



**GOLDBERG®**

*innovation. precision. performance.*



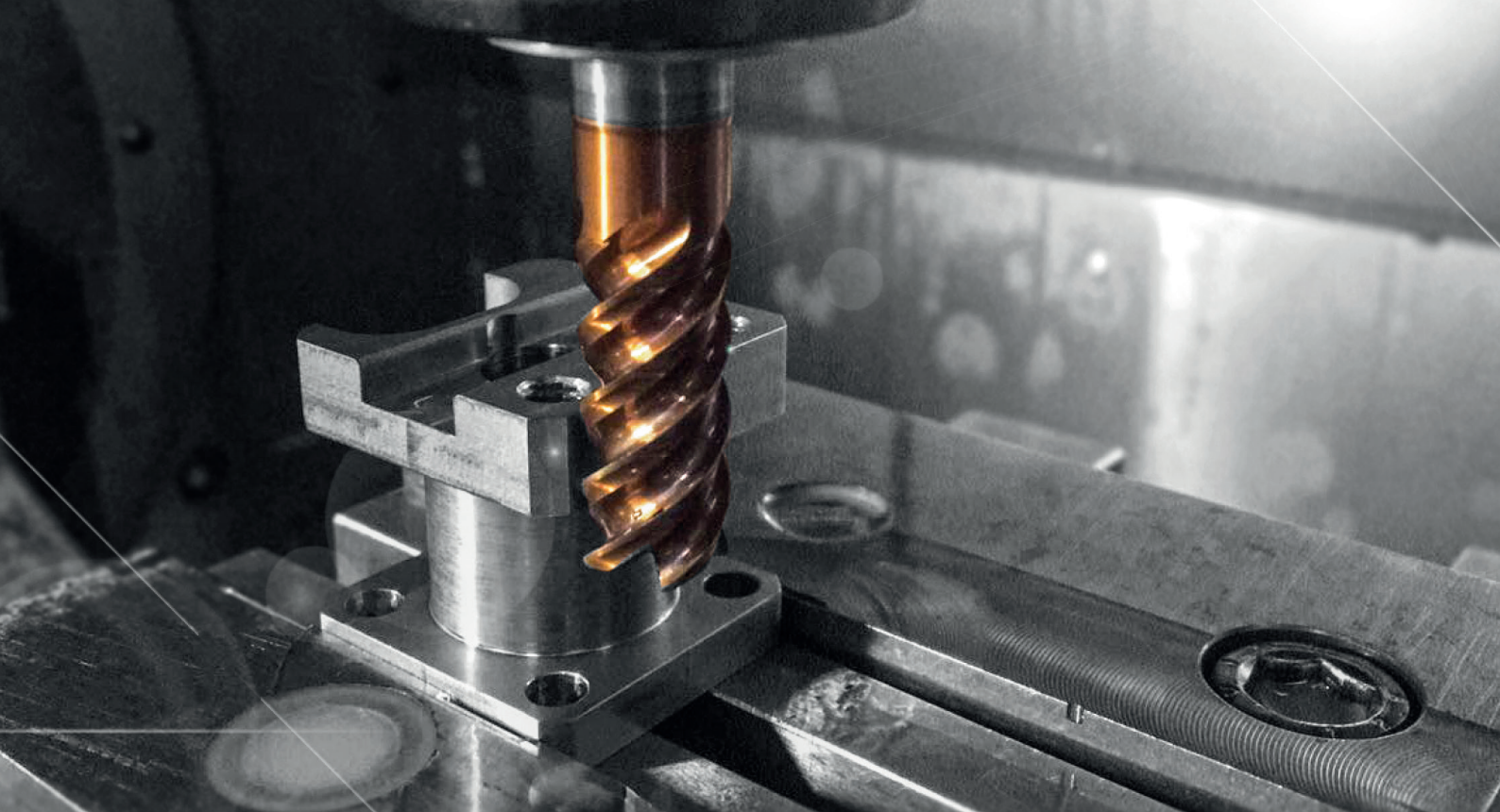
# Katalogergänzung

## VHM-Fräser

Supplement  
Solid Carbide End Mills



2022.5



## Inhaltsverzeichnis / Contents

| Bezeichnung / Designation | Anzahl Schneiden / Number of teeth                       | Drallwinkel / Helix angle | Ausführung / Version | Beschichtung / Coating                  | Ø-Bereich / Ø-range | Stahl / Steel |   |   |   |   |   | Seite / Page |
|---------------------------|----------------------------------------------------------|---------------------------|----------------------|-----------------------------------------|---------------------|---------------|---|---|---|---|---|--------------|
|                           |                                                          |                           |                      |                                         |                     | P             | M | K | N | S | H |              |
| EM25                      | Schaftfräser / End mill                                  | 3                         | 41°-43°              | standard                                | TiAlN <sup>Cr</sup> | 1,0-25,0      | ● | ● | ● | ● |   | 4            |
| EM28                      | Schaftfräser / End mill                                  | 4                         | 35°-38°              | kurz / short                            | TiAlN <sup>Cr</sup> | 3,0-20,0      | ● | ● | ● |   | ● | 5            |
| EM29                      | Schaftfräser / End mill                                  | 4                         | 35°-38°              | lang / long                             | TiAlN <sup>Cr</sup> | 3,0-25,0      | ● | ● | ● |   | ● | 6            |
| EM31                      | Torusfräser (Trochoidal) / Torical end mill (trochoidal) | 4                         | 35°-38°              | standard                                | TiAlN <sup>Cr</sup> | 3,0-20,0      | ● | ● | ● |   | ● | 7            |
| EM32                      | Schaftfräser / End mill                                  | 4                         | 35°-38°              | lang / long                             | TiAlN <sup>Cr</sup> | 6,0-20,0      | ● | ● | ● |   | ● | 8            |
| EM50                      | Umfangfräsen / Peripheral milling                        | 6-8                       | 45°                  |                                         | TiAlN               | 4,0-25,0      | ● |   | ● |   |   | 9            |
| EM51                      | Umfangfräsen / Peripheral milling                        | 6-8                       | 45°                  | lang/long                               | TiAlN               | 4,0-25,0      | ● |   | ● |   |   | 10           |
| EM52                      | Umfangfräsen / Peripheral milling                        | 6                         | 46°-48°              |                                         | TiAlN <sup>CR</sup> | 6,0-25,0      | ● | ● | ● |   | ● | 11           |
| EHM15                     | Umfangfräsen / Peripheral milling                        | 6                         | 55°                  |                                         | ALTiSiN             | 4,0-20,0      |   |   |   |   | ● | 12           |
| EHM16                     | Umfangfräsen / Peripheral milling                        | 6                         | 55°                  | lang/long                               | ALTiSiN             | 6,0-20,0      |   | ● |   |   | ● | 13           |
| PM9                       | Torusfräser / Torical end mill                           | 4                         | 35°-38°              | lange Aus-<br>kragweite /<br>long reach | ALCrN               | 3,0-20,0      | ● | ● | ● | ● | ● | 14           |
| PM31                      | Schaftfräser (Trochoidal) / End mill (trochoidal)        | 5                         | 37°-38°              | 2xD                                     | ALCrN               | 3,0-25,0      | ● |   |   |   | ● | 15           |
| PM32                      | Torusfräser (Trochoidal) / Torical end mill (trochoidal) | 5                         | 37°-38°              | 2xD                                     | ALCrN               | 6,0-20,0      | ● |   |   |   | ● | 16           |
| PM33                      | Schaftfräser (Trochoidal) / End mill (trochoidal)        | 5                         | 37°-38°              | 4xD                                     | ALCrN               | 3,0-25,0      | ● |   |   |   | ● | 17           |
| PM34                      | Torusfräser (Trochoidal) / Torical end mill (trochoidal) | 5                         | 37°-38°              | 4xD                                     | ALCrN               | 6,0-20,0      | ● |   |   |   | ● | 18           |
| ESM10                     | Schaftfräser / End mill                                  | 4                         | 36°-38°              | lang / long                             | TiCrN-basiert       | 3,0-25,0      |   | ● |   |   | ● | 19           |
| ESM12                     | Schaftfräser / End mill                                  | 4                         | 36°-38°              | 3xD                                     | TiCrN-basiert       | 3,0-20,0      |   | ● |   |   | ● | 20           |

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| Bezeichnung / Designation |                                                          | Anzahl Schneiden / Number of teeth |         | Drallwinkel / Helix angle | Ausführung / Version | Beschichtung / Coating | Ø-Bereich / Ø-range | Materialien / Materials |                             |                  |                        |                                   |                                   | Seite / Page |    |
|---------------------------|----------------------------------------------------------|------------------------------------|---------|---------------------------|----------------------|------------------------|---------------------|-------------------------|-----------------------------|------------------|------------------------|-----------------------------------|-----------------------------------|--------------|----|
|                           |                                                          |                                    |         |                           |                      |                        |                     | Stahl / Steel           | Edelstahl / Stainless steel | Guss / Cast iron | NE-Metalle / Aluminium | Hochwarmfeste Leg. / Super alloys | Gehärtete Stähle / Hardened steel |              |    |
|                           |                                                          |                                    |         |                           |                      |                        |                     | P                       | M                           | K                | N                      | S                                 | H                                 |              |    |
| SM20                      | Torusfräser (Trochoidal) / Torical end mill (trochoidal) | 4                                  | 40°-42° | standard                  | AlCr-basiert         | 6,0-16,0               |                     | ●                       | ●                           | ●                |                        |                                   | ●                                 | ◐            | 21 |
| SM28                      | Schaftfräser (Trochoidal) / End mill (trochoidal)        | 5                                  | 41°-42° | 2xD                       | AlCr-basiert         | 3,0-25,0               |                     |                         | ●                           |                  |                        |                                   | ●                                 |              | 22 |
| SM29                      | Torusfräser (Trochoidal) / Torical end mill (trochoidal) | 5                                  | 41°-42° | 2xD                       | AlCr-basiert         | 6,0-20,0               |                     |                         | ●                           |                  |                        |                                   | ●                                 |              | 23 |
| SM30                      | Schaftfräser (Trochoidal) / End mill (trochoidal)        | 5                                  | 41°-42° | 4xD                       | AlCr-basiert         | 3,0-25,0               |                     |                         | ●                           |                  |                        |                                   | ●                                 |              | 24 |
| SM31                      | Torusfräser (Trochoidal) / Torical end mill (trochoidal) | 5                                  | 41°-42° | 4xD                       | AlCr-basiert         | 6,0-20,0               |                     |                         | ●                           |                  |                        |                                   | ●                                 |              | 25 |
| AL45                      | Schaftfräser / End mill                                  | 3                                  | 50°     | standard                  | poliert/polished     | 1,0-25,0               |                     |                         |                             |                  |                        | ●                                 |                                   |              | 26 |
| AL55                      | Schaftfräser / End mill                                  | 3                                  | 44°     |                           | ZSiX                 | 3,0-20,0               |                     |                         |                             |                  |                        | ●                                 |                                   |              | 27 |
| AL56                      | Schaftfräser / End mill                                  | 3                                  | 41°-44° |                           | ZSiX                 | 6,0-20,0               |                     |                         |                             |                  |                        | ●                                 |                                   |              | 28 |
| AL57                      | Schaftfräser / End mill                                  | 3                                  | 44°     |                           | ZSiX                 | 3,0-20,0               |                     |                         |                             |                  |                        | ●                                 |                                   |              | 29 |

## EcoMill® EM25 3-Schneidig, (Variable Steigung) 3 flutes, (variable helix)

Fräsdurchmesser / Milling cutting dia.: 1,0 mm - 25,0 mm  
Typ / Type: DIN 6535 HB

Steigung / Helix angle: 41°-43°  
Beschichtung / Coating: TiAlN<sup>Cr</sup>  
Anzahl Zähne / No. of flutes: 3

Zentrumschliß / Center cutting: ✓



| -Schaft A (Shank A) | Schaft B (Shank B) | D1   | D2 | L2  | L3   | D3   | L1 | c[45°] | z |
|---------------------|--------------------|------|----|-----|------|------|----|--------|---|
| -                   | EM25-3B01043VC     | 1    | 6  | 2,5 | 5    | 0,95 | 57 | 0,1    | 3 |
| -                   | EM25-3B01543VC     | 1,5  | 6  | 4   | 7,5  | 1,44 | 57 | 0,1    | 3 |
| -                   | EM25-3B02043VC     | 2    | 6  | 5   | 10   | 1,92 | 57 | 0,1    | 3 |
| -                   | EM25-3B02543VC     | 2,5  | 6  | 6,5 | 12,5 | 2,4  | 57 | 0,1    | 3 |
| -                   | EM25-3B03043VC     | 3    | 6  | 8   | 15   | 2,9  | 57 | 0,1    | 3 |
| -                   | EM25-3B03543VC     | 3,5  | 6  | 11  | 16   | 3,4  | 57 | 0,1    | 3 |
| -                   | EM25-3B04043VC     | 4    | 6  | 11  | 16   | 3,9  | 57 | 0,1    | 3 |
| -                   | EM25-3B04543VC     | 4,5  | 6  | 13  | 19   | 4,4  | 57 | 0,1    | 3 |
| -                   | EM25-3B05043VC     | 5    | 6  | 13  | 19   | 4,9  | 57 | 0,1    | 3 |
| -                   | EM25-3B05543VC     | 5,5  | 6  | 13  | 19   | 5,4  | 57 | 0,1    | 3 |
| -                   | EM25-3B06043VC     | 6    | 6  | 13  | 19   | 5,9  | 57 | 0,1    | 3 |
| -                   | EM25-3B06543VC     | 6,5  | 8  | 19  | 25   | 6,3  | 63 | 0,2    | 3 |
| -                   | EM25-3B07043VC     | 7    | 8  | 19  | 25   | 6,8  | 63 | 0,2    | 3 |
| -                   | EM25-3B07543VC     | 7,5  | 8  | 19  | 25   | 7,3  | 63 | 0,2    | 3 |
| -                   | EM25-3B08043VC     | 8    | 8  | 19  | 25   | 7,8  | 63 | 0,2    | 3 |
| -                   | EM25-3B08543VC     | 8,5  | 10 | 22  | 30   | 8,2  | 72 | 0,2    | 3 |
| -                   | EM25-3B09043VC     | 9    | 10 | 22  | 30   | 8,7  | 72 | 0,2    | 3 |
| -                   | EM25-3B09543VC     | 9,5  | 10 | 22  | 30   | 9,2  | 72 | 0,2    | 3 |
| -                   | EM25-3B10043VC     | 10   | 10 | 22  | 30   | 9,7  | 72 | 0,2    | 3 |
| -                   | EM25-3B10543VC     | 10,5 | 12 | 26  | 36   | 10,2 | 83 | 0,2    | 3 |
| -                   | EM25-3B11043VC     | 11   | 12 | 26  | 36   | 10,7 | 83 | 0,2    | 3 |
| -                   | EM25-3B11543VC     | 11,5 | 12 | 26  | 36   | 11,2 | 83 | 0,2    | 3 |
| -                   | EM25-3B12043VC     | 12   | 12 | 26  | 36   | 11,7 | 83 | 0,2    | 3 |
| -                   | EM25-3B12543VC     | 12,5 | 14 | 26  | 36   | 12,2 | 83 | 0,2    | 3 |
| -                   | EM25-3B13043VC     | 13   | 14 | 26  | 36   | 12,7 | 83 | 0,2    | 3 |
| -                   | EM25-3B13543VC     | 13,5 | 14 | 26  | 36   | 13,2 | 83 | 0,2    | 3 |
| -                   | EM25-3B14043VC     | 14   | 14 | 26  | 36   | 13,7 | 83 | 0,2    | 3 |

| -Schaft A (Shank A) | Schaft B (Shank B) | D1   | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|---------------------|--------------------|------|----|----|----|------|-----|--------|---|
| -                   | EM25-3B14543VC     | 14,5 | 16 | 32 | 42 | 14,1 | 92  | 0,2    | 3 |
| -                   | EM25-3B15043VC     | 15   | 16 | 32 | 42 | 14,5 | 92  | 0,2    | 3 |
| -                   | EM25-3B15543VC     | 15,5 | 16 | 32 | 42 | 15,0 | 92  | 0,2    | 3 |
| -                   | EM25-3B16043VC     | 16   | 16 | 32 | 42 | 15,5 | 92  | 0,2    | 3 |
| -                   | EM25-3B18043VC     | 18   | 18 | 32 | 42 | 17,5 | 92  | 0,2    | 3 |
| -                   | EM25-3B20043VC     | 20   | 20 | 38 | 52 | 19,5 | 104 | 0,2    | 3 |
| -                   | EM25-3B25043VC     | 25   | 25 | 45 | 65 | 24   | 123 | 0,2    | 3 |

