

# Karnasch<sup>TM</sup>

PROFESSIONAL TOOLS

GERMANY

CNC TOOLS DIVISION

HAUPTKATALOG · MAIN CATALOGUE

POWER.

PRECISION.

PERFORMANCE.

2014 / 2015

GK27

PROFESSIONAL TOOLS





PRODUKTÜBERSICHT · PRODUCT OVERVIEW  
RESUMEN DE PRODUCTOS · ОБЗОР ПРОДУКТА

VOLLHARTMETALL SCHAFTFRÄSER / MICROFRÄSER DIAMANT-PCD-CBN-CERMET  
SOLID CARBIDE END MILLS / MICRO END MILLS DIAMOND-PCD-CBN-CERMET  
FRESAS DE MANGO / MICROFRESAS DE METAL DURO-DIAMANTE-PCD-CERMET  
ТВЕРДОСПЛАВНАЯ КОНЦЕВАЯ МИКРО-ФРЕЗА/-С АЛМАЗОМ/ ИЗ ПКД / ИЗ ЦБН ЦВЕТ  
СЕЙЧАС ОНЛАЙН ДЛЯ ВАС



VOLLHARTMETALL HOCHLEISTUNGSBOHRER / MICROBOHRER  
SOLID CARBIDE HIGH PERFORMANCE TWIST DRILL / MICRO TWIST DRILL  
MICROBROCAS DE ALTO RENDIMIENTO DE METAL DURO  
ТВЕРДОСПЛАВНОЕ ВЫСОКОПРОИЗВОДИТЕЛЬНОЕ МИКРО-СВЕРЛО СЕЙЧАС  
ОНЛАЙН ДЛЯ ВАС



VHM-GEWINDEWIRBLER / GEWINDEFÄSER  
SOLID CARBIDE WHIRLING THREAD CUTTERS / THREAD MILLS  
FRESA GIRATORIA METAL DURO / FRESA DE ROSCA  
ТВЕРДОСПЛАВНЫЙ НИТЕОБРЕЗАТЕЛЬ/ РЕЗЬБОВАЯ ФРЕЗА СЕЙЧАС ОНЛАЙН  
ДЛЯ ВАС



VOLLHARTMETALL REIBAHLEN / MICROREIBAHLEN  
SOLID CARBIDE REAMERS / MICRO REAMERS  
ESCARIADORES / MICROESCARIADORES DE METAL DURO  
ТВЕРДОСПЛАВНАЯ РАЗВЕРТКА/МИКРО –РАЗВЕРТКА СЕЙЧАС ОНЛАЙН ДЛЯ ВАС



WERKZEUGE FÜR COMPOSITES – CFK / GFK – TITAN – KUNSTSTOFF  
TOOLS FOR COMPOSITES – CFRP / GFRP – TITANIUM – PLASTICS  
HERRAMIENTAS PARA COMPUESTOS – CFRP / GFRP – TITANIO – PLÁSTICO  
ИНСТРУМЕНТЫ ДЛЯ КОМПОЗИТОВ – ЦФК/ГФК– ТИТАН – ПЛАСТМАССА СЕЙЧАС  
ОНЛАЙН ДЛЯ ВАС



SCHNITTDATEN / TECHNISCHE INFORMATIONEN  
CUTTING DATA / TECHNICAL INFORMATION  
DATOS DE CORTE / DATOS TÉCNICOS  
ПАРАМЕТРЫ ДЛЯ РЕЗЬБЫ/ТЕХНИЧЕСКАЯ ИНФОРМАЦИЯ СЕЙЧАС ОНЛАЙН ДЛЯ ВАС





VOLLHARTMETALL SCHAFTFRÄSER / MICROFRÄSER DIAMANT-PKD-CBN-CERMET  
SOLID CARBIDE END MILLS / MICRO END MILLS DIAMOND-PCD-CBN-CERMET  
FRESAS DE MANGO / MICROFRESAS DE METAL DURO-DIAMANTE-PCD-CERMET  
ТВЕРДОСПЛВАННАЯ КОНЦЕВАЯ МИКРО-ФРЕЗА/-С АЛМАЗОМ/ ИЗ ПКД / ИЗ ЦБН ЦВЕТ  
СЕЙЧАС ОНЛАЙН ДЛЯ ВАС



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**KARNASCH PROFESSIONAL TOOLS<sup>TM</sup>**  
**CNC TOOLS DIVISION**

Siemensstraße 1  
D-68542 Heddesheim  
info@karnasch.de

**+49 (0) 6203 - 40390**

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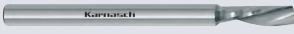
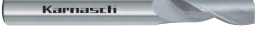
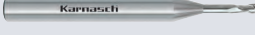
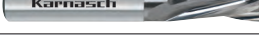
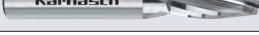
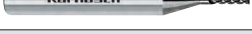
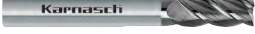
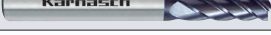
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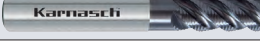
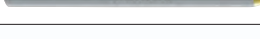
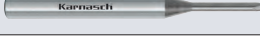
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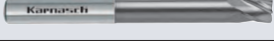
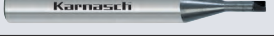
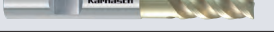
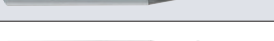
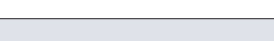
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| Art.                                                                                         | Schaftfräser · End mills                                                            | Material       |       | HSC<br>highspeed<br>cutting | HHC<br>high-hard-<br>cutting | HPC | STAHL<br>steel | INOX<br>stainless<br>steel | GG/G<br>cast iron | NE<br>non-ferrous | GRAPHIT<br>graphite | KUNSTSTOFF<br>plastic | HOLZ<br>wood | INCONEL<br>HASTELLOY<br>TITAN | MIT INNEN-<br>KÜHLUNG<br>with interior<br>cooling | Cemented<br>Carbide |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|-------|-----------------------------|------------------------------|-----|----------------|----------------------------|-------------------|-------------------|---------------------|-----------------------|--------------|-------------------------------|---------------------------------------------------|---------------------|
| Zylindrisch / cylindrical    Z = 1 Einzahnfräser / teeth = 1 one tooth end mill              |                                                                                     |                |       |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 29.1652                                                                                      |    | MICRO<br>GRAIN | 104   | ✓                           |                              |     |                |                            |                   |                   |                     | ✓                     |              |                               |                                                   |                     |
| 29.1654                                                                                      |    | MICRO<br>GRAIN | 105   | ✓                           |                              |     |                |                            |                   |                   |                     | ✓                     |              |                               |                                                   |                     |
| 29.1658                                                                                      |    | MICRO<br>GRAIN | 107   | ✓                           |                              |     |                |                            |                   |                   |                     | ✓                     |              |                               |                                                   |                     |
| 29.1661                                                                                      |    | MICRO<br>GRAIN | 106   | ✓                           |                              |     |                |                            |                   |                   |                     | ✓                     |              |                               |                                                   |                     |
| 30.7320                                                                                      |    | MICRO<br>GRAIN | 10    | ✓                           |                              |     |                |                            |                   | ✓                 |                     |                       |              |                               |                                                   |                     |
| Zylindrisch / cylindrical    Z = 2 Schaftfräser / teeth = 2 end mills                        |                                                                                     |                |       |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6202                                                                                      |    | MICRO<br>GRAIN | 12-13 | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6209                                                                                      |    | MICRO<br>GRAIN | 19    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6255                                                                                      |    | MICRO<br>GRAIN | 30-31 | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| Zylindrisch / cylindrical    Z = 3 Schaftfräser / teeth = 3 end mills    (Z = 2/3 – t = 2/3) |                                                                                     |                |       |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6223                                                                                      |    | MICRO<br>GRAIN | 26    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6228                                                                                      |    | MICRO<br>GRAIN | 25    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6233                                                                                      |  | MICRO<br>GRAIN | 29    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     | ✓            |                               |                                                   |                     |
| 30.6234                                                                                      |  | MICRO<br>GRAIN | 29    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     | ✓            |                               |                                                   |                     |
| 30.6284                                                                                      |  | MICRO<br>GRAIN | 52    | ✓                           |                              |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6296                                                                                      |  | MICRO<br>GRAIN | 53    | ✓                           |                              |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6331                                                                                      |  | MICRO<br>GRAIN | 53    | ✓                           |                              | ✓   | ✓              | ✓                          | ✓                 | ✓                 |                     |                       |              |                               |                                                   |                     |
| 30.6332                                                                                      |  | MICRO<br>GRAIN | 54    | ✓                           |                              | ✓   | ✓              | ✓                          | ✓                 | ✓                 |                     |                       |              |                               |                                                   |                     |
| 30.6572                                                                                      |  | MICRO<br>GRAIN | 96    |                             | ✓                            |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.7415                                                                                      |  | MICRO<br>GRAIN | 108   |                             | ✓                            |     | ✓              |                            |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| Z = 4-16 Schaftfräser Zylindrisch / teeth = 4-16 end mills cylindrical                       |                                                                                     |                |       |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6224                                                                                      |  | MICRO<br>GRAIN | 27    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 29.0305                                                                                      |  | MICRO<br>GRAIN | 96    | ✓                           |                              | ✓   |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6341                                                                                      |  | MICRO<br>GRAIN | 54    | ✓                           |                              | ✓   | ✓              | ✓                          | ✓                 | ✓                 |                     |                       |              |                               |                                                   |                     |
| 30.6342                                                                                      |  | MICRO<br>GRAIN | 55    | ✓                           |                              | ✓   | ✓              | ✓                          | ✓                 | ✓                 |                     |                       |              |                               |                                                   |                     |
| 30.6446                                                                                      |  | MICRO<br>GRAIN | 64    | ✓                           |                              |     | ✓              | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6447                                                                                      |  | MICRO<br>GRAIN | 64    | ✓                           |                              |     | ✓              | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6456                                                                                      |  | MICRO<br>GRAIN | 65    | ✓                           | ✓                            |     | ✓              |                            | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| Z = 2/3/4 Schruppfräser / teeth = 2/3/4 roughing end mills                                   |                                                                                     |                |       |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6222                                                                                      |  | MICRO<br>GRAIN | 26    | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |

