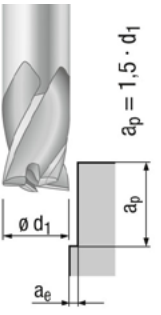
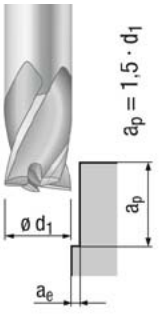
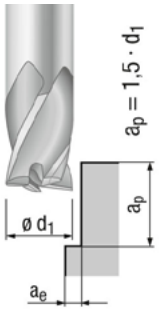
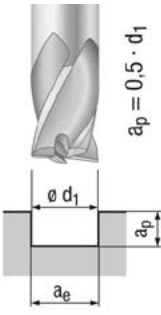
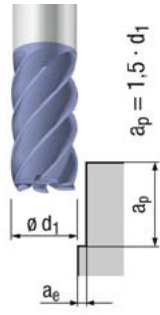


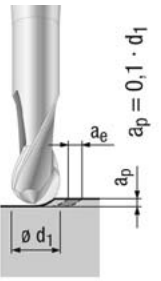
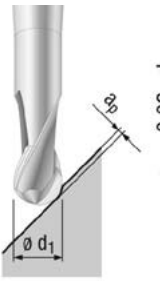
**Richtwerte für die Schnittgeschwindigkeit  $v_c$  in m/min**

**Hinweis:** Bei unbeschichteten Fräsern ist im Regelfall das Gleichlaufräsen dem Gegenlaufräsen vorzuziehen.  
Bei beschichteten Fräsern ist das Gleichlaufräsen erforderlich, um optimale Leistungen zu erreichen.