### Zerspanungswerte / Cutting conditions

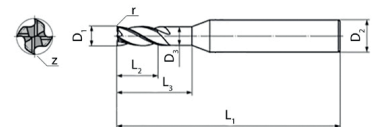
Umfangfräsen / Peripheral milling

| D1  | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|-----|---------------|----------------|-----|-----------|----------|----|
| 1   | 1,5           | 0,3            | -   | 0,004     | -        | -  |
| 1,5 | 2,25          | 0,45           | -   | 0,007     | -        | -  |
| 2   | 3             | 0,6            | -   | 0,009     | -        | -  |
| 2,5 | 3,75          | 0,75           | -   | 0,01      | -        | -  |
| 3   | 4,5           | 0,9            | -   | 0,015     | 0,02     | -  |
| 4   | 6             | 1,2            | -   | 0,019     | 0,025    | -  |
| 5   | 7,5           | 1,5            | -   | 0,022     | 0,03     | -  |
| 6   | 9             | 1,8            | -   | 0,025     | 0,035    | -  |
| 7   | 10,5          | 2,1            | -   | 0,03      | 0,04     | -  |
| 8   | 12            | 2,4            | -   | 0,035     | 0,05     | -  |
| 9   | 13,5          | 2,7            | -   | 0,04      | 0,055    | -  |
| 10  | 15            | 3              | -   | 0,05      | 0,07     | -  |
| 12  | 18            | 3,6            | -   | 0,06      | 0,08     | -  |
| 14  | 21            | 4,2            | -   | 0,065     | 0,085    | -  |
| 16  | 24            | 4,8            | -   | 0,075     | 0,1      | -  |
| 18  | 27            | 5,4            | -   | 0,085     | 0,11     | -  |
| 20  | 30            | 6              | -   | 0,1       | 0,13     | -  |
| 25  | 37,5          | 7,5            | -   | 0,12      | 0,16     | -  |

Vollnutfräsen / Slot milling

| D1  | AP<br>[1xD] | Ae<br>[1xD] | fz    |
|-----|-------------|-------------|-------|
| 1   | 1           | 1           | 0,003 |
| 1,5 | 1,5         | 1,5         | 0,005 |
| 2   | 2           | 2           | 0,007 |
| 2,5 | 2,5         | 2,5         | 0,008 |
| 3   | 3           | 3           | 0,01  |
| 4   | 4           | 4           | 0,015 |
| 5   | 5           | 5           | 0,018 |
| 6   | 6           | 6           | 0,02  |
| 7   | 7           | 7           | 0,025 |
| 8   | 8           | 8           | 0,03  |
| 9   | 9           | 9           | 0,035 |
| 10  | 10          | 10          | 0,04  |
| 12  | 12          | 12          | 0,05  |
| 14  | 14          | 14          | 0,055 |
| 16  | 16          | 16          | 0,06  |
| 18  | 18          | 18          | 0,07  |
| 20  | 20          | 20          | 0,08  |
| 25  | 25          | 25          | 0,1   |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 145                                                           | 170 | 200 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 120                                                           | 140 | 160 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 70                                                            | 95  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 50                                                            | 70  | 90  |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | 100                                                           | 120 | 150 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | 75                                                            | 90  | 110 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 25                                                            | 30  | 40  |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
AP = Spantiefe  
Ae = Querstellung  
fz = Vorschub / Zahn  
▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## EcoMill® EM28

**4-Schneidig, (Variable Steigung), kurz**  
**4 flutes, (variable helix), short**

 Fräsdurchmesser / Milling cutting dia.: 3,0 mm – 20,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 35°–38°  
 Beschichtung / Coating: TiALN<sup>CR</sup>  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliff / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3 | L1 | c[45°] | z |
|--------------------|--------------------|----|----|----|----|----|----|--------|---|
|                    | EM28-4B03038VC     | 3  | 6  | 7  | -  | -  | 54 | 0,1    | 4 |
|                    | EM28-4B04038VC     | 4  | 6  | 8  | -  | -  | 54 | 0,1    | 4 |
|                    | EM28-4B05038VC     | 5  | 6  | 9  | -  | -  | 54 | 0,1    | 4 |
|                    | EM28-4B06038VC     | 6  | 6  | 10 | -  | -  | 54 | 0,1    | 4 |
|                    | EM28-4B08038VC     | 8  | 8  | 12 | -  | -  | 58 | 0,2    | 4 |
|                    | EM28-4B10038VC     | 10 | 10 | 14 | -  | -  | 66 | 0,2    | 4 |
|                    | EM28-4B12038VC     | 12 | 12 | 16 | -  | -  | 73 | 0,3    | 4 |
|                    | EM28-4B16038VC     | 16 | 16 | 22 | -  | -  | 82 | 0,3    | 4 |
|                    | EM28-4B20038VC     | 20 | 20 | 26 | -  | -  | 92 | 0,3    | 4 |

## Zerspanungswerte / Cutting conditions

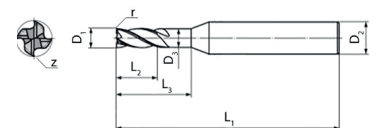
Umfangfräsen / Peripheral milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1  | fz2   | hm |
|----|---------------|----------------|-----|------|-------|----|
| 3  | 4,5           | 0,9            | -   | 0,02 | 0,035 | -  |
| 4  | 6             | 1,2            | -   | 0,02 | 0,035 | -  |
| 5  | 7,5           | 1,5            | -   | 0,03 | 0,045 | -  |
| 6  | 9             | 1,8            | -   | 0,03 | 0,045 | -  |
| 8  | 12            | 2,4            | -   | 0,04 | 0,07  | -  |
| 10 | 15            | 3              | -   | 0,05 | 0,08  | -  |
| 12 | 18            | 3,6            | -   | 0,06 | 0,10  | -  |
| 16 | 24            | 4,8            | -   | 0,08 | 0,12  | -  |
| 20 | 30            | 6              | -   | 0,10 | 0,14  | -  |

Vollnutfräsen / Slot milling

| D1 | AP<br>[1xD] | Ae<br>[1,0xD] | fz   |
|----|-------------|---------------|------|
| 3  | 3           | 3             | 0,02 |
| 4  | 4           | 4             | 0,02 |
| 5  | 5           | 5             | 0,03 |
| 6  | 6           | 6             | 0,03 |
| 8  | 8           | 8             | 0,04 |
| 10 | 10          | 10            | 0,06 |
| 12 | 12          | 12            | 0,07 |
| 16 | 16          | 16            | 0,09 |
| 20 | 20          | 20            | 0,11 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm <sup>2</sup> ] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                                          | < 230                             | 145                                                           | 170 | 200 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                                         | < 350                             | 120                                                           | 140 | 160 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                                         | < 380                             | 70                                                            | 95  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                                          | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                                          | < 240                             | 50                                                            | 70  | 100 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                              | < 280                             | 100                                                           | 120 | 150 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                              | < 320                             | 75                                                            | 90  | 110 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                                          | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                                          | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                                         | < 350                             | -                                                             | -   | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                                         | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                              | < 54 HRC                          | 40                                                            | 60  | 80  |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                              | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                              | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request



## EcoMill® EM29

**4-Schneidig, (Variable Steigung), lang**  
**4 flutes, (variable helix), long**

 Fräsdurchmesser / Milling cutting dia.: 3,0 mm - 25,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 35°-38°  
 Beschichtung / Coating: TiALN<sup>Cr</sup>  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliff / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| -                  | EM29-4B03038VC     | 3  | 6  | 8  | -  | -    | 57  | 0,1    | 4 |
| -                  | EM29-4B04038VC     | 4  | 6  | 11 | -  | -    | 57  | 0,1    | 4 |
| -                  | EM29-4B05038VC     | 5  | 6  | 13 | 18 | 4,8  | 57  | 0,1    | 4 |
| -                  | EM29-4B06038VC     | 6  | 6  | 13 | 18 | 5,8  | 57  | 0,1    | 4 |
| -                  | EM29-4B08038VC     | 8  | 8  | 19 | 25 | 7,8  | 63  | 0,2    | 4 |
| -                  | EM29-4B09038VC     | 9  | 10 | 22 | 30 | 8,7  | 72  | 0,2    | 4 |
| -                  | EM29-4B10038VC     | 10 | 10 | 22 | 30 | 9,7  | 72  | 0,2    | 4 |
| -                  | EM29-4B12038VC     | 12 | 12 | 26 | 36 | 11,7 | 83  | 0,3    | 4 |
| -                  | EM29-4B14038VC     | 14 | 14 | 26 | 36 | 13,7 | 83  | 0,3    | 4 |
| -                  | EM29-4B16038VC     | 16 | 16 | 36 | 42 | 15,5 | 92  | 0,3    | 4 |
| -                  | EM29-4B18038VC     | 18 | 18 | 36 | 42 | 17,5 | 92  | 0,3    | 4 |
| -                  | EM29-4B20038VC     | 20 | 20 | 41 | 52 | 19,5 | 103 | 0,3    | 4 |
| -                  | EM29-4B25038VC     | 25 | 25 | 55 | 66 | 24,5 | 126 | 0,4    | 4 |

## Zerspanungswerte / Cutting conditions

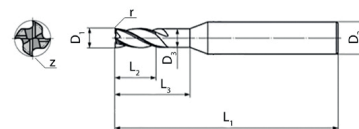
Umfangfräsen / Peripheral milling

| D1   | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼ | fz2<br>▼ | hm |
|------|---------------|----------------|-----|----------|----------|----|
| 3,0  | 4,5           | 0,9            | -   | 0,02     | 0,03     | -  |
| 4,0  | 6,0           | 1,2            | -   | 0,02     | 0,03     | -  |
| 5,0  | 7,5           | 1,5            | -   | 0,03     | 0,04     | -  |
| 6,0  | 9,0           | 1,8            | -   | 0,03     | 0,05     | -  |
| 8,0  | 12,0          | 2,4            | -   | 0,04     | 0,06     | -  |
| 9,0  | 13,5          | 2,7            | -   | 0,05     | 0,07     | -  |
| 10,0 | 15,0          | 3,0            | -   | 0,05     | 0,07     | -  |
| 12,0 | 18,0          | 3,6            | -   | 0,06     | 0,09     | -  |
| 14,0 | 21,0          | 4,2            | -   | 0,07     | 0,10     | -  |
| 16,0 | 24,0          | 4,8            | -   | 0,08     | 0,11     | -  |
| 18,0 | 27,0          | 5,4            | -   | 0,09     | 0,12     | -  |
| 20,0 | 30,0          | 6,0            | -   | 0,10     | 0,13     | -  |
| 25,0 | 37,5          | 7,5            | -   | 0,13     | 0,16     | -  |

Vollnutfräsen / Slot milling

| D1   | AP<br>[1xD] | Ae<br>[1xD] | fz   |
|------|-------------|-------------|------|
| 3,0  | 3,0         | 3,0         | 0,02 |
| 4,0  | 4,0         | 4,0         | 0,02 |
| 5,0  | 5,0         | 5,0         | 0,03 |
| 6,0  | 6,0         | 6,0         | 0,03 |
| 8,0  | 8,0         | 8,0         | 0,04 |
| 9,0  | 9,0         | 9,0         | 0,05 |
| 10,0 | 10,0        | 10,0        | 0,06 |
| 12,0 | 12,0        | 12,0        | 0,07 |
| 14,0 | 14,0        | 14,0        | 0,08 |
| 16,0 | 16,0        | 16,0        | 0,09 |
| 18,0 | 18,0        | 18,0        | 0,10 |
| 20,0 | 20,0        | 20,0        | 0,11 |
| 25,0 | 25,0        | 25,0        | 0,13 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm <sup>2</sup> ] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                                          | < 230                             | 145                                                           | 170 | 200 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                                         | < 350                             | 120                                                           | 140 | 160 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                                         | < 380                             | 70                                                            | 95  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                                          | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                                          | < 240                             | 50                                                            | 70  | 100 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                              | < 280                             | 100                                                           | 120 | 150 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                              | < 320                             | 75                                                            | 90  | 110 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                                          | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                                          | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                                         | < 350                             | -                                                             | -   | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                                         | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                              | < 54 HRC                          | 40                                                            | 60  | 80  |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                              | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                              | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request