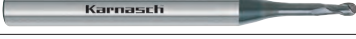
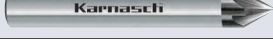
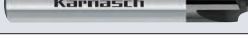
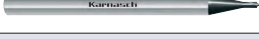
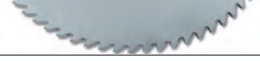


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|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|-------|---|------------------------------|-----------------------------|-----|----------------|----------------------------|-------------------|-------------------|---------------------|-----------------------|--------------|-------------------------------|---------------------------------------------------|---------------------|
| Art.                                                                           | Schaftfräser · End mills                                                            | Material       |       |   |                              |                             |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| Z = 2/3/4 Schruppfräser / teeth = 2/3/4 roughing end mills                     |                                                                                     |                |       |   |                              |                             |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6232                                                                        |    | MICRO<br>GRAIN | 27    | ✓ |                              |                             |     |                |                            |                   | ✓                 |                     | ✓                     | ✓            |                               |                                                   |                     |
| 30.6349                                                                        |    | MICRO<br>GRAIN | 55    |   |                              |                             | ✓   | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6353                                                                        |    | MICRO<br>GRAIN | 56    | ✓ |                              |                             | ✓   | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6355                                                                        |    | MICRO<br>GRAIN | 56    | ✓ |                              |                             | ✓   | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6356                                                                        |    | MICRO<br>GRAIN | 57    | ✓ |                              |                             |     | ✓              | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6358                                                                        |    | MICRO<br>GRAIN | 57    |   | ✓                            | ✓                           | ✓   | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             | ✓                                                 |                     |
| 30.6591                                                                        |    | MICRO<br>GRAIN | 98    | ✓ |                              |                             |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6593                                                                        |    | MICRO<br>GRAIN | 99    | ✓ |                              |                             |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.7431                                                                        |    | MICRO<br>GRAIN | 110   |   |                              |                             | ✓   |                | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.7432                                                                        |    | MICRO<br>GRAIN | 110   |   |                              |                             | ✓   |                | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 31.6840                                                                        |    | MICRO<br>GRAIN | 111   | ✓ |                              |                             |     |                | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 31.6868                                                                        |   | MICRO<br>GRAIN | 111   | ✓ |                              |                             |     |                | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| Z = 2-6 Schaftfräser mit Eckenradius/ teeth = 2-6 end mills with corner radius |                                                                                     |                |       |   |                              |                             |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6203                                                                        |  | MICRO<br>GRAIN | 14-15 | ✓ |                              |                             |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6212                                                                        |  | MICRO<br>GRAIN | 20-21 | ✓ |                              |                             |     |                |                            |                   | ✓                 |                     |                       |              |                               |                                                   |                     |
| 30.6215                                                                        |  | MICRO<br>GRAIN | 24    | ✓ |                              |                             |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6256                                                                        |  | MICRO<br>GRAIN | 32-33 | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6261                                                                        |  | MICRO<br>GRAIN | 36-37 | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6271                                                                        |  | MICRO<br>GRAIN | 47    | ✓ | ✓                            |                             |     |                |                            |                   |                   |                     |                       |              |                               |                                                   | ✓                   |
| 30.6262                                                                        |  | MICRO<br>GRAIN | 38    | ✓ | ✓                            |                             |     | ✓              |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6265                                                                        |  | MICRO<br>GRAIN | 42-43 | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6267                                                                        |  | MICRO<br>GRAIN | 50    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6425                                                                        |  | MICRO<br>GRAIN | 58    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6432                                                                        |  | MICRO<br>GRAIN | 59    | ✓ |                              |                             | ✓   | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6433                                                                        |  | MICRO<br>GRAIN | 60    |   | ✓                            | ✓                           | ✓   | ✓              | ✓                          |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6434                                                                        |  | MICRO<br>GRAIN | 61    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6435                                                                        |  | MICRO<br>GRAIN | 61    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6436                                                                        |  | MICRO<br>GRAIN | 62    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6437                                                                        |  | MICRO<br>GRAIN | 62    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6439                                                                        |  | MICRO<br>GRAIN | 63    | ✓ | ✓                            |                             |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |

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|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------|---------|-----------------------------|------------------------------|-----|----------------|----------------------------|-------------------|-------------------|---------------------|-----------------------|--------------|-------------------------------|---------------------------------------------------|---------------------|
| Z = 2-6 Schaftfräser mit Eckenradius/ teeth = 2-6 end mills with corner radius |                                                                                     |                    |         |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.6544                                                                        |    | MICRO GRAIN        | 80-81   | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6545                                                                        |    | MICRO GRAIN        | 82-83   | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6546                                                                        |    | MICRO GRAIN        | 84-85   | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6560                                                                        |    | MICRO GRAIN        | 94      | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6573                                                                        |    | MICRO GRAIN        | 97      | ✓                           |                              | ✓   |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6632                                                                        |    | CBN<br>MICRO GRAIN | 100-101 | ✓                           | ✓                            | ✓   | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.7421                                                                        |    | MICRO GRAIN        | 108     |                             |                              | ✓   | ✓              | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.7425                                                                        |    | MICRO GRAIN        | 109     | ✓                           |                              | ✓   |                | ✓                          |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.7428                                                                        |    | MICRO GRAIN        | 109     | ✓                           |                              | ✓   |                |                            |                   |                   |                     |                       |              | ✓                             |                                                   |                     |
| Z = 2 Radiusfräser / teeth = 2 ball nose end mills                             |                                                                                     |                    |         |                             |                              |     |                |                            |                   |                   |                     |                       |              |                               |                                                   |                     |
| 30.5955                                                                        |    | MICRO GRAIN        | 66      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             | ✓                                                 |                     |
| 30.5958                                                                        |    | MICRO GRAIN        | 66      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             | ✓                                                 |                     |
| 30.6204                                                                        |  | MICRO GRAIN        | 16-17   | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              | ✓                             |                                                   |                     |
| 30.6213                                                                        |  | MICRO GRAIN        | 22-23   | ✓                           |                              |     |                |                            |                   | ✓                 |                     |                       |              |                               |                                                   |                     |
| 30.6217                                                                        |  | MICRO GRAIN        | 24      | ✓                           |                              |     |                |                            |                   | ✓                 |                     | ✓                     |              |                               |                                                   |                     |
| 30.6257                                                                        |  | MICRO GRAIN        | 34-35   | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6264                                                                        |  | MICRO GRAIN        | 40-41   | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6266                                                                        |  | MICRO GRAIN        | 44-45   | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6274                                                                        |  | MICRO GRAIN        | 48-49   | ✓                           | ✓                            |     |                |                            |                   |                   |                     |                       |              |                               |                                                   | ✓                   |
| 30.6286                                                                        |  | MICRO GRAIN        | 52      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              | ✓                             |                                                   |                     |
| 30.6474                                                                        |  | MICRO GRAIN        | 67      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6475                                                                        |  | MICRO GRAIN        | 67      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6476                                                                        |  | MICRO GRAIN        | 68      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6477                                                                        |  | MICRO GRAIN        | 68      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6478                                                                        |  | MICRO GRAIN        | 69      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6479                                                                        |  | MICRO GRAIN        | 69      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6485                                                                        |  | MICRO GRAIN        | 70      | ✓                           | ✓                            |     | ✓              | ✓                          | ✓                 |                   |                     |                       |              |                               |                                                   |                     |
| 30.6551                                                                        |  | MICRO GRAIN        | 86-87   | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6552                                                                        |  | MICRO GRAIN        | 88      | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |
| 30.6553                                                                        |  | MICRO GRAIN        | 90-91   | ✓                           |                              |     |                |                            |                   |                   | ✓                   |                       |              |                               |                                                   |                     |