| Einsatzgebiete – Materialgruppen siehe Seite 40 |                              |                                                                     |                                      |                                                                                                                   | Korrektur-Faktor | Schnittgeschwindigkeit $v_c$ in m/min |       |     |
|-------------------------------------------------|------------------------------|---------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------|---------------------------------------|-------|-----|
|                                                 |                              |                                                                     |                                      |                                                                                                                   | (x fz)           | unbeschichtet                         | TIALN | CRN |
| <b>1</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 1.1                                             | ≤ 400 N/mm <sup>2</sup>      | Q-St37-3<br>R-Fe80                                                  | 1.0123<br>1.1014                     |                                                                                                                   | 1,2              | 180                                   | 220   |     |
| 1.2                                             | ≤ 600 N/mm <sup>2</sup>      | 9SMnPb28<br>St37-2                                                  | 1.0718<br>1.0037                     | 500-700 N/mm <sup>2</sup><br>340-470 N/mm <sup>2</sup>                                                            | 1,2              | 140                                   | 180   |     |
| 1.3                                             | ≤ 850 N/mm <sup>2</sup>      | St70-2<br>GS-25CrMo4                                                | 1.0070<br>1.7218                     | 700-900 N/mm <sup>2</sup><br>650-950 N/mm <sup>2</sup>                                                            | 1,1              | 110                                   | 170   |     |
| 1.4                                             | ≤ 1100 N/mm <sup>2</sup>     | 16MnCr5<br>Ck45<br>100Cr6                                           | 1.7131<br>1.1191<br>1.3505           | 500-700 N/mm <sup>2</sup><br>600-800 N/mm <sup>2</sup><br>700-900 N/mm <sup>2</sup>                               | 1,0              | 100                                   | 130   |     |
| 1.5                                             | ≤ 1400 N/mm <sup>2</sup>     | 42CrMo4V<br>X30WCrV5-3<br>X38CrMoV5-3<br>X155CrVMo12-1              | 1.7225<br>1.2567<br>1.2367<br>1.2379 | 1200-1400 N/mm <sup>2</sup><br>1100 N/mm <sup>2</sup><br>900-1100 N/mm <sup>2</sup><br>900-1100 N/mm <sup>2</sup> | 0,8              | 80                                    | 110   |     |
| 1.6                                             |                              | 55NiCrMoV6                                                          | 1.2713                               | 47-52 HRC                                                                                                         | 0,7              |                                       | 100   |     |
| 1.7                                             |                              | 45WCrV7                                                             | 1.2542                               | 56-57 HRC                                                                                                         | 1,1              |                                       | 90    |     |
| 1.8                                             |                              | X155CrVMo12-1                                                       | 1.2379                               | 60-63 HRC                                                                                                         | 1,0              |                                       | 80    |     |
| 1.9                                             |                              | X210CrW12                                                           | 1.2436                               | 63-64 HRC                                                                                                         | 0,9              |                                       | 70    |     |
| 1.10                                            | ≤ 850 N/mm <sup>2</sup>      | X10NiCrAlTi32-20 [INCOLOY800]<br>X12CrNiTi18-9<br>X6CrNiMoTi17-12-2 | 1.4876<br>1.4878<br>1.4571           | 610-850 N/mm <sup>2</sup><br>500-700 N/mm <sup>2</sup><br>500-730 N/mm <sup>2</sup>                               | 1,0              |                                       | 90    |     |
| 1.11                                            | ≤ 1100 N/mm <sup>2</sup>     | X45SiCr4                                                            | 1.4704                               | 900-1100 N/mm <sup>2</sup>                                                                                        | 0,9              |                                       | 70    |     |
| 1.12                                            | ≤ 1400 N/mm <sup>2</sup>     | X5NiCrTi26-15                                                       | 1.4980                               | 1200 N/mm <sup>2</sup>                                                                                            | 0,7              |                                       | 50    |     |
| 1.13                                            | ≤ 1400 N/mm <sup>2</sup>     | FerroTiC<br>Hardox500                                               |                                      | 800-900 N/mm <sup>2</sup><br>1300-1400 N/mm <sup>2</sup>                                                          | 0,7              |                                       | 40    |     |
| <b>2</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 2.1                                             |                              | GG 20<br>GG 30                                                      | 0.6020<br>0.6030                     | 120-220 HB<br>220-270 HB                                                                                          | 1,1              | 120                                   | 150   |     |
| 2.2                                             |                              | GGG 40<br>GGG 70                                                    | 0.7040<br>0.7070                     | 400 N/mm <sup>2</sup><br>700-1050 N/mm <sup>2</sup>                                                               | 1,1              | 110                                   | 140   |     |
| 2.3                                             |                              | GGV (80% Perlit)<br>GGV (100% Perlit)                               |                                      | 220 HB<br>230 HB                                                                                                  | 1,0              | 80                                    | 110   |     |
| 2.4                                             |                              | GTW 40<br>GTS 65                                                    | 0.8040<br>0.8165                     | 360-420 N/mm <sup>2</sup><br>580-650 N/mm <sup>2</sup>                                                            | 1,1              | 120                                   | 165   |     |
| 2.5                                             |                              |                                                                     |                                      | -400 HB                                                                                                           | 0,8              |                                       | 75    |     |
| <b>3</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 3.1                                             | ≤ 500 N/mm <sup>2</sup>      | E-Cu                                                                | 2.0060                               | 250-350 N/mm <sup>2</sup>                                                                                         | 1,2              | 200                                   | 230   | 190 |
| 3.2                                             |                              | CuZn40 [Ms60]<br>CuZn37 [Ms63]                                      | 2.0360<br>2.0321                     | 340-490 N/mm <sup>2</sup><br>310-550 N/mm <sup>2</sup>                                                            | 1,1              | 210                                   | 260   | 260 |
