell-Code · Order code | 6910 |
| Dimens.-Code              |      |
| .10                       | ●    |

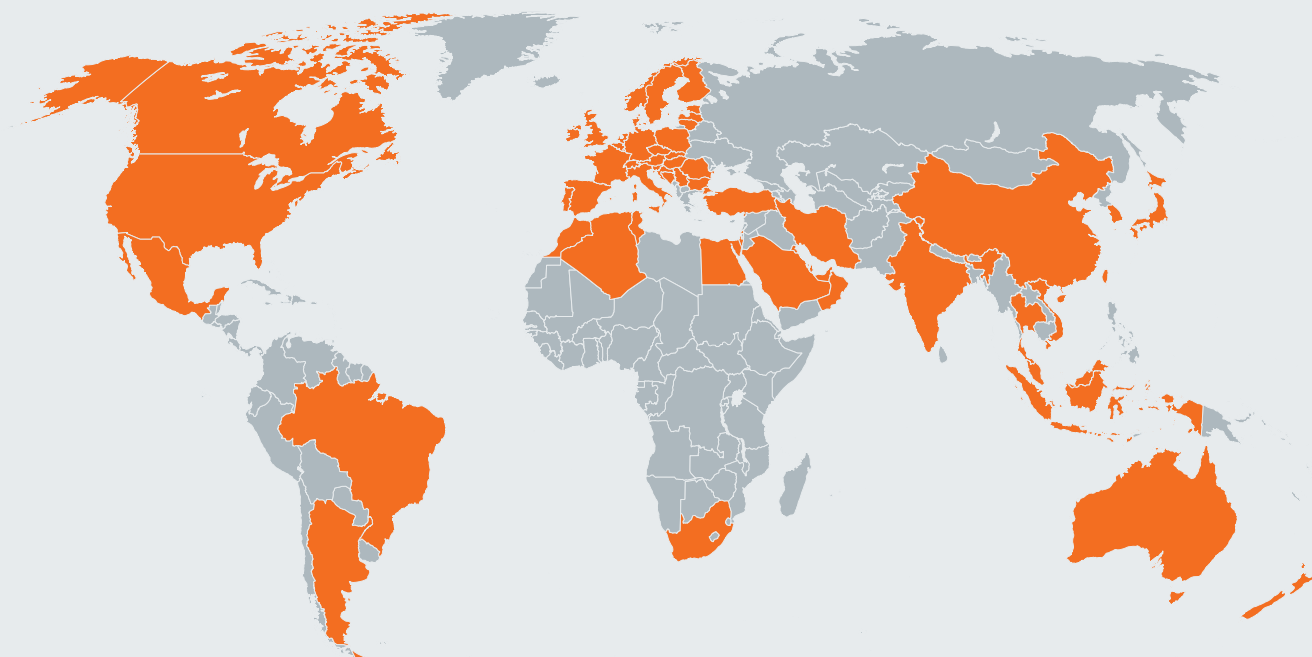
In unseren Unternehmen ist die Abteilung „Anwendungstechnik“ die Service- und Dienstleistungsabteilung für den weltweit bestehenden Kundenkreis. Für die von EMUGE-FRANKEN angebotenen Produkte stellt dieses Expertenteam folgende Leistungen zur Verfügung:

- Weltweite telefonische Beratung und Unterstützung bei der Lösung technischer Probleme
- Mitarbeit bei der Erarbeitung von Konzepten und Vorschlägen zur Optimierung des Fertigungsablaufes beim Kunden
- Durchführung von Versuchen mit spezifischen Kundenmaterialien in einer eigens dafür eingerichteten Versuchsabteilung zur optimalen Werkzeugauswahl und -empfehlung
- Entwicklung und Konstruktion kundenspezifischer Sonderwerkzeuge
- Einsatz von Servicetechnikern
- Durchführung von produktbezogenen Schulungen und Seminaren weltweit

At EMUGE-FRANKEN, the Technical Service Department is the service and consulting partner for our customers worldwide. Our team of service technicians will be happy to help you in any of the following ways:

- Worldwide telephone consulting and support in the solution of technical problems
- Active support in the development of work strategies and in the optimisation of production processes
- Cutting trials with specific customer materials in a special workshop fitted exclusively for that purpose, for the perfect tool selection
- Development and construction of special tools made to customer's specifications
- Visits to customers' workshops and active support on location
- Product-related training courses and seminars arranged at any place worldwide





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