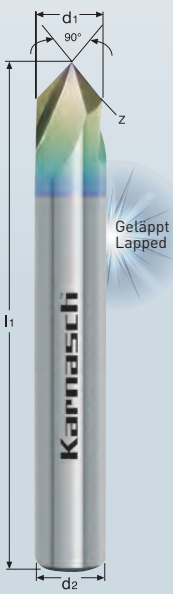


| INHALTSVERZEICHNIS · TABLE OF CONTENTS                                                                             |                                                                                     |             |         |  | HSC                | HHC               | HPC | STAHL | INOX            | GG/G      | NE          | GRAPHIT  | KUNSTSTOFF | HOLZ | INCONEL         | MIT INNEN-            | Cemented |
|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|---------|--|--------------------|-------------------|-----|-------|-----------------|-----------|-------------|----------|------------|------|-----------------|-----------------------|----------|
| Art.                                                                                                               | Schaftfräser · End mills                                                            | Material    |         |  | high-speed cutting | high-hard cutting |     | steel | stainless steel | cast iron | non-ferrous | graphite | plastic    | wood | HASTELLOY TITAN | COOLING with interior | Carbide  |
| 30.6592                                                                                                            |    | MICRO GRAIN | 98      |  | ✓                  |                   |     |       |                 |           |             | ✓        |            |      |                 |                       |          |
| 30.6633                                                                                                            |    | CBN         | 102-103 |  | ✓                  | ✓                 | ✓   | ✓     | ✓               | ✓         |             |          |            |      |                 |                       |          |
| 30.6554                                                                                                            |    | MICRO GRAIN | 92-93   |  | ✓                  |                   |     |       |                 |           |             | ✓        |            |      |                 |                       |          |
| Z = 3-4 Radiusfräser / teeth = 4 ball nose end mills                                                               |                                                                                     |             |         |  |                    |                   |     |       |                 |           |             |          |            |      |                 |                       |          |
| 30.7485                                                                                                            |    | MICRO GRAIN | 112     |  | ✓                  |                   | ✓   |       |                 |           |             |          |            |      | ✓               |                       |          |
| 30.6486                                                                                                            |    | MICRO GRAIN | 71      |  | ✓                  | ✓                 | ✓   | ✓     |                 | ✓         |             |          |            |      |                 |                       |          |
| 30.7486                                                                                                            |    | MICRO GRAIN | 112     |  | ✓                  |                   | ✓   |       | ✓               |           |             |          |            |      | ✓               |                       |          |
| 30.7487                                                                                                            |    | MICRO GRAIN | 113     |  | ✓                  |                   | ✓   |       | ✓               |           |             |          |            |      |                 |                       |          |
| 30.6574                                                                                                            |    | MICRO GRAIN | 97      |  | ✓                  |                   | ✓   |       |                 |           |             | ✓        |            |      |                 |                       |          |
| Z = 3-6/≈ Entgrad-Senk- und Sonderfräser / teeth = 3-6/≈ deburring- corner rounding- countersinker – special tools |                                                                                     |             |         |  |                    |                   |     |       |                 |           |             |          |            |      |                 |                       |          |
| 30.6200                                                                                                            |    | MICRO GRAIN | 9       |  | ✓                  |                   | ✓   |       |                 |           | ✓           |          | ✓          |      |                 |                       |          |
| 30.6490                                                                                                            |    | MICRO GRAIN | 72      |  | ✓                  |                   |     | ✓     | ✓               | ✓         |             |          |            |      |                 |                       |          |
| 30.6491                                                                                                            |    | MICRO GRAIN | 72      |  | ✓                  |                   |     | ✓     | ✓               | ✓         |             |          |            |      |                 |                       |          |
| 30.6492                                                                                                            |   | MICRO GRAIN | 73      |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           |          |            |      | ✓               |                       |          |
| 30.6493                                                                                                            |  | MICRO GRAIN | 73      |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           |          |            |      | ✓               |                       |          |
| 30.6494                                                                                                            |  | MICRO GRAIN | 74      |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           |          |            |      | ✓               |                       |          |
| 30.6495                                                                                                            |  | MICRO GRAIN | 74      |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           |          |            |      | ✓               |                       |          |
| 30.6497                                                                                                            |  | MICRO GRAIN | 75      |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           |          |            |      | ✓               |                       |          |
| 30.6539                                                                                                            |  | MICRO GRAIN | 77      |  | ✓                  |                   |     |       |                 |           |             | ✓        |            |      | ✓               |                       |          |
| 30.6540                                                                                                            |  | MICRO GRAIN | 77      |  | ✓                  |                   |     |       |                 |           |             | ✓        |            |      |                 |                       |          |
| Vollhartmetalkreissägeblätter / slitting saws solid carbide                                                        |                                                                                     |             |         |  |                    |                   |     |       |                 |           |             |          |            |      |                 |                       |          |
| 5.6000                                                                                                             |  | MICRO GRAIN | 114     |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           | ✓        | ✓          |      | ✓               |                       |          |
| 5.6001                                                                                                             |  | MICRO GRAIN | 114     |  | ✓                  | ✓                 |     | ✓     | ✓               | ✓         | ✓           | ✓        | ✓          |      | ✓               |                       |          |
| Kreissägeblätter Aufnahmehalter / Circular saws blades retainer                                                    |                                                                                     |             |         |  |                    |                   |     |       |                 |           |             |          |            |      |                 |                       |          |
| 5.6100                                                                                                             |  | HSS         | 116     |  |                    |                   |     |       |                 |           |             |          |            |      |                 |                       |          |
| 5.6101                                                                                                             |  | HSS         | 116     |  |                    |                   |     |       |                 |           |             |          |            |      |                 |                       |          |

VHM-Entgrater, lang, 90°, geläppte Schneiden

Art. **30.6200**

- ALU  
aluminium  
WEICH/SOFT
- KUPFER  
copper  
WEICH/SOFT
- Silver
- GOLD  
gold
- MESSING  
WEICH/SOFT
- Kunststoff  
plastic
- MAKROLON
- UREOL



- Solid carbide deburr, long, 90°, polished flutes
- Broca metal duro de avellanar, larga, 90°, cúchillos púlidos
- Твердосплавный инструмент для удаления грата, длинный, 90°, полированные резцы

**MICRO GRAIN**

**KARNASCH NORM**

**W**

**DIN 6535 Form HA**

**HSC ALU-NE**

**NHC 7000**

Schnittdaten  
Cutting data



i S. 285

| Art.        | d1 +0 /-0,005 | l1 | d2 h5 | Z | €      |
|-------------|---------------|----|-------|---|--------|
| 306200.0400 | • 4           | 54 | 4     | 3 | 34,00  |
| 306200.0600 | • 6           | 57 | 6     | 3 | 44,00  |
| 306200.0800 | • 8           | 63 | 8     | 3 | 51,00  |
| 306200.1000 | • 10          | 72 | 10    | 3 | 69,00  |
| 306200.1200 | • 12          | 83 | 12    | 3 | 107,00 |

# Präzisionswerkzeuge für höchste Herausforderungen.

Quality tools for highest challenges.