| 3.3                                             |                              | CuZn39Pb2 [Ms58]                                                    | 2.0380                               | 380-500 N/mm <sup>2</sup>                                                                                         | 1,1              | 190                                   | 250   | 240 |
| 3.4                                             |                              | CuAl10Ni                                                            | 2.0966                               | 500-800 N/mm <sup>2</sup>                                                                                         | 1,2              | 160                                   | 220   | 220 |
| 3.5                                             |                              | GCuSn5ZnPb [Rg5]<br>GCuSn7ZnPb [Rg7]                                | 2.1096<br>2.1090                     | 150-300 N/mm <sup>2</sup><br>150-300 N/mm <sup>2</sup>                                                            | 1,2              | 230                                   | 300   | 300 |
| 3.6                                             |                              | Ampco16                                                             |                                      | 630 N/mm <sup>2</sup>                                                                                             | 1,0              |                                       | 70    |     |
| 3.7                                             |                              | Ampco20                                                             |                                      | 600 N/mm <sup>2</sup>                                                                                             | 0,7              |                                       | 20    |     |
| <b>4</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 4.1                                             | ≤ 850 N/mm <sup>2</sup>      | NiCu30Fe [MONEL400]                                                 | 2.4360                               | 420-610 N/mm <sup>2</sup>                                                                                         | 1,1              |                                       | 70    |     |
| 4.2                                             | 850 - 1400 N/mm <sup>2</sup> | NiCr19NbMo [INCONEL718]                                             | 2.4668                               | 850-1190 N/mm <sup>2</sup>                                                                                        | 1,0              |                                       | 50    |     |
| 4.3                                             | > 1400 N/mm <sup>2</sup>     | Haynes 25 (L605)                                                    |                                      | 1550-2000 N/mm <sup>2</sup>                                                                                       | 0,7              |                                       | 40    |     |
| <b>5</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 5.1                                             |                              | Al 99,5 [F13]<br>AlCuMg1 [F39]                                      | 3.0255<br>3.1325                     | 100-250 N/mm <sup>2</sup><br>300-500 N/mm <sup>2</sup>                                                            | 1,9              | 350                                   | 650   | 500 |
| 5.2                                             |                              | G-AlMg3                                                             | 3.3541                               | 130-190 N/mm <sup>2</sup>                                                                                         | 1,8              | 200                                   | 550   | 220 |
| 5.3                                             |                              | GD-AlSi9Cu3<br>GD-AlSi12                                            | 3.2163<br>3.2582                     | 240-310 N/mm <sup>2</sup><br>220-300 N/mm <sup>2</sup>                                                            | 1,6              |                                       | 300   | 220 |
| 5.4                                             |                              | G-AlSi17Cu4                                                         |                                      | 180-250 N/mm <sup>2</sup>                                                                                         | 1,5              |                                       | 180   |     |
| <b>6</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 6.1                                             |                              | MgAl6                                                               | 3.5662                               | 300-500 N/mm <sup>2</sup>                                                                                         | 1,8              | 200                                   | 250   | 250 |
| 6.2                                             |                              | GMgAl9Zn1                                                           | 3.5912                               | 300-500 N/mm <sup>2</sup>                                                                                         | 1,9              | 200                                   | 250   | 200 |
| <b>7</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 7.1                                             | ≤ 900 N/mm <sup>2</sup>      | Ti3 [Ti99.4]<br>TiAl6V4                                             | 3.7055<br>3.7164                     | 700 N/mm <sup>2</sup><br>700-900 N/mm <sup>2</sup>                                                                | 1,0              | 90                                    | 110   | 140 |
| 7.2                                             | 900 - 1250 N/mm <sup>2</sup> | TiAl4Mo4Sn2                                                         | 3.7185                               | 900-1250 N/mm <sup>2</sup>                                                                                        | 0,9              |                                       | 70    |     |
| <b>8</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 8.1                                             |                              | BAKELIT                                                             |                                      | 110 N/mm <sup>2</sup>                                                                                             | 2,0              | 150                                   | 150   | 350 |
| 8.2                                             |                              | HOSTALEN                                                            |                                      | 80 N/mm <sup>2</sup>                                                                                              | 2,0              | 200                                   | 300   | 220 |
| 8.3                                             |                              | CFK / GFK / AFK                                                     |                                      | 800-1500 N/mm <sup>2</sup>                                                                                        | 1,0              | 90                                    | 120   | 120 |
| <b>9</b>                                        |                              |                                                                     |                                      |                                                                                                                   |                  |                                       |       |     |
| 9.1                                             |                              | C-8000                                                              |                                      | 60 N/mm <sup>2</sup>                                                                                              | 1,0              |                                       | 220   |     |
| 9.2                                             |                              | W-Cu 80/20                                                          |                                      | 230-250 HV                                                                                                        | 1,1              | 80                                    | 110   |     |