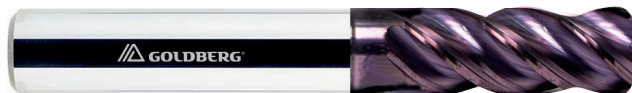
## EcoMill® EM31

**4-Schneidig, (Variable Steigung, Torusfräser)**  
**4 flutes, (variable helix, torical end mill)**

 Fräsdurchmesser / Milling cutting dia.: 3,0 mm - 20,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 35°-38°  
 Beschichtung / Coating: TiALN<sup>Cr</sup>  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliß / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | r   | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
|                    | EM31-4B03038T02VC  | 3  | 6  | 8  | 10 | 2,9  | 57  | 0,2 | 4 |
|                    | EM31-4B03038T05VC  | 3  | 6  | 8  | 10 | 2,9  | 57  | 0,5 | 4 |
|                    | EM31-4B04038T02VC  | 4  | 6  | 11 | 13 | 3,9  | 57  | 0,2 | 4 |
|                    | EM31-4B04038T05VC  | 4  | 6  | 11 | 13 | 3,9  | 57  | 0,5 | 4 |
|                    | EM31-4B05038T02VC  | 5  | 6  | 13 | 18 | 4,9  | 57  | 0,2 | 4 |
|                    | EM31-4B05038T05VC  | 5  | 6  | 13 | 18 | 4,9  | 57  | 0,5 | 4 |
|                    | EM31-4B06038T02VC  | 6  | 6  | 13 | 18 | 5,9  | 57  | 0,2 | 4 |
|                    | EM31-4B06038T05VC  | 6  | 6  | 13 | 18 | 5,9  | 57  | 0,5 | 4 |
|                    | EM31-4B06038T10VC  | 6  | 6  | 13 | 18 | 5,9  | 57  | 1   | 4 |
|                    | EM31-4B08038T05VC  | 8  | 8  | 21 | 25 | 7,8  | 63  | 0,5 | 4 |
|                    | EM31-4B08038T10VC  | 8  | 8  | 21 | 25 | 7,8  | 63  | 1   | 4 |
|                    | EM31-4B10038T05VC  | 10 | 10 | 22 | 30 | 9,7  | 72  | 0,5 | 4 |
|                    | EM31-4B10038T10VC  | 10 | 10 | 22 | 30 | 9,7  | 72  | 1   | 4 |
|                    | EM31-4B10038T20VC  | 10 | 10 | 22 | 30 | 9,7  | 72  | 2   | 4 |
|                    | EM31-4B12038T05VC  | 12 | 12 | 26 | 36 | 11,7 | 83  | 0,5 | 4 |
|                    | EM31-4B12038T10VC  | 12 | 12 | 26 | 36 | 11,7 | 83  | 1   | 4 |
|                    | EM31-4B12038T20VC  | 12 | 12 | 26 | 36 | 11,7 | 83  | 2   | 4 |
|                    | EM31-4B16038T05VC  | 16 | 16 | 36 | 42 | 15,5 | 92  | 0,5 | 4 |
|                    | EM31-4B16038T10VC  | 16 | 16 | 36 | 42 | 15,5 | 92  | 1   | 4 |
|                    | EM31-4B16038T20VC  | 16 | 16 | 36 | 42 | 15,5 | 92  | 2   | 4 |
|                    | EM31-4B20038T05VC  | 20 | 20 | 41 | 52 | 19,5 | 103 | 0,5 | 4 |
|                    | EM31-4B20038T10VC  | 20 | 20 | 41 | 52 | 19,5 | 103 | 1   | 4 |
|                    | EM31-4B20038T20VC  | 20 | 20 | 41 | 52 | 19,5 | 103 | 2   | 4 |

## Zerspanungswerte / Cutting conditions

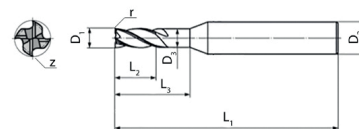
Umfangfräsen / Peripheral milling

Vollnutfräsen / Slot milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 3  | 4,5           | 0,9            | -   | 0,02      | 0,03     | -  |
| 4  | 6             | 1,2            | -   | 0,02      | 0,03     | -  |
| 5  | 7,5           | 1,5            | -   | 0,03      | 0,04     | -  |
| 6  | 9             | 1,8            | -   | 0,03      | 0,05     | -  |
| 8  | 12            | 2,4            | -   | 0,04      | 0,06     | -  |
| 10 | 15            | 3              | -   | 0,05      | 0,07     | -  |
| 12 | 18            | 3,6            | -   | 0,06      | 0,09     | -  |
| 16 | 24            | 4,8            | -   | 0,08      | 0,11     | -  |
| 20 | 30            | 6              | -   | 0,1       | 0,13     | -  |

| D1 | AP | Ae | fz   |
|----|----|----|------|
| 3  | 3  | 3  | 0,02 |
| 4  | 4  | 4  | 0,02 |
| 5  | 5  | 5  | 0,03 |
| 6  | 6  | 6  | 0,03 |
| 8  | 8  | 8  | 0,04 |
| 10 | 10 | 10 | 0,06 |
| 12 | 12 | 12 | 0,07 |
| 16 | 16 | 16 | 0,09 |
| 20 | 20 | 20 | 0,11 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 145                                                           | 170 | 200 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 120                                                           | 140 | 160 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 70                                                            | 95  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 50                                                            | 70  | 100 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | 100                                                           | 120 | 150 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | 75                                                            | 90  | 110 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 40                                                            | 60  | 80  |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## EcoMill® EM32 4-Schneidig, (Variable Steigung), lang 4 flutes, (variable helix), long

Fräsdurchmesser / Milling cutting dia.: 6,0 mm – 20,0 mm  
 Typ / Type: DIN 6535 HB

Steigung / Helix angle: 35°–38°  
 Beschichtung / Coating: TiAlN<sup>Cr</sup>  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliff / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| -                  | EM32-4B06038VC     | 6  | 6  | 18 | 24 | 5,8  | 62  | 0,1    | 4 |
| -                  | EM32-4B08038VC     | 8  | 8  | 24 | 30 | 7,8  | 68  | 0,2    | 4 |
| -                  | EM32-4B10038VC     | 10 | 10 | 30 | 39 | 9,7  | 80  | 0,2    | 4 |
| -                  | EM32-4B12038VC     | 12 | 12 | 36 | 46 | 11,7 | 93  | 0,3    | 4 |
| -                  | EM32-4B14038VC     | 14 | 14 | 36 | 46 | 13,7 | 93  | 0,3    | 4 |
| -                  | EM32-4B16038VC     | 16 | 16 | 48 | 58 | 15,5 | 108 | 0,3    | 4 |
| -                  | EM32-4B18038VC     | 18 | 18 | 48 | 58 | 17,5 | 108 | 0,3    | 4 |
| -                  | EM32-4B20038VC     | 20 | 20 | 60 | 75 | 19,5 | 126 | 0,3    | 4 |

### Zerspanungswerte / Cutting conditions

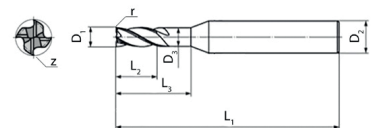
Umfangfräsen / Peripheral milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 6  | 9             | 1,8            | -   | 0,03      | 0,05     | -  |
| 8  | 12            | 2,4            | -   | 0,04      | 0,06     | -  |
| 10 | 15            | 3              | -   | 0,05      | 0,07     | -  |
| 12 | 18            | 3,6            | -   | 0,06      | 0,09     | -  |
| 14 | 21            | 4,2            | -   | 0,07      | 0,1      | -  |
| 16 | 24            | 4,8            | -   | 0,08      | 0,11     | -  |
| 18 | 27            | 5,4            | -   | 0,09      | 0,12     | -  |
| 20 | 30            | 6              | -   | 0,1       | 0,13     | -  |

Vollnutfräsen / Slot milling

| D1 | AP | Ae | fz   |
|----|----|----|------|
| 6  | 6  | 6  | 0,02 |
| 8  | 8  | 8  | 0,03 |
| 10 | 10 | 10 | 0,05 |
| 12 | 12 | 12 | 0,06 |
| 14 | 14 | 14 | 0,07 |
| 16 | 16 | 16 | 0,08 |
| 18 | 18 | 18 | 0,09 |
| 20 | 20 | 20 | 0,10 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 145                                                           | 170 | 200 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 120                                                           | 140 | 160 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 70                                                            | 95  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 50                                                            | 70  | 100 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | 100                                                           | 120 | 150 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | 75                                                            | 90  | 110 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 40                                                            | 60  | 80  |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querschnitt  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request



**EcoMill® EM50**
**6/8-Schneidig**  
**6/8 flutes**

 Fräsdurchmesser / Milling cutting dia.: 4,0 mm - 25,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 45°  
 Beschichtung / Coating: TiAlN  
 Anzahl Zähne / No. of flutes: 6/8

Zentrumschliff / Center cutting: ✕

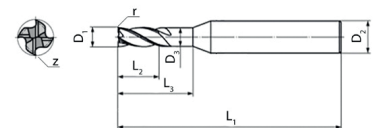


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| -                  | EM50-6B04045C      | 4  | 6  | 11 | 16 | 3,9  | 57  | 0,1    | 6 |
| -                  | EM50-6B05045C      | 5  | 6  | 13 | 19 | 4,9  | 57  | 0,1    | 6 |
| -                  | EM50-6B06045C      | 6  | 6  | 13 | 19 | 5,9  | 57  | 0,1    | 6 |
| -                  | EM50-6B08045C      | 8  | 8  | 21 | 25 | 7,8  | 64  | 0,1    | 6 |
| -                  | EM50-6B10045C      | 10 | 10 | 22 | 30 | 9,7  | 72  | 0,1    | 6 |
| -                  | EM50-6B12045C      | 12 | 12 | 26 | 36 | 11,7 | 83  | 0,1    | 6 |
| -                  | EM50-6B14045C      | 14 | 14 | 26 | 36 | 13,7 | 83  | 0,1    | 6 |
| -                  | EM50-6B16045C      | 16 | 16 | 36 | 42 | 15,5 | 92  | 0,1    | 6 |
| -                  | EM50-6B18045C      | 18 | 18 | 36 | 42 | 17,5 | 92  | 0,1    | 6 |
| -                  | EM50-6B20045C      | 20 | 20 | 41 | 52 | 19,5 | 104 | 0,1    | 8 |
| -                  | EM50-6B25045C      | 25 | 25 | 55 | -  | -    | 126 | 0,1    | 8 |

**Zerspanungswerte / Cutting conditions**  
 Umfangfräsen / Periphal milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 4  | 8             | 0,2            | -   | 0,015     | 0,025    | -  |
| 5  | 10            | 0,3            | -   | 0,02      | 0,03     | -  |
| 6  | 12            | 0,3            | -   | 0,03      | 0,04     | -  |
| 8  | 16            | 0,4            | -   | 0,04      | 0,055    | -  |
| 10 | 20            | 0,5            | -   | 0,05      | 0,07     | -  |
| 12 | 24            | 0,6            | -   | 0,06      | 0,08     | -  |
| 14 | 28            | 0,7            | -   | 0,07      | 0,09     | -  |
| 16 | 32            | 0,8            | -   | 0,08      | 0,11     | -  |
| 18 | 36            | 0,9            | -   | 0,09      | 0,12     | -  |
| 20 | 40            | 1              | -   | 0,1       | 0,13     | -  |
| 25 | 50            | 1,3            | -   | 0,13      | 0,16     | -  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 160                                                           | 190 | 220 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 130                                                           | 150 | 180 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 85                                                            | 120 | 140 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | 130                                                           | 180 | 220 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | 90                                                            | 120 | 140 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

**EcoMill® EM51**
**6/8-Schneidig, lang**  
**6/8 flutes, long**

 Fräsdurchmesser / Milling cutting dia.: 4,0 mm - 25,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 45°  
 Beschichtung / Coating: TiAlN  
 Anzahl Zähne / No. of flutes: 6/8

Zentrumschliff / Center cutting: ✕

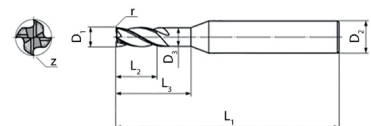


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3 | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|----|-----|--------|---|
| -                  | EM51-6B04045C      | 4  | 6  | 16 | -  | -  | 62  | 0,1    | 6 |
| -                  | EM51-6B05045C      | 5  | 6  | 18 | -  | -  | 62  | 0,1    | 6 |
| -                  | EM51-6B06045C      | 6  | 6  | 18 | -  | -  | 62  | 0,1    | 6 |
| -                  | EM51-6B08045C      | 8  | 8  | 24 | -  | -  | 68  | 0,1    | 6 |
| -                  | EM51-6B10045C      | 10 | 10 | 30 | -  | -  | 80  | 0,1    | 6 |
| -                  | EM51-6B12045C      | 12 | 12 | 36 | -  | -  | 93  | 0,1    | 6 |
| -                  | EM51-6B14045C      | 14 | 14 | 42 | -  | -  | 99  | 0,1    | 6 |
| -                  | EM51-6B16045C      | 16 | 16 | 48 | -  | -  | 108 | 0,1    | 6 |
| -                  | EM51-6B18045C      | 18 | 18 | 54 | -  | -  | 114 | 0,1    | 6 |
| -                  | EM51-6B20045C      | 20 | 20 | 60 | -  | -  | 126 | 0,1    | 8 |
| -                  | EM51-6B25045C      | 25 | 25 | 95 | -  | -  | 160 | 0,1    | 8 |

**Zerspanungswerte / Cutting conditions**  
 Umfangfräsen / Periphal milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 4  | 8             | 0,2            | -   | 0,01      | 0,02     | -  |
| 5  | 10            | 0,3            | -   | 0,01      | 0,025    | -  |
| 6  | 12            | 0,3            | -   | 0,02      | 0,035    | -  |
| 8  | 16            | 0,4            | -   | 0,03      | 0,045    | -  |
| 10 | 20            | 0,5            | -   | 0,04      | 0,055    | -  |
| 12 | 24            | 0,6            | -   | 0,05      | 0,07     | -  |
| 14 | 28            | 0,7            | -   | 0,06      | 0,08     | -  |
| 16 | 32            | 0,8            | -   | 0,07      | 0,09     | -  |
| 18 | 36            | 0,9            | -   | 0,08      | 0,11     | -  |
| 20 | 40            | 1              | -   | 0,09      | 0,12     | -  |
| 25 | 50            | 1,3            | -   | 0,12      | 0,15     | -  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 160                                                           | 190 | 220 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 130                                                           | 150 | 180 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 85                                                            | 120 | 140 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | 130                                                           | 180 | 220 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | 90                                                            | 120 | 140 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## EcoMill® EM52 6-Schneidig, (Variable Steigung) 6 flutes, (variable helix)

Fräsdurchmesser / Milling cutting dia.: 6,0 mm – 25,0 mm  
 Typ / Type: DIN 6535 HA

Steigung / Helix angle: 46°–48°  
 Beschichtung / Coating: TiAlN<sup>Cr</sup>  
 Anzahl Zähne / No. of flutes: 6

Zentrumschliff / Center cutting: ✕

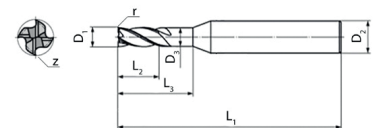


### Zerspanungswerte / Cutting conditions Umfangfräsen / Peripheral milling

| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| EM52-6A06048VC     | -                  | 6  | 6  | 13 | 19 | 5,9  | 57  | -      | 6 |
| EM52-6A08048VC     | -                  | 8  | 8  | 19 | 25 | 7,8  | 63  | -      | 6 |
| EM52-6A10048VC     | -                  | 10 | 10 | 22 | 30 | 9,7  | 72  | -      | 6 |
| EM52-6A12048VC     | -                  | 12 | 12 | 26 | 36 | 11,7 | 83  | -      | 6 |
| EM52-6A16048VC     | -                  | 16 | 16 | 32 | 42 | 15,5 | 92  | -      | 6 |
| EM52-6A20048VC     | -                  | 20 | 20 | 38 | 52 | 19,5 | 104 | -      | 6 |
| EM52-6A25048VC     | -                  | 25 | 25 | 42 | -  | -    | 110 | -      | 6 |