**Karnasch**™  
PROFESSIONAL TOOLS

Art. 30.7320 Vollhartmetall Einzahn-Schaftfräser, rechtsspirale, rechtsschneidend

- ALU  
aluminium
- KUPFER-  
weich  
COPPER-  
soft
- GOLD  
gold
- MESSING  
brass
- lang-  
spanend  
long chip



- Solid carbide one-tooth end mill, right spiral - right cutting
- Fresa MD a codolo ad un dente, elica destra - taglio destro
- Твердосплавная однозубая концевая фреза  
Правосторонняя спираль - правозаходная

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

30°

HSC  
High-Speed-  
Cutting

POLIERT  
POLISHED

Schnittdaten  
Cutting data

i S. 306

|     | Art.                  | d1 h10 | l2   | d2 | l3 | l1 | Z | €      |
|-----|-----------------------|--------|------|----|----|----|---|--------|
| NEU | 307320.0010.003.03    | • 0,1  | 0,3  | 3  | -  | 38 | 1 | 47,00  |
| NEU | 307320.0020.006.03    | • 0,2  | 0,6  | 3  | -  | 38 | 1 | 35,00  |
| NEU | 307320.0030.010.03    | • 0,3  | 1,0  | 3  | -  | 38 | 1 | 35,00  |
|     | 307320.0030.02        | • 0,3  | 2,0  | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0040.010.03    | • 0,4  | 1,0  | 3  | -  | 38 | 1 | 35,00  |
|     | 307320.0040.025       | • 0,4  | 2,5  | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0050.015.03    | • 0,5  | 1,5  | 3  | -  | 38 | 1 | 29,00  |
|     | 307320.0060.025       | • 0,6  | 2,5  | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0060.030.03    | • 0,6  | 3,0  | 3  | -  | 38 | 1 | 22,00  |
|     | 307320.0080.04.03     | • 0,8  | 4,0  | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0080.050.03    | • 0,8  | 5,0  | 3  | -  | 38 | 1 | 22,00  |
|     | 307320.0100.04        | • 1,0  | 4,0  | 3  | -  | 38 | 1 | 19,00  |
| NEU | 307320.0100.050.06    | • 1,0  | 5,0  | 6  | -  | 40 | 1 | 27,00  |
|     | 307320.0120.050.03    | • 1,2  | 5,0  | 3  | -  | 38 | 1 | 22,00  |
|     | 307320.0150.05        | • 1,5  | 5,0  | 3  | -  | 50 | 1 | 19,00  |
| NEU | 307320.0150.050.03    | • 1,5  | 5,0  | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0150.050.06    | • 1,5  | 5,0  | 6  | -  | 40 | 1 | 27,00  |
|     | 307320.0160.060.03    | • 1,6  | 6,0  | 3  | -  | 38 | 1 | 19,00  |
|     | 307320.0180.070.03    | • 1,8  | 7,0  | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0200.050.06    | • 2,0  | 5,0  | 6  | -  | 40 | 1 | 26,00  |
| NEU | 307320.0200.050.06.12 | • 2,0  | 5,0  | 6  | 12 | 50 | 1 | 34,00  |
| NEU | 307320.0200.070.04    | • 2,0  | 7,0  | 4  | -  | 40 | 1 | 25,00  |
|     | 307320.0200.08        | • 2,0  | 8,0  | 3  | -  | 50 | 1 | 24,00  |
| NEU | 307320.0200.080.03    | • 2,0  | 8,0  | 3  | -  | 40 | 1 | 22,00  |
| NEU | 307320.0200.100.03    | • 2,0  | 10,0 | 3  | -  | 38 | 1 | 22,00  |
| NEU | 307320.0300.050.03    | • 3,0  | 5,0  | 3  | -  | 40 | 1 | 18,00  |
| NEU | 307320.0300.050.03.22 | • 3,0  | 5,0  | 3  | 22 | 50 | 1 | 29,00  |
| NEU | 307320.0300.050.06    | • 3,0  | 5,0  | 6  | -  | 40 | 1 | 26,00  |
| NEU | 307320.0300.050.06.22 | • 3,0  | 5,0  | 6  | 22 | 50 | 1 | 34,00  |
| NEU | 307320.0300.080.06    | • 3,0  | 8,0  | 6  | -  | 40 | 1 | 26,00  |
| NEU | 307320.0300.100.03    | • 3,0  | 10,0 | 3  | -  | 38 | 1 | 19,00  |
| NEU | 307320.0300.100.04    | • 3,0  | 10,0 | 4  | -  | 40 | 1 | 24,00  |
| NEU | 307320.0300.100.06    | • 3,0  | 10,0 | 6  | -  | 50 | 1 | 27,00  |
|     | 307320.0300.12        | • 3,0  | 12,0 | 3  | -  | 50 | 1 | 24,00  |
| NEU | 307320.0300.120.06    | • 3,0  | 12,0 | 6  | -  | 50 | 1 | 28,00  |
| NEU | 307320.0400.060.04    | • 4,0  | 6,0  | 4  | -  | 40 | 1 | 20,00  |
| NEU | 307320.0400.060.06    | • 4,0  | 6,0  | 6  | -  | 40 | 1 | 26,00  |
| NEU | 307320.0400.080.04.22 | • 4,0  | 8,0  | 4  | 22 | 50 | 1 | 27,00  |
| NEU | 307320.0400.080.06.22 | • 4,0  | 8,0  | 6  | 22 | 50 | 1 | 34,00  |
| NEU | 307320.0400.100.04    | • 4,0  | 10,0 | 4  | -  | 40 | 1 | 22,00  |
| NEU | 307320.0400.120.06    | • 4,0  | 12,0 | 6  | -  | 60 | 1 | 30,00  |
| NEU | 307320.0400.140.04    | • 4,0  | 14,0 | 4  | -  | 50 | 1 | 23,00  |
|     | 307320.0400.15        | • 4,0  | 15,0 | 4  | -  | 60 | 1 | 27,00  |
| NEU | 307320.0500.070.06    | • 5,0  | 7,0  | 6  | -  | 40 | 1 | 26,00  |
| NEU | 307320.0500.140.06.22 | • 5,0  | 14,0 | 6  | 22 | 50 | 1 | 34,00  |
| NEU | 307320.0500.140.06.32 | • 5,0  | 14,0 | 6  | 32 | 60 | 1 | 35,00  |
| NEU | 307320.0500.160.05    | • 5,0  | 16,0 | 5  | -  | 60 | 1 | 26,00  |
|     | 307320.0500.17        | • 5,0  | 17,0 | 5  | -  | 60 | 1 | 33,00  |
| NEU | 307320.0600.080.06    | • 6,0  | 8,0  | 6  | -  | 40 | 1 | 25,00  |
| NEU | 307320.0600.140.06.22 | • 6,0  | 14,0 | 6  | 22 | 50 | 1 | 33,00  |
| NEU | 307320.0600.140.06.32 | • 6,0  | 14,0 | 6  | 32 | 60 | 1 | 34,00  |
| NEU | 307320.0600.140.06.42 | • 6,0  | 14,0 | 6  | 42 | 70 | 1 | 35,00  |
| NEU | 307320.0600.160.06    | • 6,0  | 16,0 | 6  | -  | 60 | 1 | 27,00  |
|     | 307320.0600.20        | • 6,0  | 20,0 | 6  | -  | 65 | 1 | 34,00  |
| NEU | 307320.0600.200.06    | • 6,0  | 20,0 | 6  | -  | 60 | 1 | 27,00  |
| NEU | 307320.0600.250.06    | • 6,0  | 25,0 | 6  | -  | 60 | 1 | 29,00  |
| NEU | 307320.0800.140.08.32 | • 8,0  | 14,0 | 8  | 32 | 60 | 1 | 41,00  |
| NEU | 307320.0800.140.08.42 | • 8,0  | 14,0 | 8  | 42 | 60 | 1 | 47,00  |
| NEU | 307320.0800.200.08    | • 8,0  | 20,0 | 8  | -  | 60 | 1 | 33,00  |
|     | 307320.0800.22        | • 8,0  | 22,0 | 8  | -  | 65 | 1 | 49,00  |
| NEU | 307320.0800.250.08    | • 8,0  | 25,0 | 8  | -  | 75 | 1 | 36,00  |
| NEU | 307320.0800.300.08    | • 8,0  | 30,0 | 8  | -  | 75 | 1 | 38,00  |
|     | 307320.1000.24        | • 10,0 | 24,0 | 10 | -  | 80 | 1 | 76,00  |
| NEU | 307320.1000.250.10    | • 10,0 | 25,0 | 10 | -  | 75 | 1 | 50,00  |
| NEU | 307320.1200.250.12    | • 12,0 | 25,0 | 12 | -  | 75 | 1 | 63,00  |
|     | 307320.1200.30        | • 12,0 | 30,0 | 12 | -  | 85 | 1 | 104,00 |

 **Qualitätslinien**

 **Quality lines**

 **Lineas de calidad**

 **Линии качества**

**PROFESSIONAL**  
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Für den professionellen Einsatz bei höchsten Zerspanungsansprüchen.