**Richtwerte für den Vorschub pro Zahn  $f_z$  in mm**

| (Werte sind nicht für Hartfräsen geeignet!) |                                                                                   |             |                                                                                   |             |                                                                                   |             |                                                                                     |             |                                                                                     | Hartfräsen |
|---------------------------------------------|-----------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|------------|
|                                             |  |             |  |             |  |             |  |             |  |            |
|                                             | $a_e = 0,2 - 0,3 \text{ mm}$                                                      |             | $a_e = 0,1 \cdot d_1$                                                             |             | $a_e = 0,25 \cdot d_1$                                                            |             | $a_e = d_1$                                                                         |             | $a_e = 0,02 \cdot d_1$                                                              |            |
| $\emptyset d_1$                             | unbeschichtet                                                                     | beschichtet | unbeschichtet                                                                     | beschichtet | unbeschichtet                                                                     | beschichtet | unbeschichtet                                                                       | beschichtet | beschichtet                                                                         |            |
| 2                                           | 0,006                                                                             | 0,008       | 0,006                                                                             | 0,008       | 0,004                                                                             | 0,005       | 0,003                                                                               | 0,004       |                                                                                     |            |
| 3                                           | 0,010                                                                             | 0,012       | 0,010                                                                             | 0,012       | 0,007                                                                             | 0,008       | 0,005                                                                               | 0,007       |                                                                                     |            |
| 4                                           | 0,013                                                                             | 0,016       | 0,011                                                                             | 0,014       | 0,009                                                                             | 0,010       | 0,007                                                                               | 0,009       |                                                                                     |            |
| 5                                           | 0,017                                                                             | 0,020       | 0,013                                                                             | 0,017       | 0,011                                                                             | 0,013       | 0,008                                                                               | 0,011       | 0,013                                                                               |            |
| 6                                           | 0,020                                                                             | 0,024       | 0,015                                                                             | 0,020       | 0,013                                                                             | 0,015       | 0,010                                                                               | 0,013       | 0,015                                                                               |            |
| 8                                           | 0,027                                                                             | 0,032       | 0,020                                                                             | 0,027       | 0,018                                                                             | 0,020       | 0,013                                                                               | 0,018       | 0,020                                                                               |            |
| 10                                          | 0,033                                                                             | 0,040       | 0,025                                                                             | 0,033       | 0,022                                                                             | 0,025       | 0,017                                                                               | 0,022       | 0,025                                                                               |            |
| 12                                          | 0,040                                                                             | 0,048       | 0,030                                                                             | 0,040       | 0,027                                                                             | 0,030       | 0,020                                                                               | 0,027       | 0,030                                                                               |            |
| 14                                          | 0,047                                                                             | 0,056       | 0,035                                                                             | 0,047       | 0,031                                                                             | 0,035       | 0,023                                                                               | 0,031       | 0,035                                                                               |            |
| 16                                          | 0,053                                                                             | 0,064       | 0,040                                                                             | 0,053       | 0,036                                                                             | 0,040       | 0,027                                                                               | 0,036       | 0,040                                                                               |            |
| 18                                          | 0,060                                                                             | 0,072       | 0,045                                                                             | 0,060       | 0,040                                                                             | 0,045       | 0,030                                                                               | 0,040       | 0,045                                                                               |            |
| 20                                          | 0,067                                                                             | 0,080       | 0,050                                                                             | 0,067       | 0,044                                                                             | 0,050       | 0,033                                                                               | 0,044       | 0,050                                                                               |            |

| (Werte sind nicht für Hartfräsen geeignet!) |                                                                                     |                                                                                     |
|---------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                             | Schruppen                                                                           | Schlichten                                                                          |
|                                             |  |  |
|                                             | $a_e = 0,2 \cdot d_1$                                                               |                                                                                     |
| $\emptyset d_1$                             | beschichtet                                                                         | beschichtet                                                                         |
| 3                                           | 0,030                                                                               | 0,020                                                                               |
| 4                                           | 0,040                                                                               | 0,030                                                                               |
| 5                                           | 0,060                                                                               | 0,050                                                                               |
| 6                                           | 0,070                                                                               | 0,060                                                                               |
| 8                                           | 0,100                                                                               | 0,080                                                                               |
| 10                                          | 0,120                                                                               | 0,100                                                                               |
| 12                                          | 0,150                                                                               | 0,120                                                                               |
| 16                                          | 0,180                                                                               | 0,150                                                                               |
| 18                                          | 0,200                                                                               | 0,180                                                                               |
| 20                                          | 0,220                                                                               | 0,200                                                                               |

Bitte beachten Sie, dass der Wert  $f_z$  aus obenstehender Tabelle mit dem entsprechenden Korrektur-Faktor multipliziert werden muss. Die Korrektur-Faktoren finden Sie in der Tabelle auf Seite 32.

Generell gilt:

$$f_{z \text{ Fräsen}} = f_{z \text{ Tabelle}} \times \text{Korrektur-Faktor}$$

$$f_{z \text{ Bohren}} = \frac{f_{z \text{ Fräsen}}}{\text{Zähnezahl}}$$

$f_z$  -Werte für Werkzeuge  $d_1 < 2 \text{ mm}$  auf Anfrage