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 6  | 9             | 0,3            | -   | 0,03      | 0,04     | -  |
| 8  | 12            | 0,4            | -   | 0,04      | 0,055    | -  |
| 10 | 15            | 0,5            | -   | 0,05      | 0,07     | -  |
| 12 | 18            | 0,6            | -   | 0,06      | 0,08     | -  |
| 16 | 24            | 0,8            | -   | 0,08      | 0,11     | -  |
| 20 | 30            | 1              | -   | 0,1       | 0,13     | -  |
| 25 | 37,5          | 1,4            | -   | 0,13      | 0,16     | -  |

| Werkstoffgruppe / Material group |                                                                             | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                      | < 600                                             | < 230                             | 160                                                           | 190 | 220 |
|                                  | Legierter Stahl / Alloy Steel                                               | < 1200                                            | < 350                             | 130                                                           | 150 | 180 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel     | < 1400                                            | < 380                             | 85                                                            | 120 | 140 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel          | < 680                                             | < 220                             | 65                                                            | 90  | 115 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                              | < 820                                             | < 240                             | 50                                                            | 65  | 80  |
| K                                | Grauguß / Grey cast iron                                                    | -                                                 | < 280                             | 130                                                           | 180 | 220 |
|                                  | Sphäroguß / Ductile cast iron                                               | -                                                 | < 320                             | 90                                                            | 120 | 140 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                      | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                     | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Wärmefeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 30                                                            | 40  | 50  |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta          | < 2100                                            | < 400                             | -                                                             | -   | -   |
| H                                | Gehärtete Stähle / Hardened steel                                           | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                           | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                           | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## EcoHardMill® EHM15

**6-Schneidig**  
**6 flutes**

 Fräsdurchmesser / Milling cutting dia.: 4,0 mm - 20,0 mm  
 Typ / Type: DIN 6535 HA

 Steigung / Helix angle: 55°  
 Beschichtung / Coating: ALTiSiN  
 Anzahl Zähne / No. of flutes: 6-8

Zentrumschliff / Center cutting: ✕



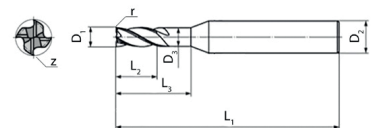
| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| EHM15-6A04055C     | -                  | 4  | 6  | 11 | -  | -    | 57  | -      | 6 |
| EHM15-6A05055C     | -                  | 5  | 6  | 13 | 18 | 4,9  | 57  | -      | 6 |
| EHM15-6A06055C     | -                  | 6  | 6  | 13 | 18 | 5,9  | 57  | -      | 6 |
| EHM15-6A08055C     | -                  | 8  | 8  | 21 | 25 | 7,8  | 64  | -      | 6 |
| EHM15-6A10055C     | -                  | 10 | 10 | 22 | 30 | 9,7  | 72  | -      | 6 |
| EHM15-6A12055C     | -                  | 12 | 12 | 26 | 36 | 11,7 | 83  | -      | 6 |
| EHM15-6A14055C     | -                  | 14 | 14 | 26 | 36 | 13,7 | 83  | -      | 6 |
| EHM15-8A16055C     | -                  | 16 | 16 | 36 | 42 | 15,5 | 92  | -      | 8 |
| EHM15-8A18055C     | -                  | 18 | 18 | 36 | 42 | 17,5 | 92  | -      | 8 |
| EHM15-8A20055C     | -                  | 20 | 20 | 41 | 52 | 19,5 | 104 | -      | 8 |

## Zerspanungswerte / Cutting conditions

Umfangfräsen / Periphal milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 4  | 6             | 0,1            | -   | 0,015     | -        | -  |
| 5  | 7,5           | 0,1            | -   | 0,02      | -        | -  |
| 6  | 9             | 0,1            | -   | 0,025     | -        | -  |
| 8  | 12            | 0,15           | -   | 0,035     | -        | -  |
| 10 | 15            | 0,15           | -   | 0,04      | -        | -  |
| 12 | 18            | 0,15           | -   | 0,05      | -        | -  |
| 14 | 21            | 0,2            | -   | 0,06      | -        | -  |
| 16 | 24            | 0,2            | -   | 0,07      | -        | -  |
| 18 | 27            | 0,3            | -   | 0,085     | -        | -  |
| 20 | 30            | 0,3            | -   | 0,1       | -        | -  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |    |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -  | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -  | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -  | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -  | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -  | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -  | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -  | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -  | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -  | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -  | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -  | -   |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 60                                                            | 85 | 110 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | 50                                                            | 70 | 85  |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | 40                                                            | 50 | 65  |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

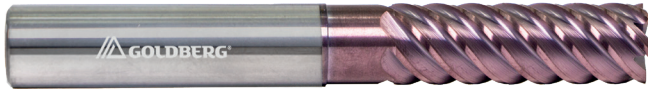
## EcoHardMill® EHM16

**6-Schneidig, lang**  
**6 flutes, long**

 Fräsdurchmesser / Milling cutting dia.: 6,0 mm – 20,0 mm  
 Typ / Type: DIN 6535 HA

 Steigung / Helix angle: 55°  
 Beschichtung / Coating: ALTiSiN  
 Anzahl Zähne / No. of flutes: 6-8

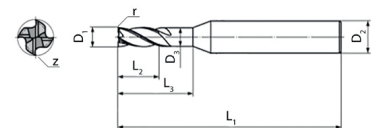
Zentrumschliff / Center cutting: ✕


 Zerspanungswerte / Cutting conditions  
 Umfangfräsen / Peripheral milling

| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3 | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|----|-----|--------|---|
| EHM16-6A06055C     |                    | 6  | 6  | 18 | -  | -  | 62  | -      | 6 |
| EHM16-6A08055C     |                    | 8  | 8  | 24 | -  | -  | 68  | -      | 6 |
| EHM16-6A10055C     |                    | 10 | 10 | 30 | -  | -  | 80  | -      | 6 |
| EHM16-6A12055C     |                    | 12 | 12 | 36 | -  | -  | 93  | -      | 6 |
| EHM16-6A14055C     |                    | 14 | 14 | 42 | -  | -  | 99  | -      | 6 |
| EHM16-8A16055C     |                    | 16 | 16 | 48 | -  | -  | 108 | -      | 8 |
| EHM16-8A18055C     |                    | 18 | 18 | 54 | -  | -  | 114 | -      | 8 |
| EHM16-8A20055C     |                    | 20 | 20 | 60 | -  | -  | 126 | -      | 8 |

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 4  | 6             | 0,1            | -   | 0,015     | -        | -  |
| 5  | 7,5           | 0,1            | -   | 0,02      | -        | -  |
| 6  | 9             | 0,1            | -   | 0,025     | -        | -  |
| 8  | 12            | 0,15           | -   | 0,035     | -        | -  |
| 10 | 15            | 0,15           | -   | 0,04      | -        | -  |
| 12 | 18            | 0,15           | -   | 0,05      | -        | -  |
| 14 | 21            | 0,2            | -   | 0,06      | -        | -  |
| 16 | 24            | 0,2            | -   | 0,07      | -        | -  |
| 18 | 27            | 0,3            | -   | 0,085     | -        | -  |
| 20 | 30            | 0,3            | -   | 0,1       | -        | -  |

| Werkstoffgruppe / Material group |                                                                             | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |    |     |
|----------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                      | < 600                                             | < 230                             | -                                                             | -  | -   |
|                                  | Legierter Stahl / Alloy Steel                                               | < 1200                                            | < 350                             | -                                                             | -  | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel     | < 1400                                            | < 380                             | -                                                             | -  | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel          | < 680                                             | < 220                             | -                                                             | -  | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                              | < 820                                             | < 240                             | -                                                             | -  | -   |
| K                                | Grauguß / Grey cast iron                                                    | -                                                 | < 280                             | -                                                             | -  | -   |
|                                  | Sphäroguß / Ductile cast iron                                               | -                                                 | < 320                             | -                                                             | -  | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                      | < 250                                             | < 110                             | -                                                             | -  | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                     | < 530                                             | < 130                             | -                                                             | -  | -   |
| S                                | Wärmefeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -  | -   |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta          | < 2100                                            | < 400                             | -                                                             | -  | -   |
| H                                | Gehärtete Stähle / Hardened steel                                           | -                                                 | < 54 HRC                          | 60                                                            | 85 | 110 |
|                                  | Gehärtete Stähle / Hardened steel                                           | -                                                 | 52-60 HRC                         | 50                                                            | 70 | 85  |
|                                  | Gehärtete Stähle / Hardened steel                                           | -                                                 | > 58 HRC                          | 40                                                            | 50 | 65  |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request



## PowerMill® PM9 4-Schneidig, (Variable Steigung, Torusfräser, lange Auskragweite) 4 flutes, (variable helix, torical end mill, long reach)

Fräsdurchmesser / Milling cutting dia.: 3 mm - 20,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

Steigung / Helix angle: 35°-38°  
 Beschichtung / Coating: AlCrN  
 Anzahl Zähne / No. of flutes: 4

Zentrumschleif / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1  | D2 | L2 | L3 | D3   | L1  | r    | z |
|--------------------|--------------------|-----|----|----|----|------|-----|------|---|
| PM9-4A03038T02VC   | PM9-4B03038T02VC   | 3   | 6  | 8  | 14 | 2,8  | 62  | 0,20 | 4 |
| PM9-4A03538T02VC   | PM9-4B03538T02VC   | 3,5 | 6  | 10 | 16 | 3,3  | 62  | 0,20 | 4 |
| PM9-4A04038T02VC   | PM9-4B04038T02VC   | 4   | 6  | 11 | 18 | 3,8  | 62  | 0,20 | 4 |
| PM9-4A04538T02VC   | PM9-4B04538T02VC   | 4,5 | 6  | 11 | 20 | 4,3  | 62  | 0,20 | 4 |
| PM9-4A05038T02VC   | PM9-4B05038T02VC   | 5   | 6  | 13 | 22 | 4,8  | 62  | 0,20 | 4 |
| PM9-4A06038T02VC   | PM9-4B06038T02VC   | 6   | 6  | 13 | 26 | 5,7  | 62  | 0,20 | 4 |
| PM9-4A08038T03VC   | PM9-4B08038T03VC   | 8   | 8  | 19 | 34 | 7,6  | 68  | 0,30 | 4 |
| PM9-4A10038T05VC   | PM9-4B10038T05VC   | 10  | 10 | 22 | 42 | 9,5  | 80  | 0,50 | 4 |
| PM9-4A12038T05VC   | PM9-4B12038T05VC   | 12  | 12 | 26 | 50 | 11,5 | 100 | 0,50 | 4 |
| PM9-4A14038T05VC   | PM9-4B14038T05VC   | 14  | 14 | 26 | 50 | 13,5 | 110 | 0,50 | 4 |
| PM9-4A16038T10VC   | PM9-4B16038T10VC   | 16  | 16 | 32 | 66 | 15,5 | 120 | 1,00 | 4 |
| PM9-4A18038T10VC   | PM9-4B18038T10VC   | 18  | 18 | 32 | 66 | 17,5 | 125 | 1,00 | 4 |
| PM9-4A20038T10VC   | PM9-4B20038T10VC   | 20  | 20 | 38 | 82 | 19,5 | 140 | 1,00 | 4 |

### Zerspanungswerte / Cutting conditions

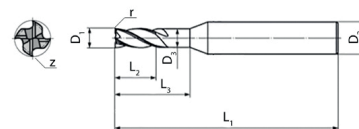
Umfangfräsen / Peripheral milling

| DC   | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm |
|------|-------------|-----------------|-----------------|-----------|-----------|----|
| 3,0  | 4,5         | 0,9             | -               | 0,02      | 0,03      | -  |
| 3,5  | 5,3         | 1,1             | -               | 0,02      | 0,03      | -  |
| 4,0  | 6,0         | 1,2             | -               | 0,02      | 0,03      | -  |
| 4,5  | 6,8         | 1,4             | -               | 0,02      | 0,04      | -  |
| 5,0  | 7,5         | 1,5             | -               | 0,03      | 0,04      | -  |
| 6,0  | 9,0         | 1,8             | -               | 0,03      | 0,05      | -  |
| 8,0  | 12,0        | 2,4             | -               | 0,04      | 0,06      | -  |
| 10,0 | 15,0        | 3,0             | -               | 0,05      | 0,07      | -  |
| 12,0 | 18,0        | 3,6             | -               | 0,06      | 0,09      | -  |
| 14,0 | 21,0        | 4,2             | -               | 0,07      | 0,10      | -  |
| 16,0 | 24,0        | 4,8             | -               | 0,08      | 0,12      | -  |
| 18,0 | 27,0        | 5,4             | -               | 0,09      | 0,13      | -  |
| 20,0 | 30,0        | 6,0             | -               | 0,10      | 0,14      | -  |

Vollnutfräsen / Slot milling

| DC   | AP<br>[1xD] | Ae<br>[1xD] | fz   |
|------|-------------|-------------|------|
| 3,0  | 3,0         | 3,0         | 0,02 |
| 3,5  | 3,5         | 3,5         | 0,03 |
| 4,0  | 4,0         | 4,0         | 0,03 |
| 4,5  | 4,5         | 4,5         | 0,03 |
| 5,0  | 5,0         | 5,0         | 0,03 |
| 6,0  | 6,0         | 6,0         | 0,04 |
| 8,0  | 8,0         | 8,0         | 0,05 |
| 10,0 | 10,0        | 10,0        | 0,06 |
| 12,0 | 12,0        | 12,0        | 0,07 |
| 14,0 | 14,0        | 14,0        | 0,09 |
| 16,0 | 16,0        | 16,0        | 0,10 |
| 18,0 | 18,0        | 18,0        | 0,11 |
| 20,0 | 20,0        | 20,0        | 0,12 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 180                                                           | 210 | 240 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 150                                                           | 175 | 200 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 100                                                           | 120 | 140 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 80                                                            | 110 | 140 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 60                                                            | 90  | 120 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | 120                                                           | 150 | 180 |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | 90                                                            | 110 | 130 |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 40                                                            | 50  | 60  |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 60                                                            | 70  | 80  |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 90                                                            | 120 | 150 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | 70                                                            | 100 | 130 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

**PowerMill® PM31 5-Schneidig (Variable Steigung, 2xd)**  
**Trochoidal 5 flutes (variable helix, 2xD)**

 Fräsdurchmesser / Milling cutting dia.: 3 mm – 25,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

 Steigung / Helix angle: 37°–38°  
 Beschichtung / Coating: AlCrN  
 Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: ✖

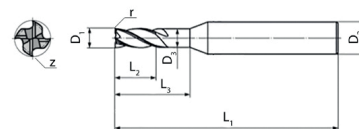


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| PM31-5A03038VC     | PM31-5B03038VC     | 3  | 6  | 6  | 14 | 2,8  | 57  | 0,06   | 5 |
| PM31-5A04038VC     | PM31-5B04038VC     | 4  | 6  | 8  | 16 | 3,8  | 57  | 0,08   | 5 |
| PM31-5A05038VC     | PM31-5B05038VC     | 5  | 6  | 10 | 18 | 4,8  | 57  | 0,10   | 5 |
| PM31-5A06038VC     | PM31-5B06038VC     | 6  | 6  | 12 | 19 | 5,7  | 57  | 0,12   | 5 |
| PM31-5A08038VC     | PM31-5B08038VC     | 8  | 8  | 16 | 25 | 7,6  | 63  | 0,16   | 5 |
| PM31-5A10038VC     | PM31-5B10038VC     | 10 | 10 | 20 | 30 | 9,5  | 72  | 0,20   | 5 |
| PM31-5A12038VC     | PM31-5B12038VC     | 12 | 12 | 24 | 36 | 11,5 | 83  | 0,24   | 5 |
| PM31-5A14038VC     | PM31-5B14038VC     | 14 | 14 | 28 | 36 | 13,5 | 83  | 0,28   | 5 |
| PM31-5A16038VC     | PM31-5B16038VC     | 16 | 16 | 32 | 42 | 15,5 | 92  | 0,32   | 5 |
| PM31-5A18038VC     | PM31-5B18038VC     | 18 | 18 | 36 | 42 | 17,5 | 92  | 0,36   | 5 |
| PM31-5A20038VC     | PM31-5B20038VC     | 20 | 20 | 40 | 52 | 19,5 | 104 | 0,40   | 5 |
| PM31-5A25038VC     | PM31-5B25038VC     | 25 | 25 | 50 | 62 | 24   | 120 | 0,50   | 5 |