For professional use and highest performance.

Para el uso profesional de los requisitos de mecanizado.

Для профессионального использования при высоких требованиях к обработке резанием

 **± 0,003 mm**

Formgenauigkeit Radius  
Shape accuracy  
Precisión de forma ( radio )  
Точность формы по радиусу

 **0,003 mm**

Rundlaufgenauigkeit  
Concentricity  
Precisión de marcha concéntrica  
Точность вращения

 **0/-0,010 mm**

Durchmessertoleranz  
Diameter tolerance  
Tolerancia de diámetro  
Допуск по диаметру

**EXPERT**  
★ ★ ★

Für den Experten in der Klein- und Großserienfertigung.

For experts in small and large production.

Para el experto en la fabricación de series pequeños y grandes.

Для эксперта по мелко- и крупносерийному производству

 **± 0,005 mm**

Formgenauigkeit Radius  
Shape accuracy  
Precisión de forma ( radio )  
Точность формы по радиусу

 **0,010 mm**

Rundlaufgenauigkeit  
Concentricity  
Precisión de marcha concéntrica  
Точность вращения

 **0/-0,010 mm**

Durchmessertoleranz  
Diameter tolerance  
Tolerancia de diámetro  
Допуск по диаметру

**T O P**  
★ ★ ★

TOP für die Schruppbearbeitung

TOP for roughing

TOP para el desbaste

Наилучший вариант для черновой обработки

 **± 0,007 mm**

Formgenauigkeit Radius  
Shape accuracy  
Precisión de forma ( radio )  
Точность формы по радиусу

 **0,015 mm**

Rundlaufgenauigkeit  
Concentricity  
Precisión de marcha concéntrica  
Точность вращения

 **0/-0,036 mm**

Durchmessertoleranz  
Diameter tolerance  
Tolerancia de diámetro  
Допуск по диаметру

Art. **30.6202** **PROFESSIONAL** VHM-Micro Schaftfräser, < 15xD Schnitttiefe, Schaft 4mm

- ALU  
aluminium
- ALU  
< 6% Si
- ALU  
< 12% Si
- MESSING  
brass
- KUPFER  
copper
- Ampco
- TITAN
- Nickel  
< 500  
N/mm²
- Bronze  
Brass
- GFK-CFK  
GFK-CFK
- Kunststoff  
plastic
- MAKROLON
- UHMW  
PE
- PMMA
- Wachs



- Solid carbide miniatur end mills, < 15xD diameter cutting depth, shank 4mm
- Microfresa metal duro < 15xD profundidad de corte, mango 4mm
- Твердосплавная концевая микро, хвостовик 4 мм

NEU / NEW

scharfkantig / sharp edge

d1\* = Ø 0,1 - Ø 2,0    tol 0,000 / -0,008

MICRO GRAIN

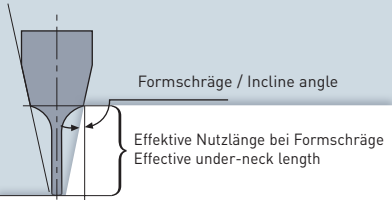
KARNASCH NORM

SPEZIAL

DIN 6335 Form HA

Schnittdaten  
Cutting data

i S. 253



| Art.            | d1*   | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5° | 1°   | 2°    | 3°    |
|-----------------|-------|-----|-------|------|----|------|-------|------|------|-------|-------|
| 306202.0010.002 | • 0,1 | 0,2 | 4     | 0,08 | 45 | 0,15 | 58,00 | 0,59 | 0,66 | 0,82  | 0,98  |
| 306202.0010.003 | • 0,1 | 0,3 | 4     | 0,08 | 45 | 0,15 | 58,00 | 0,70 | 0,79 | 0,96  | 1,13  |
| 306202.0010.004 | • 0,1 | 0,4 | 4     | 0,08 | 45 | 0,15 | 58,00 | 0,81 | 0,91 | 1,09  | 1,27  |
| 306202.0010.005 | • 0,1 | 0,5 | 4     | 0,08 | 45 | 0,15 | 58,00 | 0,92 | 1,03 | 1,22  | 1,41  |
| 306202.0020.005 | • 0,2 | 0,5 | 4     | 0,17 | 50 | 0,30 | 49,00 | 0,99 | 1,08 | 1,27  | 1,45  |
| 306202.0020.010 | • 0,2 | 1   | 4     | 0,17 | 50 | 0,30 | 49,00 | 1,53 | 1,66 | 1,90  | 2,11  |
| 306202.0020.015 | • 0,2 | 1,5 | 4     | 0,17 | 50 | 0,30 | 49,00 | 2,07 | 2,23 | 2,51  | 2,75  |
| 306202.0020.020 | • 0,2 | 2   | 4     | 0,17 | 50 | 0,30 | 49,00 | 2,61 | 2,80 | 3,10  | 3,37  |
| 306202.0030.010 | • 0,3 | 1   | 4     | 0,27 | 50 | 0,45 | 45,00 | 1,53 | 1,66 | 1,90  | 2,11  |
| 306202.0030.015 | • 0,3 | 1,5 | 4     | 0,27 | 50 | 0,45 | 45,00 | 2,07 | 2,23 | 2,51  | 2,75  |
| 306202.0030.020 | • 0,3 | 2   | 4     | 0,27 | 50 | 0,45 | 45,00 | 2,61 | 2,80 | 3,10  | 3,37  |
| 306202.0030.025 | • 0,3 | 2,5 | 4     | 0,27 | 50 | 0,45 | 45,00 | 3,15 | 3,35 | 3,69  | 3,98  |
| 306202.0030.030 | • 0,3 | 3   | 4     | 0,27 | 50 | 0,45 | 45,00 | 3,69 | 3,91 | 4,27  | 4,58  |
| 306202.0040.010 | • 0,4 | 1   | 4     | 0,37 | 50 | 0,60 | 40,00 | 1,53 | 1,66 | 1,90  | 2,11  |
| 306202.0040.015 | • 0,4 | 1,5 | 4     | 0,37 | 50 | 0,60 | 40,00 | 2,07 | 2,23 | 2,51  | 2,75  |
| 306202.0040.020 | • 0,4 | 2   | 4     | 0,37 | 50 | 0,60 | 40,00 | 2,61 | 2,80 | 3,10  | 3,37  |
| 306202.0040.030 | • 0,4 | 3   | 4     | 0,37 | 50 | 0,60 | 40,00 | 3,69 | 3,91 | 4,27  | 4,58  |
| 306202.0040.040 | • 0,4 | 4   | 4     | 0,37 | 50 | 0,60 | 40,00 | 4,75 | 5,01 | 5,41  | 5,75  |
| 306202.0050.010 | • 0,5 | 1   | 4     | 0,47 | 50 | 0,75 | 40,00 | 1,53 | 1,66 | 1,90  | 2,11  |
| 306202.0050.020 | • 0,5 | 2   | 4     | 0,47 | 50 | 0,75 | 40,00 | 2,61 | 2,80 | 3,10  | 3,37  |
| 306202.0050.030 | • 0,5 | 3   | 4     | 0,47 | 50 | 0,75 | 40,00 | 3,69 | 3,91 | 4,27  | 4,58  |
| 306202.0050.040 | • 0,5 | 4   | 4     | 0,47 | 50 | 0,75 | 40,00 | 4,75 | 5,01 | 5,41  | 5,75  |
| 306202.0050.050 | • 0,5 | 5   | 4     | 0,47 | 50 | 0,75 | 40,00 | 5,81 | 6,10 | 6,54  | 6,90  |
| 306202.0050.060 | • 0,5 | 6   | 4     | 0,47 | 50 | 0,75 | 40,00 | 6,86 | 7,18 | 7,66  | 8,04  |
| 306202.0060.020 | • 0,6 | 2   | 4     | 0,57 | 50 | 0,90 | 36,00 | 2,90 | 3,19 | 3,69  | 4,14  |
| 306202.0060.030 | • 0,6 | 3   | 4     | 0,57 | 50 | 0,90 | 36,00 | 4,00 | 4,34 | 4,92  | 5,43  |
| 306202.0060.040 | • 0,6 | 4   | 4     | 0,57 | 50 | 0,90 | 36,00 | 5,09 | 5,48 | 6,13  | 6,68  |
| 306202.0060.050 | • 0,6 | 5   | 4     | 0,57 | 50 | 0,90 | 36,00 | 6,17 | 6,61 | 7,31  | 7,90  |
| 306202.0060.060 | • 0,6 | 6   | 4     | 0,57 | 50 | 0,90 | 36,00 | 7,25 | 7,72 | 8,47  | 9,10  |
| 306202.0060.080 | • 0,6 | 8   | 4     | 0,57 | 50 | 0,90 | 36,00 | 9,39 | 9,93 | 10,77 | 11,45 |
| 306202.0080.040 | • 0,8 | 4   | 4     | 0,77 | 50 | 1,20 | 36,00 | 5,09 | 5,48 | 6,13  | 6,68  |
| 306202.0080.060 | • 0,8 | 6   | 4     | 0,77 | 50 | 1,20 | 36,00 | 7,25 | 7,72 | 8,47  | 9,10  |
| 306202.0080.080 | • 0,8 | 8   | 4     | 0,77 | 50 | 1,20 | 36,00 | 9,39 | 9,93 | 10,77 | 11,45 |





PROFESSIONAL  
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Art. **30.6202**

| Art.            | d1*   | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306202.0100.020 | • 1,0 | 2  | 4     | 0,96 | 50 | 1,50 | 36,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306202.0100.030 | • 1,0 | 3  | 4     | 0,96 | 50 | 1,50 | 36,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306202.0100.040 | • 1,0 | 4  | 4     | 0,96 | 50 | 1,50 | 36,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306202.0100.050 | • 1,0 | 5  | 4     | 0,96 | 50 | 1,50 | 36,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306202.0100.060 | • 1,0 | 6  | 4     | 0,96 | 50 | 1,50 | 36,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306202.0100.080 | • 1,0 | 8  | 4     | 0,96 | 50 | 1,50 | 36,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306202.0100.100 | • 1,0 | 10 | 4     | 0,96 | 50 | 1,50 | 36,00 | 11,55 | 12,14 | 13,05 | 13,78 |
| 306202.0100.120 | • 1,0 | 12 | 4     | 0,96 | 55 | 1,50 | 36,00 | 13,66 | 14,31 | 15,28 | 16,06 |
| 306202.0100.150 | • 1,0 | 15 | 4     | 0,96 | 55 | 1,50 | 36,00 | 16,82 | 17,52 | 18,60 | 19,44 |
| 306202.0120.060 | • 1,2 | 6  | 4     | 1,15 | 50 | 1,80 | 36,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306202.0120.120 | • 1,2 | 12 | 4     | 1,15 | 55 | 1,80 | 36,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306202.0150.040 | • 1,5 | 4  | 4     | 1,44 | 50 | 2,25 | 36,00 | 5,23  | 5,59  | 6,21  | 6,74  |
| 306202.0150.060 | • 1,5 | 6  | 4     | 1,44 | 50 | 2,25 | 36,00 | 7,37  | 7,82  | 8,54  | 9,15  |
| 306202.0150.080 | • 1,5 | 8  | 4     | 1,44 | 50 | 2,25 | 36,00 | 9,50  | 10,01 | 10,83 | 11,50 |
| 306202.0150.100 | • 1,5 | 10 | 4     | 1,44 | 50 | 2,25 | 36,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306202.0150.120 | • 1,5 | 12 | 4     | 1,44 | 55 | 2,25 | 36,00 | 13,72 | 14,35 | 15,31 | 16,09 |
| 306202.0150.140 | • 1,5 | 14 | 4     | 1,44 | 55 | 2,25 | 36,00 | 15,83 | 16,50 | 17,53 | 18,34 |
| 306202.0150.160 | • 1,5 | 16 | 4     | 1,44 | 55 | 2,25 | 36,00 | 17,92 | 18,64 | 19,72 | 20,58 |
| 306202.0150.180 | • 1,5 | 18 | 4     | 1,44 | 60 | 2,25 | 37,00 | 20,01 | 20,77 | 21,91 | 22,80 |
| 306202.0150.200 | • 1,5 | 20 | 4     | 1,44 | 60 | 2,25 | 37,00 | 22,10 | 22,90 | 24,08 | –     |
| 306202.0200.040 | • 2,0 | 4  | 4     | 1,92 | 50 | 3,00 | 36,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306202.0200.060 | • 2,0 | 6  | 4     | 1,92 | 50 | 3,00 | 36,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306202.0200.080 | • 2,0 | 8  | 4     | 1,92 | 50 | 3,00 | 36,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306202.0200.100 | • 2,0 | 10 | 4     | 1,92 | 50 | 3,00 | 36,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306202.0200.120 | • 2,0 | 12 | 4     | 1,92 | 55 | 3,00 | 36,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306202.0200.150 | • 2,0 | 15 | 4     | 1,92 | 55 | 3,00 | 36,00 | 16,93 | 17,61 | 18,65 | –     |
| 306202.0200.200 | • 2,0 | 20 | 4     | 1,92 | 60 | 3,00 | 37,00 | 22,15 | 22,93 | 24,11 | –     |



KARNASCH Technologie- und Schulungszentrum  
KARNASCH technology and training facility



Art. 30.6203 PROFESSIONAL VHM-Micro Schaftfräser mit Eckenradius, < 15xD Schnitttiefe, Schaft 4mm

- ALU  
aluminium
- ALU  
< 6% Si
- ALU  
< 12% Si
- MESSING  
brass
- KUPFER  
copper
- Ampco
- TITAN
- Nickel  
< 500  
N/mm<sup>2</sup>
- Bronze  
Brass
- GFK-CFK  
GFK-CFK
- Kunststoff  
plastic
- MAKROLON
- UHMW  
PE
- PMMA
- Wachs



- Solid carbide miniatur end mills with corner radius, < 15xD diameter cutting depth, shank 4mm
- Microfresa metal duro con radio angular, < 15xD profundidad de corte, mango 4mm
- Твердосплавная концевая микро-фреза с угловым радиусом, глубина распила < 15xD, хвостовик 4mm