**Zerspanungswerte / Cutting conditions**  
 Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,15xD] | Ae2<br>[0,25xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm   |
|------|-------------|-----------------|-----------------|-----------|-----------|------|
| 3,0  | 6,0         | 0,5             | 0,8             | 0,04      | 0,03      | 0,01 |
| 4,0  | 8,0         | 0,6             | 1,0             | 0,05      | 0,04      | 0,02 |
| 5,0  | 10,0        | 0,8             | 1,3             | 0,06      | 0,05      | 0,02 |
| 6,0  | 12,0        | 0,9             | 1,5             | 0,07      | 0,06      | 0,03 |
| 8,0  | 16,0        | 1,2             | 2,0             | 0,10      | 0,07      | 0,04 |
| 10,0 | 20,0        | 1,5             | 2,5             | 0,12      | 0,09      | 0,05 |
| 12,0 | 24,0        | 1,8             | 3,0             | 0,14      | 0,11      | 0,06 |
| 14,0 | 28,0        | 2,1             | 3,5             | 0,17      | 0,13      | 0,07 |
| 16,0 | 32,0        | 2,4             | 4,0             | 0,19      | 0,15      | 0,07 |
| 18,0 | 36,0        | 2,7             | 4,5             | 0,22      | 0,17      | 0,08 |
| 20,0 | 40,0        | 3,0             | 5,0             | 0,24      | 0,19      | 0,09 |
| 25,0 | 50,0        | 3,8             | 6,3             | 0,30      | 0,23      | 0,12 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 220                                                           | 300 | 380 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 200                                                           | 250 | 300 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 180                                                           | 210 | 250 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 70                                                            | 100 | 130 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52–60 HRC                         | 50                                                            | 90  | 120 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

**PowerMill® PM32 5-Schneidig (Variable Steigung, 2xD, Torusfräser)**  
**Trochoidal 5 flutes (variable helix, 2xD, torical end mill)**

 Fräsdurchmesser / Milling cutting dia.: 6 mm - 20,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

 Steigung / Helix angle: 37°-38°  
 Beschichtung / Coating: AlCrN  
 Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: ✕

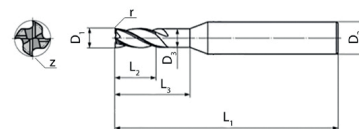


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | r   | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
| PM32-5A06038T05VC  | PM32-5B06038T05VC  | 6  | 6  | 12 | 19 | 5,7  | 57  | 0,5 | 5 |
| PM32-5A06038T10VC  | PM32-5B06038T10VC  | 6  | 6  | 12 | 19 | 5,7  | 57  | 1,0 | 5 |
| PM32-5A08038T05VC  | PM32-5B08038T05VC  | 8  | 8  | 16 | 25 | 7,6  | 63  | 0,5 | 5 |
| PM32-5A08038T10VC  | PM32-5B08038T10VC  | 8  | 8  | 16 | 25 | 7,6  | 63  | 1,0 | 5 |
| PM32-5A10038T05VC  | PM32-5B10038T05VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 0,5 | 5 |
| PM32-5A10038T10VC  | PM32-5B10038T10VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 1,0 | 5 |
| PM32-5A10038T20VC  | PM32-5B10038T20VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 2,0 | 5 |
| PM32-5A12038T05VC  | PM32-5B12038T05VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 0,5 | 5 |
| PM32-5A12038T10VC  | PM32-5B12038T10VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 1,0 | 5 |
| PM32-5A12038T20VC  | PM32-5B12038T20VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 2,0 | 5 |
| PM32-5A16038T05VC  | PM32-5B16038T05VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 0,5 | 5 |
| PM32-5A16038T10VC  | PM32-5B16038T10VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 1,0 | 5 |
| PM32-5A16038T20VC  | PM32-5B16038T20VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 2,0 | 5 |
| PM32-5A20038T10VC  | PM32-5B20038T10VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 1,0 | 5 |
| PM32-5A20038T20VC  | PM32-5B20038T20VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 2,0 | 5 |
| PM32-5A20038T30VC  | PM32-5B20038T30VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 3,0 | 5 |

**Zerspanungswerte / Cutting conditions**  
 Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,15xD] | Ae2<br>[0,25xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm   |
|------|-------------|-----------------|-----------------|-----------|-----------|------|
| 6,0  | 12,0        | 0,9             | 1,5             | 0,07      | 0,06      | 0,03 |
| 8,0  | 16,0        | 1,2             | 2,0             | 0,10      | 0,07      | 0,04 |
| 10,0 | 20,0        | 1,5             | 2,5             | 0,12      | 0,09      | 0,05 |
| 12,0 | 24,0        | 1,8             | 3,0             | 0,14      | 0,11      | 0,06 |
| 16,0 | 32,0        | 2,4             | 4,0             | 0,19      | 0,15      | 0,07 |
| 20,0 | 40,0        | 3,0             | 5,0             | 0,24      | 0,18      | 0,09 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 220                                                           | 300 | 380 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 200                                                           | 250 | 300 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 180                                                           | 210 | 250 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 70                                                            | 100 | 130 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | 50                                                            | 90  | 120 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## PowerMill® PM33 5-Schneidig (Variable Steigung, 4xD) Trochoidal 5 flutes (variable helix, 4xD)

Fräsdurchmesser / Milling cutting dia.: 3 mm – 25,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

Steigung / Helix angle: 37°–38°  
 Beschichtung / Coating: AlCrN  
 Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: ✕

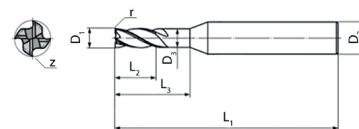


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2  | L3  | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|-----|-----|------|-----|--------|---|
| PM33-5A03038VC     | PM33-5B03038VC     | 3  | 6  | 12  | 18  | 2,8  | 80  | 0,06   | 5 |
| PM33-5A04038VC     | PM33-5B04038VC     | 4  | 6  | 16  | 21  | 3,8  | 80  | 0,08   | 5 |
| PM33-5A05038VC     | PM33-5B05038VC     | 5  | 6  | 20  | 25  | 4,8  | 80  | 0,10   | 5 |
| PM33-5A06038VC     | PM33-5B06038VC     | 6  | 6  | 24  | 30  | 5,7  | 80  | 0,12   | 5 |
| PM33-5A08038VC     | PM33-5B08038VC     | 8  | 8  | 32  | 38  | 7,6  | 90  | 0,16   | 5 |
| PM33-5A10038VC     | PM33-5B10038VC     | 10 | 10 | 40  | 48  | 9,5  | 100 | 0,20   | 5 |
| PM33-5A12038VC     | PM33-5B12038VC     | 12 | 12 | 48  | 58  | 11,5 | 120 | 0,24   | 5 |
| PM33-5A14038VC     | PM33-5B14038VC     | 14 | 14 | 56  | 64  | 13,5 | 120 | 0,28   | 5 |
| PM33-5A16038VC     | PM33-5B16038VC     | 16 | 16 | 64  | 74  | 15,5 | 140 | 0,32   | 5 |
| PM33-5A18038VC     | PM33-5B18038VC     | 18 | 18 | 72  | 85  | 17,5 | 140 | 0,36   | 5 |
| PM33-5A20038VC     | PM33-5B20038VC     | 20 | 20 | 80  | 94  | 19,5 | 160 | 0,40   | 5 |
| PM33-5A25038VC     | PM33-5B25038VC     | 25 | 25 | 100 | 117 | 24   | 180 | 0,50   | 5 |

### Zerspanungswerte / Cutting conditions Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,05xD] | Ae2<br>[0,15xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm    |
|------|-------------|-----------------|-----------------|-----------|-----------|-------|
| 3,0  | 12,0        | 0,2             | 0,5             | 0,063     | 0,036     | 0,014 |
| 4,0  | 16,0        | 0,2             | 0,6             | 0,080     | 0,046     | 0,018 |
| 5,0  | 20,0        | 0,3             | 0,8             | 0,103     | 0,059     | 0,023 |
| 6,0  | 24,0        | 0,3             | 0,9             | 0,125     | 0,072     | 0,028 |
| 8,0  | 32,0        | 0,4             | 1,2             | 0,165     | 0,096     | 0,037 |
| 10,0 | 40,0        | 0,5             | 1,5             | 0,206     | 0,119     | 0,046 |
| 12,0 | 48,0        | 0,6             | 1,8             | 0,246     | 0,142     | 0,055 |
| 14,0 | 56,0        | 0,7             | 2,1             | 0,291     | 0,168     | 0,065 |
| 16,0 | 64,0        | 0,8             | 2,4             | 0,331     | 0,191     | 0,074 |
| 18,0 | 72,0        | 0,9             | 2,7             | 0,371     | 0,214     | 0,083 |
| 20,0 | 80,0        | 1,0             | 3,0             | 0,411     | 0,238     | 0,092 |
| 25,0 | 100,0       | 1,3             | 3,8             | 0,514     | 0,297     | 0,115 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 220                                                           | 300 | 380 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 200                                                           | 250 | 300 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 180                                                           | 210 | 250 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 70                                                            | 100 | 130 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52–60 HRC                         | 50                                                            | 90  | 120 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## PowerMill® PM34 5-Schneidig (Variable Steigung, 4xD, Torusfräser) Trochoidal 5 flutes (variable helix, 4xD, torical end mill)

Fräsdurchmesser / Milling cutting dia.: 6 mm – 20,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

Steigung / Helix angle: 37°–38°  
 Beschichtung / Coating: AlCrN  
 Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: ✕

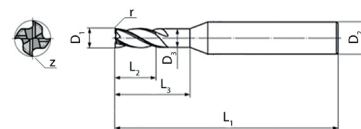


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | r   | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
| PM34-5A06038T05VC  | PM34-5B06038T05VC  | 6  | 6  | 24 | 30 | 5,7  | 80  | 0,5 | 5 |
| PM34-5A06038T10VC  | PM34-5B06038T10VC  | 6  | 6  | 24 | 30 | 5,7  | 80  | 1,0 | 5 |
| PM34-5A08038T05VC  | PM34-5B08038T05VC  | 8  | 8  | 32 | 38 | 7,6  | 90  | 0,5 | 5 |
| PM34-5A08038T10VC  | PM34-5B08038T10VC  | 8  | 8  | 32 | 38 | 7,6  | 90  | 1,0 | 5 |
| PM34-5A10038T05VC  | PM34-5B10038T05VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 0,5 | 5 |
| PM34-5A10038T10VC  | PM34-5B10038T10VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 1,0 | 5 |
| PM34-5A10038T20VC  | PM34-5B10038T20VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 2,0 | 5 |
| PM34-5A12038T05VC  | PM34-5B12038T05VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 0,5 | 5 |
| PM34-5A12038T10VC  | PM34-5B12038T10VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 1,0 | 5 |
| PM34-5A12038T20VC  | PM34-5B12038T20VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 2,0 | 5 |
| PM34-5A16038T05VC  | PM34-5B16038T05VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 0,5 | 5 |
| PM34-5A16038T10VC  | PM34-5B16038T10VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 1,0 | 5 |
| PM34-5A16038T20VC  | PM34-5B16038T20VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 2,0 | 5 |
| PM34-5A20038T10VC  | PM34-5B20038T10VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 1,0 | 5 |
| PM34-5A20038T20VC  | PM34-5B20038T20VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 2,0 | 5 |
| PM34-5A20038T30VC  | PM34-5B20038T30VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 3,0 | 5 |

### Zerspanungswerte / Cutting conditions Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,05xD] | Ae2<br>[0,15xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm    |
|------|-------------|-----------------|-----------------|-----------|-----------|-------|
| 6,0  | 24,0        | 0,3             | 0,9             | 0,125     | 0,072     | 0,028 |
| 8,0  | 32,0        | 0,4             | 1,2             | 0,165     | 0,096     | 0,037 |
| 10,0 | 40,0        | 0,5             | 1,5             | 0,206     | 0,119     | 0,046 |
| 12,0 | 48,0        | 0,6             | 1,8             | 0,246     | 0,142     | 0,055 |
| 16,0 | 64,0        | 0,8             | 2,4             | 0,331     | 0,191     | 0,074 |
| 20,0 | 80,0        | 1,0             | 3,0             | 0,411     | 0,238     | 0,092 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 220                                                           | 300 | 380 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 200                                                           | 250 | 300 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 180                                                           | 210 | 250 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | 70                                                            | 100 | 130 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | 50                                                            | 90  | 120 |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## EcoSpeedMill® ESM10

**4-Schneidig (Variable Steigung)**  
**4 flutes (variable helix)**

 Fräsdurchmesser / Milling cutting dia.: 3 mm - 25,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 36°-38°  
 Beschichtung / Coating: TiCrN-basiert  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliff / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | r   | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
|                    | ESM10-4B03038VC    | 3  | 6  | 8  | -  | -    | 57  | 0,1 | 4 |
|                    | ESM10-4B04038VC    | 4  | 6  | 11 | -  | -    | 57  | 0,1 | 4 |
|                    | ESM10-4B05038VC    | 5  | 6  | 13 | 18 | 4,9  | 57  | 0,1 | 4 |
|                    | ESM10-4B06038VC    | 6  | 6  | 13 | 18 | 5,9  | 57  | 0,1 | 4 |
|                    | ESM10-4B08038VC    | 8  | 8  | 21 | 25 | 7,8  | 63  | 0,2 | 4 |
|                    | ESM10-4B10038VC    | 10 | 10 | 22 | 30 | 9,7  | 72  | 0,2 | 4 |
|                    | ESM10-4B12038VC    | 12 | 12 | 26 | 36 | 11,7 | 83  | 0,3 | 4 |
|                    | ESM10-4B14038VC    | 14 | 14 | 26 | 36 | 13,7 | 83  | 0,3 | 4 |
|                    | ESM10-4B16038VC    | 16 | 16 | 36 | 42 | 15,5 | 92  | 0,3 | 4 |
|                    | ESM10-4B18038VC    | 18 | 18 | 36 | 42 | 17,5 | 92  | 0,3 | 4 |
|                    | ESM10-4B20038VC    | 20 | 20 | 41 | 52 | 19,5 | 103 | 0,3 | 4 |
|                    | ESM10-4B25038VC    | 25 | 25 | 55 | 66 | 24,5 | 126 | 0,4 | 4 |