NEU / NEW

tol. r = -0,004

d1\* = Ø 0,1 - Ø 2,0    tol -0,000 / -0,008

MICRO GRAIN

KARNASCH NORM

SPEZIAL

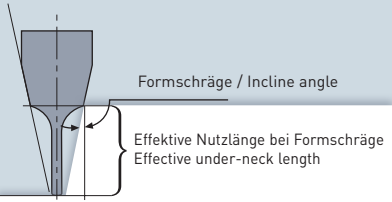
DIN 6535 Form HA

HSC HPC

NHC 7000

Schnittdaten  
Cutting data

i S. 254



| Art.                | d1*   | r -0,004 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|-------|----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306203.0010.002.002 | • 0,1 | 0,02     | 0,2 | 4     | 0,08 | 45 | 0,10 | 58,00 | 0,59  | 0,66  | 0,82  | 0,98  |
| 306203.0010.002.003 | • 0,1 | 0,02     | 0,3 | 4     | 0,08 | 45 | 0,10 | 58,00 | 0,70  | 0,79  | 0,96  | 1,13  |
| 306203.0010.002.004 | • 0,1 | 0,02     | 0,4 | 4     | 0,08 | 45 | 0,10 | 58,00 | 0,81  | 0,91  | 1,09  | 1,27  |
| 306203.0020.005.005 | • 0,2 | 0,05     | 0,5 | 4     | 0,17 | 50 | 0,15 | 49,00 | 0,99  | 1,08  | 1,27  | 1,45  |
| 306203.0020.005.010 | • 0,2 | 0,05     | 1   | 4     | 0,17 | 50 | 0,15 | 49,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306203.0020.005.015 | • 0,2 | 0,05     | 1,5 | 4     | 0,17 | 50 | 0,15 | 49,00 | 2,07  | 2,23  | 2,51  | 2,75  |
| 306203.0020.005.020 | • 0,2 | 0,05     | 2   | 4     | 0,17 | 50 | 0,15 | 49,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306203.0030.005.010 | • 0,3 | 0,05     | 1   | 4     | 0,27 | 50 | 0,25 | 45,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306203.0030.005.015 | • 0,3 | 0,05     | 1,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,07  | 2,23  | 2,51  | 2,75  |
| 306203.0030.005.020 | • 0,3 | 0,05     | 2   | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306203.0030.005.025 | • 0,3 | 0,05     | 2,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 3,15  | 3,35  | 3,69  | 3,98  |
| 306203.0030.005.030 | • 0,3 | 0,05     | 3   | 4     | 0,27 | 50 | 0,25 | 45,00 | 3,69  | 3,91  | 4,27  | 4,58  |
| 306203.0040.010.010 | • 0,4 | 0,10     | 1   | 4     | 0,37 | 50 | 0,30 | 40,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306203.0040.010.015 | • 0,4 | 0,10     | 1,5 | 4     | 0,37 | 50 | 0,30 | 40,00 | 2,07  | 2,23  | 2,51  | 2,75  |
| 306203.0040.010.020 | • 0,4 | 0,10     | 2   | 4     | 0,37 | 50 | 0,30 | 40,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306203.0040.010.030 | • 0,4 | 0,10     | 3   | 4     | 0,37 | 50 | 0,30 | 40,00 | 3,69  | 3,91  | 4,27  | 4,58  |
| 306203.0040.010.040 | • 0,4 | 0,10     | 4   | 4     | 0,37 | 50 | 0,30 | 40,00 | 4,75  | 5,01  | 5,41  | 5,75  |
| 306203.0050.010.010 | • 0,5 | 0,10     | 1   | 4     | 0,47 | 50 | 0,35 | 40,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306203.0050.010.020 | • 0,5 | 0,10     | 2   | 4     | 0,47 | 50 | 0,35 | 40,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306203.0050.010.030 | • 0,5 | 0,10     | 3   | 4     | 0,47 | 50 | 0,35 | 40,00 | 3,69  | 3,91  | 4,27  | 4,58  |
| 306203.0050.010.040 | • 0,5 | 0,10     | 4   | 4     | 0,47 | 50 | 0,35 | 40,00 | 4,75  | 5,01  | 5,41  | 5,75  |
| 306203.0050.010.050 | • 0,5 | 0,10     | 5   | 4     | 0,47 | 50 | 0,35 | 40,00 | 5,81  | 6,10  | 6,54  | 6,90  |
| 306203.0050.010.060 | • 0,5 | 0,10     | 6   | 4     | 0,47 | 50 | 0,35 | 40,00 | 6,86  | 7,18  | 7,66  | 8,04  |
| 306203.0060.010.020 | • 0,6 | 0,10     | 2   | 4     | 0,57 | 50 | 0,40 | 36,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306203.0060.010.030 | • 0,6 | 0,10     | 3   | 4     | 0,57 | 50 | 0,40 | 36,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306203.0060.010.040 | • 0,6 | 0,10     | 4   | 4     | 0,57 | 50 | 0,40 | 36,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306203.0060.010.050 | • 0,6 | 0,10     | 5   | 4     | 0,57 | 50 | 0,40 | 36,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306203.0060.010.060 | • 0,6 | 0,10     | 6   | 4     | 0,57 | 50 | 0,40 | 36,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306203.0060.010.080 | • 0,6 | 0,10     | 8   | 4     | 0,57 | 50 | 0,40 | 36,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306203.0080.020.020 | • 0,8 | 0,20     | 2   | 4     | 0,77 | 50 | 0,50 | 36,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306203.0080.020.040 | • 0,8 | 0,20     | 4   | 4     | 0,77 | 50 | 0,50 | 36,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306203.0080.020.050 | • 0,8 | 0,20     | 5   | 4     | 0,77 | 50 | 0,50 | 36,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306203.0080.020.060 | • 0,8 | 0,20     | 6   | 4     | 0,77 | 50 | 0,50 | 36,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306203.0080.020.080 | • 0,8 | 0,20     | 8   | 4     | 0,77 | 50 | 0,50 | 36,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306203.0080.020.100 | • 0,8 | 0,20     | 10  | 4     | 0,77 | 50 | 0,50 | 36,00 | 11,49 | 12,12 | 12,99 | 13,71 |



| Art.                |   | d1* | r -0,004 | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|---|-----|----------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306203.0100.020.020 | • | 1,0 | 0,20     | 2  | 4     | 0,96 | 50 | 0,80 | 36,00 | 2,96  | 3,23  | 3,73  | 4,17  |
| 306203.0100.020.030 | • | 1,0 | 0,20     | 3  | 4     | 0,96 | 50 | 0,80 | 36,00 | 4,05  | 4,39  | 4,96  | 5,45  |
| 306203.0100.020.040 | • | 1,0 | 0,20     | 4  | 4     | 0,96 | 50 | 0,80 | 36,00 | 5,14  | 5,52  | 6,15  | 6,70  |
| 306203.0100.020.050 | • | 1,0 | 0,20     | 5  | 4     | 0,96 | 50 | 0,80 | 36,00 | 6,22  | 6,64  | 7,33  | 7,92  |
| 306203.0100.020.060 | • | 1,0 | 0,20     | 6  | 4     | 0,96 | 50 | 0,80 | 36,00 | 7,29  | 7,76  | 8,50  | 9,12  |
| 306203.0100.020.070 | • | 1,0 | 0,20     | 7  | 4     | 0,96 | 50 | 0,80 | 36,00 | 8,36  | 8,86  | 9,65  | 10,30 |
| 306203.0100.020.080 | • | 1,0 | 0,20     | 8  | 4     | 0,96 | 50 | 0,80 | 36,00 | 9,43  | 9,96  | 10,79 | 11,47 |
| 306203.0100.020.090 | • | 1,0 | 0,20     | 9  | 4     | 0,96 | 50 | 0,80 | 36,00 | 10,49 | 11,05 | 11,92 | 12,63 |
| 306203.0100.020.100 | • | 1,0 | 0,20     | 10 | 4     | 0,96 | 50 | 0,80 | 36,00 | 11,55 | 12,14 | 13,05 | 13,78 |
| 306203.0100.020.120 | • | 1,0 | 0,20     | 12 | 4     | 0,96 | 55 | 0,80 | 36,00 | 13,66 | 14,31 | 15,28 | 16,06 |
| 306203.0100.020.150 | • | 1,0 | 0,20     | 15 | 4     | 0,96 | 55 | 0,80 | 36,00 | 16,82 | 17,53 | 18,60 | 19,44 |
| 306203.0120.020.060 | • | 1,2 | 0,20     | 6  | 4     | 1,15 | 50 | 1,00 | 36,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306203.0120.020.120 | • | 1,2 | 0,20     | 12 | 4     | 1,15 | 55 | 1,00 | 36,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306203.0150.020.040 | • | 1,5 | 0,20     | 4  | 4     | 1,44 | 50 | 1,35 | 36,00 | 5,23  | 5,59  | 6,21  | 6,74  |
| 306203.0150.020.060 | • | 1,5 | 0,20     | 6  | 4     | 1,44 | 50 | 1,35 | 36,00 | 7,37  | 7,82  | 8,54  | 9,15  |
| 306203.0150.020.080 | • | 1,5 | 0,20     | 8  | 4     | 1,44 | 50 | 1,35 | 36,00 | 9,50  | 10,01 | 10,83 | 11,50 |
| 306203.0150.020.100 | • | 1,5 | 0,20     | 10 | 4     | 1,44 | 50 | 1,35 | 36,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306203.0150.020.120 | • | 1,5 | 0,20     | 12 | 4     | 1,44 | 55 | 1,35 | 36,00 | 13,72 | 14,35 | 15,31 | 16,09 |
| 306203.0150.020.140 | • | 1,5 | 0,20     | 14 | 4     | 1,44 | 55 | 1,35 | 36,00 | 15,83 | 16,60 | 17,53 | 18,34 |
| 306203.0150.020.160 | • | 1,5 | 0,20     | 16 | 4     | 1,44 | 55 | 1,35 | 36,00 | 17,92 | 18,64 | 19,72 | 20,58 |
| 306203.0150.020.180 | • | 1,5 | 0,20     | 18 | 4     | 1,44 | 60 | 1,35 | 37,00 | 20,01 | 20,77 | 21,91 | 22,80 |
| 306203.0150.020.200 | • | 1,5 | 0,20     | 20 | 4     | 1,44 | 60 | 1,35 | 37,00 | 22,10 | 22,90 | 24,08 | -     |
| 306203.0200.020.040 | • | 2,0 | 0,20     | 4  | 4     | 1,92 | 50 | 1,70 | 36,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306203.0200.020.060 | • | 2,0 | 0,20     | 6  | 4     | 1,92 | 50 | 1,70 | 36,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306203.0200.020.080 | • | 2,0 | 0,20     | 8  | 4     | 1,92 | 50 | 1,70 | 36,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306203.0200.020.100 | • | 2,0 | 0,20     | 10 | 4     | 1,92 | 50 | 1,70 | 36,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306203.0200.020.120 | • | 2,0 | 0,20     | 12 | 4     | 1,92 | 55 | 1,70 | 36,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306203.0200.020.150 | • | 2,0 | 0,20     | 15 | 4     | 1,92 | 55 | 1,70 | 36,00 | 16,93 | 17,61 | 18,65 | -     |
| 306203.0200.020.200 | • | 2,0 | 0,20     | 20 | 4     | 1,92 | 60 | 1,70 | 37,00 | 22,15 | 22,93 | 24,11 | -     |
| 306203.0200.050.040 | • | 2,0 | 0,50     | 4  | 4     | 1,92 | 50 | 1,70 | 36,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306203.0200.050.060 | • | 2,0 | 0,50     | 6  | 4     | 1,92 | 50 | 1,70 | 36,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306203.0200.050.080 | • | 2,0 | 0,50     | 8  | 4     | 1,92 | 50 | 1,70 | 36,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306203.0200.050.100 | • | 2,0 | 0,50     | 10 | 4     | 1,92 | 50 | 1,70 | 36,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306203.0200.050.120 | • | 2,0 | 0,50     | 12 | 4     | 1,92 | 55 | 1,70 | 36,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306203.0200.050.150 | • | 2,0 | 0,50     | 15 | 4     | 1,92 | 55 | 1,70 | 36,00 | 16,93 | 17,61 | 18,65 | -     |
| 306203.0200.050.200 | • | 2,0 | 0,50     | 20 | 4     | 1,92 | 60 | 1,70 | 37,00 | 22,15 | 22,93 | 24,11 | -     |