## Zerspanungswerte / Cutting conditions

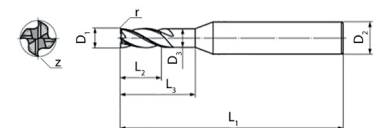
Umfangfräsen / Peripheral milling

Vollnutfräsen / Slot milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|----------------|-----|-----------|----------|----|
| 3  | 4,5           | 0,9            | -   | 0,015     | 0,02     | -  |
| 4  | 6             | 1,2            | -   | 0,02      | 0,025    | -  |
| 5  | 7,5           | 1,5            | -   | 0,025     | 0,035    | -  |
| 6  | 9             | 1,8            | -   | 0,03      | 0,04     | -  |
| 8  | 12            | 2,4            | -   | 0,045     | 0,06     | -  |
| 10 | 15            | 3              | -   | 0,055     | 0,07     | -  |
| 12 | 18            | 3,6            | -   | 0,06      | 0,085    | -  |
| 14 | 21            | 4,2            | -   | 0,07      | 0,095    | -  |
| 16 | 24            | 4,8            | -   | 0,08      | 0,11     | -  |
| 18 | 27            | 5,4            | -   | 0,09      | 0,12     | -  |
| 20 | 30            | 6              | -   | 0,1       | 0,13     | -  |
| 25 | 37,5          | 7,5            | -   | 0,13      | 0,16     | -  |

| D1 | AP<br>[1xD] | Ae<br>[1xD] | fz    |
|----|-------------|-------------|-------|
| 3  | 3           | 3           | 0,008 |
| 4  | 4           | 4           | 0,016 |
| 5  | 5           | 5           | 0,025 |
| 6  | 6           | 6           | 0,03  |
| 8  | 8           | 8           | 0,04  |
| 10 | 10          | 10          | 0,05  |
| 12 | 12          | 12          | 0,06  |
| 14 | 14          | 14          | 0,07  |
| 16 | 16          | 16          | 0,08  |
| 18 | 18          | 18          | 0,09  |
| 20 | 20          | 20          | 0,1   |
| 25 | 25          | 25          | 0,13  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 120                                                           | 150 | 180 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 100                                                           | 130 | 150 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 70                                                            | 90  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 60                                                            | 90  | 120 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 55                                                            | 80  | 110 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 20                                                            | 30  | 45  |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 35                                                            | 45  | 70  |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request



## EcoSpeedMill® ESM12

**4-Schneidig (Variable Steigung, 3xD), lang**  
**4 flutes (variable helix, 3xD), long**

 Fräsdurchmesser / Milling cutting dia.: 3 mm - 20,0 mm  
 Typ / Type: DIN 6535 HB

 Steigung / Helix angle: 36°-38°  
 Beschichtung / Coating: TiCrN-basiert  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliff / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
|                    | ESM12-4B06038VC    | 6  | 6  | 18 | 24 | 5,9  | 62  | 0,1    | 4 |
|                    | ESM12-4B08038VC    | 8  | 8  | 24 | 30 | 7,8  | 68  | 0,2    | 4 |
|                    | ESM12-4B10038VC    | 10 | 10 | 30 | 39 | 9,7  | 80  | 0,2    | 4 |
|                    | ESM12-4B12038VC    | 12 | 12 | 36 | 46 | 11,7 | 93  | 0,3    | 4 |
|                    | ESM12-4B14038VC    | 14 | 14 | 36 | 46 | 13,7 | 93  | 0,3    | 4 |
|                    | ESM12-4B16038VC    | 16 | 16 | 48 | 58 | 15,5 | 108 | 0,3    | 4 |
|                    | ESM12-4B18038VC    | 18 | 18 | 48 | 58 | 17,5 | 108 | 0,3    | 4 |
|                    | ESM12-4B20038VC    | 20 | 20 | 60 | 75 | 19,5 | 126 | 0,3    | 4 |

## Zerspanungswerte / Cutting conditions

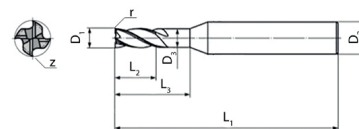
Umfangfräsen / Peripheral milling

| D1 | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm |
|----|-------------|-----------------|-----------------|-----------|-----------|----|
| 6  | 9           | 1,8             | -               | 0,03      | 0,04      | -  |
| 8  | 12          | 2,4             | -               | 0,045     | 0,06      | -  |
| 10 | 15          | 3               | -               | 0,055     | 0,07      | -  |
| 12 | 18          | 3,6             | -               | 0,06      | 0,085     | -  |
| 14 | 21          | 4,2             | -               | 0,07      | 0,095     | -  |
| 16 | 24          | 4,8             | -               | 0,08      | 0,11      | -  |
| 18 | 27          | 5,4             | -               | 0,09      | 0,12      | -  |
| 20 | 30          | 6               | -               | 0,1       | 0,13      | -  |

Vollnutfräsen / Slot milling

| D1 | AP<br>[1xD] | Ae<br>[1xD] | fz   |
|----|-------------|-------------|------|
| 6  | 6           | 6           | 0,02 |
| 8  | 8           | 8           | 0,03 |
| 10 | 10          | 10          | 0,04 |
| 12 | 12          | 12          | 0,04 |
| 14 | 14          | 14          | 0,05 |
| 16 | 16          | 16          | 0,06 |
| 18 | 18          | 18          | 0,07 |
| 20 | 20          | 20          | 0,08 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | 120                                                           | 150 | 180 |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | 100                                                           | 130 | 150 |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | 70                                                            | 90  | 110 |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 60                                                            | 90  | 120 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 55                                                            | 80  | 110 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 20                                                            | 30  | 45  |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 35                                                            | 45  | 70  |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

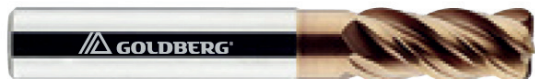
Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## SpeedMill® SM20 4-Schneidig (Variable Steigung, Torusfräser) 4 flutes (variable helic, torical end mill)

Fräsdurchmesser / Milling cutting dia.: 6 mm - 16,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

Steigung / Helix angle: 40°-42°  
 Beschichtung / Coating: AlCr-basiert  
 Anzahl Zähne / No. of flutes: 4

Zentrumschliff / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1 | r   | z |
|--------------------|--------------------|----|----|----|----|------|----|-----|---|
| SM20-4A06042T05VC  | SM20-4B06042T05VC  | 6  | 6  | 13 | 19 | 5,7  | 57 | 0,5 | 4 |
| SM20-4A06042T10VC  | SM20-4B06042T10VC  | 6  | 6  | 13 | 19 | 5,7  | 57 | 1,0 | 4 |
| SM20-4A08042T05VC  | SM20-4B08042T05VC  | 8  | 8  | 19 | 25 | 7,6  | 63 | 0,5 | 4 |
| SM20-4A08042T10VC  | SM20-4B08042T10VC  | 8  | 8  | 19 | 25 | 7,6  | 63 | 1,0 | 4 |
| SM20-4A10042T05VC  | SM20-4B10042T05VC  | 10 | 10 | 22 | 30 | 9,5  | 72 | 0,5 | 4 |
| SM20-4A10042T10VC  | SM20-4B10042T10VC  | 10 | 10 | 22 | 30 | 9,5  | 72 | 1,0 | 4 |
| SM20-4A10042T20VC  | SM20-4B10042T20VC  | 10 | 10 | 22 | 30 | 9,5  | 72 | 2,0 | 4 |
| SM20-4A12042T05VC  | SM20-4B12042T05VC  | 12 | 12 | 26 | 36 | 11,5 | 83 | 0,5 | 4 |
| SM20-4A12042T10VC  | SM20-4B12042T10VC  | 12 | 12 | 26 | 36 | 11,5 | 83 | 1,0 | 4 |
| SM20-4A12042T20VC  | SM20-4B12042T20VC  | 12 | 12 | 26 | 36 | 11,5 | 83 | 2,0 | 4 |
| SM20-4A16042T05VC  | SM20-4B16042T05VC  | 16 | 16 | 32 | 42 | 15,5 | 92 | 0,5 | 4 |
| SM20-4A16042T10VC  | SM20-4B16042T10VC  | 16 | 16 | 32 | 42 | 15,5 | 92 | 1,0 | 4 |
| SM20-4A16042T20VC  | SM20-4B16042T20VC  | 16 | 16 | 32 | 42 | 15,5 | 92 | 2,0 | 4 |

### Zerspanungswerte / Cutting conditions

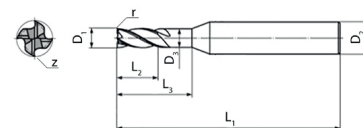
Umfangfräsen / Peripheral milling

| DC   | AP<br>[1,5xD] | Ae1<br>[0,3xD] | Ae2 | fz1<br>▼▼ | fz2<br>▼▼ | hm |
|------|---------------|----------------|-----|-----------|-----------|----|
| 6,0  | 9,0           | 1,8            | -   | 0,03      | 0,05      | -  |
| 8,0  | 12,0          | 2,4            | -   | 0,04      | 0,06      | -  |
| 10,0 | 15,0          | 3,0            | -   | 0,05      | 0,07      | -  |
| 12,0 | 18,0          | 3,6            | -   | 0,06      | 0,09      | -  |
| 16,0 | 24,0          | 4,8            | -   | 0,08      | 0,12      | -  |

Vollnutfräsen / Slot milling

| DC   | AP<br>[1xD] | Ae<br>[1xD] | fz   |
|------|-------------|-------------|------|
| 6,0  | 6,0         | 6,0         | 0,04 |
| 8,0  | 8,0         | 8,0         | 0,05 |
| 10,0 | 10,0        | 10,0        | 0,06 |
| 12,0 | 12,0        | 12,0        | 0,07 |
| 16,0 | 16,0        | 16,0        | 0,09 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 90                                                            | 120 | 150 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 70                                                            | 100 | 130 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 60                                                            | 70  | 80  |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 80                                                            | 90  | 100 |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

**SpeedMill® SM28 5-Schneidig (Variable Steigung, 2xD)  
Trochoidal 5 flutes (variable helix, 2xD)**

 Fräsdurchmesser / Milling cutting dia.: 3 mm – 25,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

 Steigung / Helix angle: 41°–42°  
 Beschichtung / Coating: AlCr-basiert  
 Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: ✕

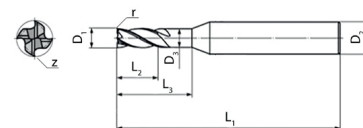


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|----|----|------|-----|--------|---|
| SM28-5A03042VC     | SM28-5B03042VC     | 3  | 6  | 6  | 14 | 2,8  | 57  | 0,06   | 5 |
| SM28-5A04042VC     | SM28-5B04042VC     | 4  | 6  | 8  | 16 | 3,8  | 57  | 0,08   | 5 |
| SM28-5A05042VC     | SM28-5B05042VC     | 5  | 6  | 10 | 18 | 4,8  | 57  | 0,10   | 5 |
| SM28-5A06042VC     | SM28-5B06042VC     | 6  | 6  | 12 | 19 | 5,7  | 57  | 0,12   | 5 |
| SM28-5A08042VC     | SM28-5B08042VC     | 8  | 8  | 16 | 25 | 7,6  | 63  | 0,16   | 5 |
| SM28-5A10042VC     | SM28-5B10042VC     | 10 | 10 | 20 | 30 | 9,5  | 72  | 0,20   | 5 |
| SM28-5A12042VC     | SM28-5B12042VC     | 12 | 12 | 24 | 36 | 11,5 | 83  | 0,24   | 5 |
| SM28-5A14042VC     | SM28-5B14042VC     | 14 | 14 | 28 | 36 | 13,5 | 83  | 0,28   | 5 |
| SM28-5A16042VC     | SM28-5B16042VC     | 16 | 16 | 32 | 42 | 15,5 | 92  | 0,32   | 5 |
| SM28-5A18042VC     | SM28-5B18042VC     | 18 | 18 | 36 | 42 | 17,5 | 92  | 0,36   | 5 |
| SM28-5A20042VC     | SM28-5B20042VC     | 20 | 20 | 40 | 52 | 19,5 | 104 | 0,40   | 5 |
| SM28-5A25042VC     | SM28-5B25042VC     | 25 | 25 | 50 | 62 | 24   | 120 | 0,50   | 5 |

**Zerspanungswerte / Cutting conditions**  
 Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm   |
|------|-------------|-----------------|-----------------|-----------|-----------|------|
| 3,0  | 6,0         | 0,3             | 0,5             | 0,03      | 0,02      | 0,01 |
| 4,0  | 8,0         | 0,4             | 0,6             | 0,04      | 0,03      | 0,01 |
| 5,0  | 10,0        | 0,5             | 0,8             | 0,05      | 0,04      | 0,02 |
| 6,0  | 12,0        | 0,5             | 0,9             | 0,06      | 0,05      | 0,02 |
| 8,0  | 16,0        | 0,7             | 1,2             | 0,08      | 0,06      | 0,02 |
| 10,0 | 20,0        | 0,9             | 1,5             | 0,10      | 0,08      | 0,03 |
| 12,0 | 24,0        | 1,1             | 1,8             | 0,12      | 0,10      | 0,04 |
| 14,0 | 28,0        | 1,3             | 2,1             | 0,14      | 0,11      | 0,04 |
| 16,0 | 32,0        | 1,4             | 2,4             | 0,16      | 0,12      | 0,05 |
| 18,0 | 36,0        | 1,6             | 2,7             | 0,18      | 0,14      | 0,05 |
| 20,0 | 40,0        | 1,8             | 3,0             | 0,20      | 0,16      | 0,06 |
| 25,0 | 50,0        | 2,3             | 3,8             | 0,25      | 0,19      | 0,08 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 150                                                           | 190 | 230 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 130                                                           | 170 | 200 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 50                                                            | 80  | 100 |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 80                                                            | 130 | 170 |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |


 D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

### SpeedMill® SM29 5-Schneidig (Variable Steigung, 2xD, Torusfräser) Trochoidal 5 flutes (variable helix, 2xD, torical end mill)

Fräsdurchmesser / Milling cutting dia.: 6 mm - 20,0 mm  
Typ / Type: DIN 6535 HA  
DIN 6535 HB

Steigung / Helix angle: 41°-42°  
Beschichtung / Coating: AlCr-basiert  
Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: \*

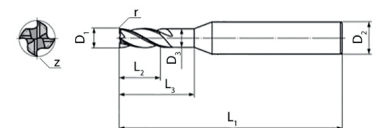


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | r   | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
| SM29-5A06042T01VC  | SM29-5B06042T01VC  | 6  | 6  | 12 | 19 | 5,7  | 57  | 0,1 | 5 |
| SM29-5A06042T05VC  | SM29-5B06042T05VC  | 6  | 6  | 12 | 19 | 5,7  | 57  | 0,5 | 5 |
| SM29-5A06042T10VC  | SM29-5B06042T10VC  | 6  | 6  | 12 | 19 | 5,7  | 57  | 1,0 | 5 |
| SM29-5A08042T02VC  | SM29-5B08042T02VC  | 8  | 8  | 16 | 25 | 7,6  | 63  | 0,2 | 5 |
| SM29-5A08042T05VC  | SM29-5B08042T05VC  | 8  | 8  | 16 | 25 | 7,6  | 63  | 0,5 | 5 |
| SM29-5A08042T10VC  | SM29-5B08042T10VC  | 8  | 8  | 16 | 25 | 7,6  | 63  | 1,0 | 5 |
| SM29-5A10042T02VC  | SM29-5B10042T02VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 0,2 | 5 |
| SM29-5A10042T05VC  | SM29-5B10042T05VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 0,5 | 5 |
| SM29-5A10042T10VC  | SM29-5B10042T10VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 1,0 | 5 |
| SM29-5A10042T20VC  | SM29-5B10042T20VC  | 10 | 10 | 20 | 30 | 9,5  | 72  | 2,0 | 5 |
| SM29-5A12042T03VC  | SM29-5B12042T03VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 0,3 | 5 |
| SM29-5A12042T05VC  | SM29-5B12042T05VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 0,5 | 5 |
| SM29-5A12042T10VC  | SM29-5B12042T10VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 1,0 | 5 |
| SM29-5A12042T20VC  | SM29-5B12042T20VC  | 12 | 12 | 24 | 36 | 11,5 | 83  | 2,0 | 5 |
| SM29-5A16042T03VC  | SM29-5B16042T03VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 0,3 | 5 |
| SM29-5A16042T05VC  | SM29-5B16042T05VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 0,5 | 5 |
| SM29-5A16042T10VC  | SM29-5B16042T10VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 1,0 | 5 |
| SM29-5A16042T20VC  | SM29-5B16042T20VC  | 16 | 16 | 32 | 42 | 15,5 | 92  | 2,0 | 5 |
| SM29-5A20042T03VC  | SM29-5B20042T03VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 0,3 | 5 |
| SM29-5A20042T10VC  | SM29-5B20042T10VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 1,0 | 5 |
| SM29-5A20042T20VC  | SM29-5B20042T20VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 2,0 | 5 |
| SM29-5A20042T30VC  | SM29-5B20042T30VC  | 20 | 20 | 40 | 52 | 19,5 | 104 | 3,0 | 5 |

#### Zerspanungswerte / Cutting conditions Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm   |
|------|-------------|-----------------|-----------------|-----------|-----------|------|
| 6,0  | 12,0        | 0,54            | 0,9             | 0,06      | 0,05      | 0,02 |
| 8,0  | 16,0        | 0,72            | 1,2             | 0,08      | 0,06      | 0,02 |
| 10,0 | 20,0        | 0,90            | 1,5             | 0,10      | 0,08      | 0,03 |
| 12,0 | 24,0        | 1,08            | 1,8             | 0,12      | 0,09      | 0,04 |
| 16,0 | 32,0        | 1,44            | 2,4             | 0,16      | 0,12      | 0,04 |
| 20,0 | 40,0        | 1,80            | 3,0             | 0,20      | 0,16      | 0,06 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 150                                                           | 190 | 230 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 130                                                           | 170 | 200 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 50                                                            | 80  | 100 |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 80                                                            | 130 | 170 |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
Ap = Spantiefe  
Ae = Querstellung  
fz = Vorschub / Zahn  
▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

### SpeedMill® SM30 5-Schneidig (Variable Steigung, 4xD) Trochoidal 5 flutes (variable helix, 4xD)

Fräsdurchmesser / Milling cutting dia.: 3 mm - 25,0 mm  
Typ / Type: DIN 6535 HA  
DIN 6535 HB

Steigung / Helix angle: 41°-42°  
Beschichtung / Coating: AlCr-basiert  
Anzahl Zähne / No. of flutes: 5

Zentrumschliff / Center cutting: ✕

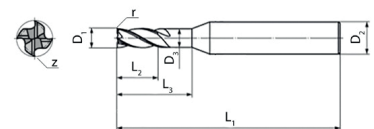


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2  | L3  | D3   | L1  | c[45°] | z |
|--------------------|--------------------|----|----|-----|-----|------|-----|--------|---|
| SM30-5A03042VC     | SM30-5B03042VC     | 3  | 6  | 12  | 18  | 2,8  | 80  | 0,06   | 5 |
| SM30-5A04042VC     | SM30-5B04042VC     | 4  | 6  | 16  | 21  | 3,8  | 80  | 0,08   | 5 |
| SM30-5A05042VC     | SM30-5B05042VC     | 5  | 6  | 20  | 25  | 4,8  | 80  | 0,10   | 5 |
| SM30-5A06042VC     | SM30-5B06042VC     | 6  | 6  | 24  | 30  | 5,7  | 80  | 0,12   | 5 |
| SM30-5A08042VC     | SM30-5B08042VC     | 8  | 8  | 32  | 38  | 7,6  | 90  | 0,16   | 5 |
| SM30-5A10042VC     | SM30-5B10042VC     | 10 | 10 | 40  | 48  | 9,5  | 100 | 0,20   | 5 |
| SM30-5A12042VC     | SM30-5B12042VC     | 12 | 12 | 48  | 58  | 11,5 | 120 | 0,24   | 5 |
| SM30-5A14042VC     | SM30-5B14042VC     | 14 | 14 | 56  | 64  | 13,5 | 120 | 0,28   | 5 |
| SM30-5A16042VC     | SM30-5B16042VC     | 16 | 16 | 64  | 74  | 15,5 | 140 | 0,32   | 5 |
| SM30-5A18042VC     | SM30-5B18042VC     | 18 | 18 | 72  | 85  | 17,5 | 140 | 0,36   | 5 |
| SM30-5A20042VC     | SM30-5B20042VC     | 20 | 20 | 80  | 94  | 19,5 | 160 | 0,40   | 5 |
| SM30-5A25042VC     | SM30-5B25042VC     | 25 | 25 | 100 | 117 | 24   | 190 | 0,50   | 5 |

#### Zerspanungswerte / Cutting conditions Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm   |
|------|-------------|-----------------|-----------------|-----------|-----------|------|
| 3,0  | 12,0        | 0,09            | 0,27            | 0,05      | 0,03      | 0,01 |
| 4,0  | 16,0        | 0,12            | 0,36            | 0,07      | 0,04      | 0,01 |
| 5,0  | 20,0        | 0,15            | 0,45            | 0,09      | 0,05      | 0,02 |
| 6,0  | 24,0        | 0,18            | 0,54            | 0,10      | 0,06      | 0,02 |
| 8,0  | 32,0        | 0,24            | 0,72            | 0,14      | 0,08      | 0,02 |
| 10,0 | 40,0        | 0,30            | 0,90            | 0,17      | 0,10      | 0,03 |
| 12,0 | 48,0        | 0,36            | 1,08            | 0,21      | 0,12      | 0,04 |
| 14,0 | 56,0        | 0,42            | 1,26            | 0,24      | 0,14      | 0,04 |
| 16,0 | 64,0        | 0,48            | 1,44            | 0,28      | 0,16      | 0,05 |
| 18,0 | 72,0        | 0,54            | 1,62            | 0,31      | 0,18      | 0,05 |
| 20,0 | 80,0        | 0,60            | 1,80            | 0,35      | 0,20      | 0,06 |
| 25,0 | 100,0       | 0,75            | 2,25            | 0,43      | 0,25      | 0,08 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 150                                                           | 190 | 230 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 130                                                           | 170 | 200 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 50                                                            | 80  | 100 |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 80                                                            | 130 | 170 |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
Ap = Spantiefe  
Ae = Querstellung  
fz = Vorschub / Zahn  
▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## SpeedMill® SM31 5-Schneidig (Variable Steigung, 4xD, Torusfräser) Trochoidal 5 flutes (variable helix, 4xD, torical end mill)

Fräsdurchmesser / Milling cutting dia.: 6 mm - 20,0 mm  
 Typ / Type: DIN 6535 HA  
 DIN 6535 HB

Steigung / Helix angle: 41°-42°  
 Beschichtung / Coating: AlCr-basiert  
 Anzahl Zähne / No. of flutes: 5

Zentrumschleiß / Center cutting: ✕

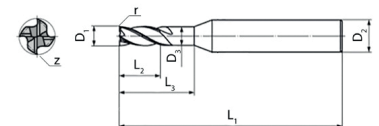


| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | r   | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
| SM31-5A06042T01VC  | SM31-5B06042T01VC  | 6  | 6  | 24 | 30 | 5,7  | 80  | 0,1 | 5 |
| SM31-5A06042T05VC  | SM31-5B06042T05VC  | 6  | 6  | 24 | 30 | 5,7  | 80  | 0,5 | 5 |
| SM31-5A06042T10VC  | SM31-5B06042T10VC  | 6  | 6  | 24 | 30 | 5,7  | 80  | 1,0 | 5 |
| SM31-5A08042T02VC  | SM31-5B08042T02VC  | 8  | 8  | 32 | 38 | 7,6  | 90  | 0,2 | 5 |
| SM31-5A08042T05VC  | SM31-5B08042T05VC  | 8  | 8  | 32 | 38 | 7,6  | 90  | 0,5 | 5 |
| SM31-5A08042T10VC  | SM31-5B08042T10VC  | 8  | 8  | 32 | 38 | 7,6  | 90  | 1,0 | 5 |
| SM31-5A10042T02VC  | SM31-5B10042T02VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 0,2 | 5 |
| SM31-5A10042T05VC  | SM31-5B10042T05VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 0,5 | 5 |
| SM31-5A10042T10VC  | SM31-5B10042T10VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 1,0 | 5 |
| SM31-5A10042T20VC  | SM31-5B10042T20VC  | 10 | 10 | 40 | 48 | 9,5  | 100 | 2,0 | 5 |
| SM31-5A12042T03VC  | SM31-5B12042T03VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 0,3 | 5 |
| SM31-5A12042T05VC  | SM31-5B12042T05VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 0,5 | 5 |
| SM31-5A12042T10VC  | SM31-5B12042T10VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 1,0 | 5 |
| SM31-5A12042T20VC  | SM31-5B12042T20VC  | 12 | 12 | 48 | 58 | 11,5 | 120 | 2,0 | 5 |
| SM31-5A16042T03VC  | SM31-5B16042T03VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 0,3 | 5 |
| SM31-5A16042T05VC  | SM31-5B16042T05VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 0,5 | 5 |
| SM31-5A16042T10VC  | SM31-5B16042T10VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 1,0 | 5 |
| SM31-5A16042T20VC  | SM31-5B16042T20VC  | 16 | 16 | 64 | 74 | 15,5 | 140 | 2,0 | 5 |
| SM31-5A20042T03VC  | SM31-5B20042T03VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 0,3 | 5 |
| SM31-5A20042T10VC  | SM31-5B20042T10VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 1,0 | 5 |
| SM31-5A20042T20VC  | SM31-5B20042T20VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 2,0 | 5 |
| SM31-5A20042T30VC  | SM31-5B20042T30VC  | 20 | 20 | 80 | 94 | 19,5 | 160 | 3,0 | 5 |

### Zerspanungswerte / Cutting conditions Trochoidales Fräsen / Trochoidal milling

| DC   | AP<br>[mm] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>[mm/z] | fz2<br>[mm/z] | hm   |
|------|------------|-----------------|-----------------|---------------|---------------|------|
| 6,0  | 24,0       | 0,18            | 0,54            | 0,10          | 0,06          | 0,02 |
| 8,0  | 32,0       | 0,24            | 0,72            | 0,14          | 0,08          | 0,02 |
| 10,0 | 40,0       | 0,30            | 0,90            | 0,17          | 0,10          | 0,03 |
| 12,0 | 48,0       | 0,36            | 1,08            | 0,21          | 0,12          | 0,04 |
| 16,0 | 64,0       | 0,48            | 1,44            | 0,28          | 0,16          | 0,05 |
| 20,0 | 80,0       | 0,60            | 1,80            | 0,35          | 0,20          | 0,06 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | 150                                                           | 190 | 230 |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | 130                                                           | 170 | 200 |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | -                                                             | -   | -   |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | -                                                             | -   | -   |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | 50                                                            | 80  | 100 |
|                                  | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | 80                                                            | 130 | 170 |
| H                                | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
 Ap = Spantiefe  
 Ae = Querstellung  
 fz = Vorschub / Zahn  
 ▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request



### AluMill® AL45 3-Schneidig (poliert) 3 flutes (polished)

Fräsdurchmesser / Milling cutting dia.: 1,0 mm - 25,0 mm  
Typ / Type: DIN 6535 HA

Steigung / Helix angle: 50°  
Beschichtung / Coating: poliert/polished  
Anzahl Zähne / No. of flutes: 3

Zentrumschliff / Center cutting: ✓



N

| Schaft A (Shank A) | Schaft B (Shank B) | D1  | D2 | L2  | L3 | D3   | L1  | r | z |
|--------------------|--------------------|-----|----|-----|----|------|-----|---|---|
| AL45-3A01050UP     | -                  | 1   | 3  | 1,5 | -  | -    | 38  | - | 3 |
| AL45-3A01550UP     | -                  | 1,5 | 3  | 2   | -  | -    | 38  | - | 3 |
| AL45-3A02050UP     | -                  | 2   | 6  | 6   | -  | -    | 57  | - | 3 |
| AL45-3A03050UP     | -                  | 3   | 6  | 8   | 13 | 2,9  | 57  | - | 3 |
| AL45-3A04050UP     | -                  | 4   | 6  | 11  | 17 | 3,9  | 57  | - | 3 |
| AL45-3A05050UP     | -                  | 5   | 6  | 13  | 18 | 4,9  | 57  | - | 3 |
| AL45-3A06050UP     | -                  | 6   | 6  | 13  | 18 | 5,9  | 57  | - | 3 |
| AL45-3A08050UP     | -                  | 8   | 8  | 21  | 25 | 7,8  | 64  | - | 3 |
| AL45-3A10050UP     | -                  | 10  | 10 | 22  | 30 | 9,8  | 72  | - | 3 |
| AL45-3A12050UP     | -                  | 12  | 12 | 26  | 36 | 11,7 | 83  | - | 3 |
| AL45-3A14050UP     | -                  | 14  | 14 | 26  | 36 | 13,7 | 83  | - | 3 |
| AL45-3A16050UP     | -                  | 16  | 16 | 36  | 42 | 15,5 | 92  | - | 3 |
| AL45-3A18050UP     | -                  | 18  | 18 | 36  | 42 | 17,5 | 92  | - | 3 |
| AL45-3A20050UP     | -                  | 20  | 20 | 41  | 52 | 19,5 | 104 | - | 3 |
| AL45-3A25050UP     | -                  | 25  | 25 | 55  | 66 | 24,5 | 126 | - | 3 |

#### Zerspanungswerte / Cutting conditions

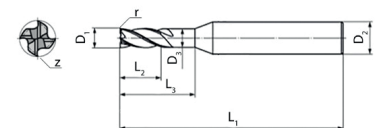
Umfangfräsen / Peripheral milling

| D1  | AP<br>[1,5xD] | Ae1<br>[0,25xD] | Ae2<br>[0,5xD] | fz1<br>▼▼ | fz2<br>▼ | hm |
|-----|---------------|-----------------|----------------|-----------|----------|----|
| 1   | 1,5           | 0,3             | -              | 0,01      | 0,02     | -  |
| 1,5 | 2,25          | 0,45            | -              | 0,013     | 0,02     | -  |
| 2   | 3             | 0,6             | -              | 0,02      | 0,03     | -  |
| 3   | 4,5           | 0,9             | -              | 0,025     | 0,04     | -  |
| 4   | 6             | 1,2             | -              | 0,04      | 0,06     | -  |
| 5   | 7,5           | 1,5             | -              | 0,05      | 0,08     | -  |
| 6   | 9             | 1,8             | -              | 0,06      | 0,09     | -  |
| 8   | 12            | 2,4             | -              | 0,07      | 0,10     | -  |
| 10  | 15            | 3               | -              | 0,08      | 0,12     | -  |
| 12  | 18            | 3,6             | -              | 0,09      | 0,13     | -  |
| 14  | 21            | 4,2             | -              | 0,1       | 0,15     | -  |
| 16  | 24            | 4,8             | -              | 0,11      | 0,16     | -  |
| 18  | 27            | 5,4             | -              | 0,12      | 0,18     | -  |
| 20  | 30            | 6               | -              | 0,15      | 0,22     | -  |
| 25  | 37,5          | 7,5             | -              | 0,22      | 0,33     | -  |

Vollnutfräsen / Slot milling

| D1  | AP  | Ae  | fz   |
|-----|-----|-----|------|
| 1   | 1   | 1   | 0,01 |
| 1,5 | 1,5 | 1,5 | 0,01 |
| 2   | 2   | 2   | 0,02 |
| 3   | 3   | 3   | 0,02 |
| 4   | 4   | 4   | 0,04 |
| 5   | 5   | 5   | 0,04 |
| 6   | 6   | 6   | 0,05 |
| 8   | 8   | 8   | 0,06 |
| 10  | 10  | 10  | 0,07 |
| 12  | 12  | 12  | 0,07 |
| 14  | 14  | 14  | 0,08 |
| 16  | 16  | 16  | 0,09 |
| 18  | 18  | 18  | 0,10 |
| 20  | 20  | 20  | 0,12 |
| 25  | 25  | 25  | 0,19 |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | 120                                                           | 200 | 350 |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | 150                                                           | 240 | 360 |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni und Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
Ap = Spantiefe  
Ae = Querstellung  
fz = Vorschub / Zahn  
▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## AluMill® AL55 3-Schneidig (Variable Steigung) 3 flutes (variable helix)

Fräsdurchmesser / Milling cutting dia.: 3 mm - 20,0 mm  
Typ / Type: DIN 6535 HA bis 14mm  
DIN 6535 HB

Steigung / Helix angle: 41°-44°  
Beschichtung / Coating: ZSiX  
Anzahl Zähne / No. of flutes: 3

Zentrumschleif / Center cutting: ✓



| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | 45° | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
| AL55-3A03044VC     | -                  | 3  | 6  | 8  | 12 | 2,9  | 57  | 0,1 | 3 |
| AL55-3A04044VC     | -                  | 4  | 6  | 13 | 17 | 3,9  | 57  | 0,1 | 3 |
| AL55-3A05044VC     | -                  | 5  | 6  | 13 | 18 | 4,9  | 57  | 0,1 | 3 |
| AL55-3A06044VC     | -                  | 6  | 6  | 19 | 25 | 5,9  | 57  | 0,2 | 3 |
| AL55-3A08044VC     | -                  | 8  | 8  | 21 | 30 | 7,5  | 63  | 0,2 | 3 |
| AL55-3A10044VC     | -                  | 10 | 10 | 22 | 30 | 9,7  | 72  | 0,2 | 3 |
| AL55-3A12044VC     | -                  | 12 | 12 | 26 | 36 | 11,7 | 83  | 0,2 | 3 |
| AL55-3A14044VC     | -                  | 14 | 14 | 26 | 36 | 13,7 | 83  | 0,2 | 3 |
| -                  | AL55-3B16044VC     | 16 | 16 | 36 | 42 | 15,5 | 92  | 0,2 | 3 |
| -                  | AL55-3B18044VC     | 18 | 18 | 36 | 42 | 17,5 | 92  | 0,2 | 3 |
| -                  | AL55-3B20044VC     | 20 | 20 | 41 | 52 | 19,5 | 104 | 0,2 | 3 |

### Zerspanungswerte / Cutting conditions

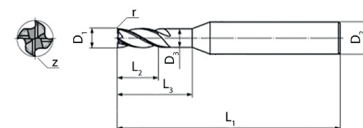
Umfangfräsen / Peripheral milling

| DC | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm |
|----|-------------|-----------------|-----------------|-----------|-----------|----|
| -  | 4,5         | 0,9             | -               | 0,025     | 0,035     | -  |
| 4  | 6           | 1,2             | -               | 0,04      | 0,06      | -  |
| 5  | 7,5         | 1,5             | -               | 0,05      | 0,075     | -  |
| 6  | 9           | 1,8             | -               | 0,06      | 0,09      | -  |
| 8  | 12          | 2,4             | -               | 0,07      | 0,1       | -  |
| 10 | 15          | 3               | -               | 0,08      | 0,12      | -  |
| 12 | 18          | 3,6             | -               | 0,09      | 0,13      | -  |
| 14 | 21          | 4,2             | -               | 0,1       | 0,15      | -  |
| 16 | 24          | 4,8             | -               | 0,11      | 0,16      | -  |
| 18 | 27          | 5,4             | -               | 0,12      | 0,19      | -  |
| 20 | 30          | 6               | -               | 0,15      | 0,24      | -  |

Vollnutfräsen / Slot milling

| D1 | AP | fz1 | fz2   |
|----|----|-----|-------|
| 3  | 3  | 3   | 0,02  |
| 4  | 4  | 4   | 0,035 |
| 5  | 5  | 5   | 0,04  |
| 6  | 6  | 6   | 0,045 |
| 8  | 8  | 8   | 0,06  |
| 10 | 10 | 10  | 0,065 |
| 12 | 12 | 12  | 0,07  |
| 14 | 14 | 14  | 0,08  |
| 16 | 16 | 16  | 0,1   |
| 18 | 18 | 18  | 0,12  |
| 20 | 20 | 20  | 0,15  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | 250                                                           | 450 | 600 |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | 150                                                           | 240 | 360 |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
Ap = Spantiefe  
Ae = Querstellung  
fz = Vorschub / Zahn  
▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

## AluMill® AL56 3-Schneidig (Variable Steigung), lang 3 flutes (variable helix), long

Fräsdurchmesser / Milling cutting dia.: 6,0 mm – 20,0 mm  
Typ / Type: DIN 6535 HA bis 14mm  
DIN 6535 HB

Steigung / Helix angle: 41°–44°  
Beschichtung / Coating: ZSiX  
Anzahl Zähne / No. of flutes: 3

Zentrumschliff / Center cutting: ✓



N

| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3 | D3   | L1  | 45° | z |
|--------------------|--------------------|----|----|----|----|------|-----|-----|---|
| AL56-3A06044VC     | -                  | 6  | 6  | 18 | 24 | 5,9  | 62  | 0,2 | 3 |
| AL56-3A08044VC     | -                  | 8  | 8  | 24 | 30 | 7,8  | 68  | 0,2 | 3 |
| AL56-3A10044VC     | -                  | 10 | 10 | 30 | 38 | 9,7  | 80  | 0,2 | 3 |
| AL56-3A12044VC     | -                  | 12 | 12 | 36 | 46 | 11,7 | 93  | 0,2 | 3 |
| AL56-3A14044VC     | -                  | 14 | 14 | 36 | 46 | 13,7 | 93  | 0,2 | 3 |
| -                  | AL56-3B16044VC     | 16 | 16 | 48 | 58 | 15,5 | 108 | 0,2 | 3 |
| -                  | AL56-3B18044VC     | 18 | 18 | 48 | 58 | 17,5 | 108 | 0,2 | 3 |
| -                  | AL56-3B20044VC     | 20 | 20 | 60 | 74 | 19,5 | 126 | 0,2 | 3 |

### Zerspanungswerte / Cutting conditions

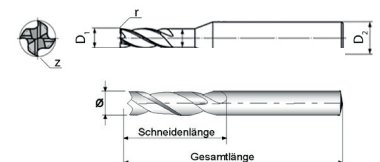
Umfangfräsen / Peripheral milling

| D1 | AP<br>[1,5xD] | Ae1<br>[0,25xD] | Ae2<br>[0,5xD] | fz1<br>▼▼ | fz2<br>▼ | hm |
|----|---------------|-----------------|----------------|-----------|----------|----|
| 6  | 9             | 1,8             | -              | 0,05      | 0,07     | -  |
| 8  | 12            | 2,4             | -              | 0,06      | 0,08     | -  |
| 10 | 15            | 3               | -              | 0,07      | 0,1      | -  |
| 12 | 18            | 3,6             | -              | 0,08      | 0,11     | -  |
| 14 | 21            | 4,2             | -              | 0,09      | 0,13     | -  |
| 16 | 24            | 4,8             | -              | 0,1       | 0,14     | -  |
| 18 | 27            | 5,4             | -              | 0,11      | 0,17     | -  |
| 20 | 30            | 6               | -              | 0,14      | 0,21     | -  |

Vollnutfräsen / Slot milling

| D1 | AP | Ae | fz    |
|----|----|----|-------|
| 6  | 6  | 6  | 0,04  |
| 8  | 8  | 8  | 0,05  |
| 10 | 10 | 10 | 0,055 |
| 12 | 12 | 12 | 0,06  |
| 14 | 14 | 14 | 0,07  |
| 16 | 16 | 16 | 0,09  |
| 18 | 18 | 18 | 0,1   |
| 20 | 20 | 20 | 0,13  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | 250                                                           | 450 | 600 |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | 150                                                           | 240 | 360 |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



D1 = Durchmesser  
Ap = Spantiefe  
Ae = Querstellung  
fz = Vorschub / Zahn  
▼▼/▼ = Oberfläche

Andere Abmessungen und Schaftformen auf Anfrage / Other dimensions and shank types on request

**AluMill® AL57**

**3-Schneidig (Variable Steigung), XXL 5xD Hals**  
**3 flutes (variable helix), XXL 5xD neck**

Fräsdurchmesser / Milling cutting dia.: 3 mm - 20,0 mm  
Typ / Type: DIN 6535 HA bis 14mm  
DIN 6535 HB

Steigung / Helix angle: 41°-44°  
Beschichtung / Coating: ZSiX  
Anzahl Zähne / No. of flutes: 3

Zentrumschleif / Center cutting: ✓



N

| Schaft A (Shank A) | Schaft B (Shank B) | D1 | D2 | L2 | L3  | D3   | L1  | 45° | z |
|--------------------|--------------------|----|----|----|-----|------|-----|-----|---|
| AL57-3A03044VC     | -                  | 3  | 6  | 8  | 20  | 2,9  | 60  | 0,1 | 3 |
| AL57-3A04044VC     | -                  | 4  | 6  | 11 | 22  | 3,9  | 65  | 0,1 | 3 |
| AL57-3A05044VC     | -                  | 5  | 6  | 13 | 26  | 4,9  | 76  | 0,1 | 3 |
| AL57-3A06044VC     | -                  | 6  | 6  | 13 | 42  | 5,9  | 80  | 0,2 | 3 |
| AL57-3A08044VC     | -                  | 8  | 8  | 21 | 62  | 7,7  | 100 | 0,2 | 3 |
| AL57-3A10044VC     | -                  | 10 | 10 | 25 | 62  | 9,7  | 100 | 0,2 | 3 |
| AL57-3A12044VC     | -                  | 12 | 12 | 26 | 73  | 11,7 | 120 | 0,2 | 3 |
| AL57-3A14044VC     | -                  | 14 | 14 | 26 | 73  | 13,7 | 120 | 0,2 | 3 |
| -                  | AL57-3B16044VC     | 16 | 16 | 36 | 100 | 15,5 | 150 | 0,2 | 3 |
| -                  | AL57-3B18044VC     | 18 | 18 | 36 | 100 | 17,5 | 150 | 0,2 | 3 |
| -                  | AL57-3B20044VC     | 20 | 20 | 41 | 100 | 19,5 | 150 | 0,2 | 3 |

**Zerspanungswerte / Cutting conditions**

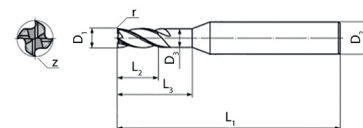
Umfangfräsen / Peripheral milling

| DC | AP<br>[max] | Ae1<br>[0,03xD] | Ae2<br>[0,09xD] | fz1<br>▼▼ | fz2<br>▼▼ | hm |
|----|-------------|-----------------|-----------------|-----------|-----------|----|
| 3  | 4,5         | 0,9             | -               | 0,02      | 0,025     | -  |
| 4  | 6           | 1,2             | -               | 0,03      | 0,04      | -  |
| 5  | 7,5         | 1,5             | -               | 0,04      | 0,065     | -  |
| 6  | 9           | 1,8             | -               | 0,05      | 0,07      | -  |
| 8  | 12          | 2,4             | -               | 0,06      | 0,08      | -  |
| 10 | 15          | 3               | -               | 0,07      | 0,09      | -  |
| 12 | 18          | 3,6             | -               | 0,08      | 0,11      | -  |
| 14 | 21          | 4,2             | -               | 0,09      | 0,12      | -  |
| 16 | 24          | 4,8             | -               | 0,1       | 0,13      | -  |
| 18 | 27          | 5,4             | -               | 0,11      | 0,16      | -  |
| 20 | 30          | 6               | -               | 0,12      | 0,19      | -  |

Vollnutfräsen / Slot milling

| D1 | AP | Ae | fz    |
|----|----|----|-------|
| 3  | 3  | 3  | 0,015 |
| 4  | 4  | 4  | 0,025 |
| 5  | 5  | 5  | 0,03  |
| 6  | 6  | 6  | 0,035 |
| 8  | 8  | 8  | 0,04  |
| 10 | 10 | 10 | 0,05  |
| 12 | 12 | 12 | 0,055 |
| 14 | 14 | 14 | 0,06  |
| 16 | 16 | 16 | 0,075 |
| 18 | 18 | 18 | 0,09  |
| 20 | 20 | 20 | 0,11  |

| Werkstoffgruppe / Material group |                                                                            | Zugfestigkeit /<br>Tensile strength<br>Rm [N/mm²] | Härte /<br>Hardness<br>[HB / HRC] | Schnittgeschwindigkeiten /<br>Cutting speed<br>min. opt. max. |     |     |
|----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------------------|-----|-----|
| P                                | Unlegierter Stahl / Plain carbon steel                                     | < 600                                             | < 230                             | -                                                             | -   | -   |
|                                  | Legierter Stahl / Alloy Steel                                              | < 1200                                            | < 350                             | -                                                             | -   | -   |
|                                  | Hochlegierter Stahl und Werkzeugstahl / High alloy steel and tool steel    | < 1400                                            | < 380                             | -                                                             | -   | -   |
| M                                | Aust. und Ferr. rostfreie Stähle / Aust. and Ferr. Stainless steel         | < 680                                             | < 220                             | -                                                             | -   | -   |
|                                  | Mart. rostfreie Stähle / Mart. Stainless steel                             | < 820                                             | < 240                             | -                                                             | -   | -   |
| K                                | Grauguß / Grey cast iron                                                   | -                                                 | < 280                             | -                                                             | -   | -   |
|                                  | Sphäroguß / Ductile cast iron                                              | -                                                 | < 320                             | -                                                             | -   | -   |
| N                                | Nichteisenmetalle / Non-ferrous alloys                                     | < 250                                             | < 110                             | 250                                                           | 450 | 600 |
|                                  | Aluminiumlegierungen / Aluminium alloys                                    | < 530                                             | < 130                             | 150                                                           | 240 | 360 |
| S                                | Warmfeste Leg. Fe, Ni und Co / High temperature alloys Fe, Ni and Co based | < 3300                                            | < 350                             | -                                                             | -   | -   |
| H                                | Titan Legierungen Alpha und Beta / Titanium alloys; Alpha and Beta         | < 2100                                            | < 400                             | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | < 54 HRC                          | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | 52-60 HRC                         | -                                                             | -   | -   |
|                                  | Gehärtete Stähle / Hardened steel                                          | -                                                 | > 58 HRC                          | -                                                             | -   | -   |



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