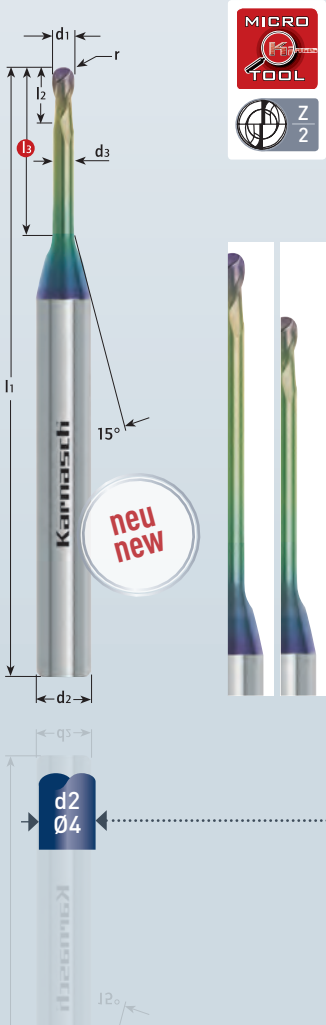
QUALITÄTSKONTROLLE · QUALITY CONTROL

Vermessung des Rundlauf im Prisma mit einem Laserstrahl.  
Run out measuring in a V-block with a laser beam.



Art. 30.6204 PROFESSIONAL VHM-Micro-3D Mini-Radiusfräser, < 15xD Schnitttiefe, Schaft 4mm

- ALU  
aluminium
- ALU  
< 6% Si
- ALU  
< 12% Si
- MESSING  
brass
- KUPFER  
copper
- Ampco
- TITAN
- Nickel  
< 500  
N/mm²
- Bronze  
Brass
- GFK-CFK  
GFK-CFK
- Kunststoff  
plastic
- MAKROLON
- UHMW  
PE
- PMMA
- Wachs



- Solid carbide miniatur ball nose slot mill, < 15xD diameter cutting depth, shank 4 mm
- Microfresa metal duro con radio de 3D, < 15xD profundidad de corte, mango 4mm
- Твердосплавная радиусная мини-фреза 3D, глубина распила < 15xD, хвостовик 4mm

NEU / NEW

tol. r = ± 0,003

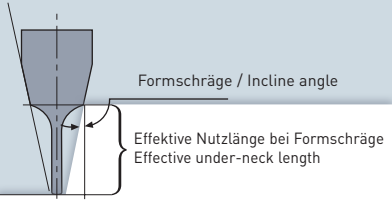
d1\* = Ø 0,1 - Ø 2,0    tol 0,000 / -0,008

MICRO GRAIN KARNASCH NORM

SPEZIAL DIN 6335 Form HA

Schnittdaten  
Cutting data

i S. 255



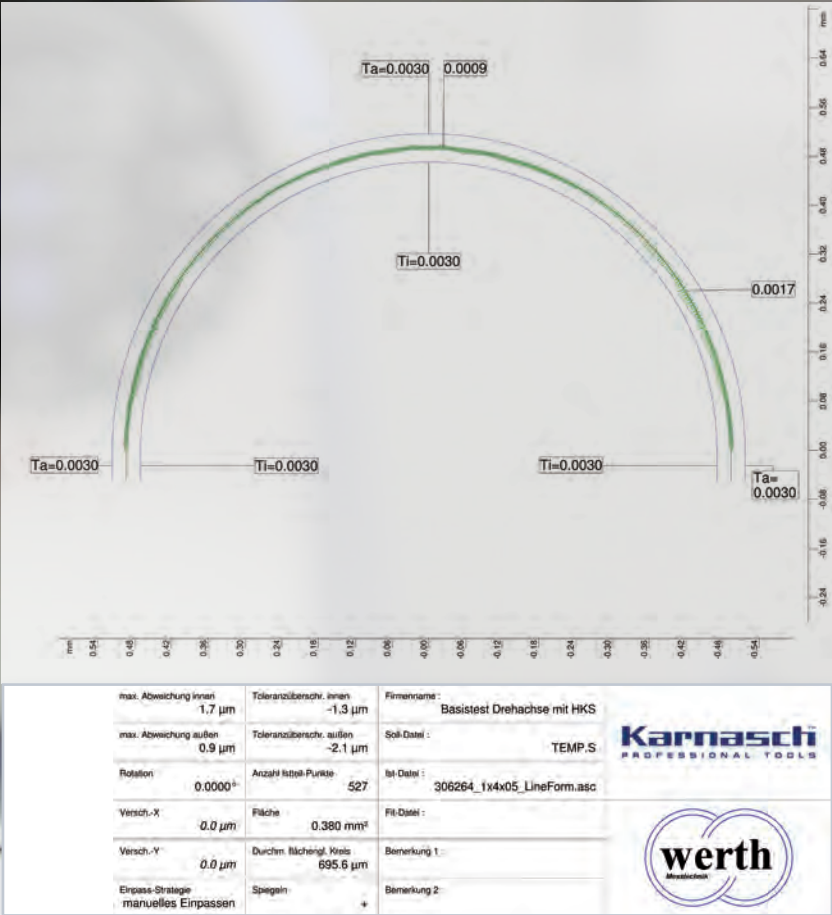
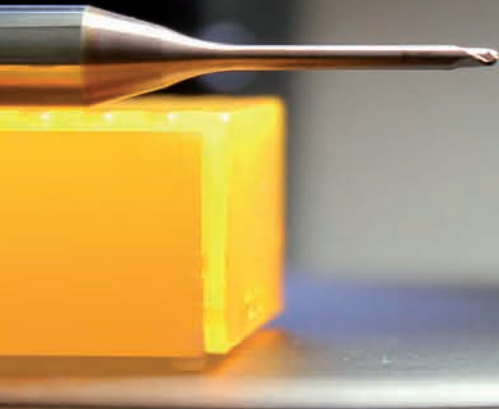
| Art.            | d1*   | r ± 0,003 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|-----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306204.0010.002 | • 0,1 | 0,05      | 0,2 | 4     | 0,08 | 45 | 0,08 | 58,00 | 0,59  | 0,66  | 0,82  | 0,98  |
| 306204.0010.003 | • 0,1 | 0,05      | 0,3 | 4     | 0,08 | 45 | 0,08 | 58,00 | 0,70  | 0,79  | 0,96  | 1,13  |
| 306204.0010.004 | • 0,1 | 0,05      | 0,4 | 4     | 0,08 | 45 | 0,08 | 58,00 | 0,81  | 0,91  | 1,09  | 1,27  |
| 306204.0010.005 | • 0,1 | 0,05      | 0,5 | 4     | 0,08 | 45 | 0,08 | 58,00 | 0,92  | 1,03  | 1,22  | 1,41  |
| 306204.0020.005 | • 0,2 | 0,10      | 0,5 | 4     | 0,17 | 50 | 0,20 | 49,00 | 0,99  | 1,08  | 1,27  | 1,45  |
| 306204.0020.010 | • 0,2 | 0,10      | 1   | 4     | 0,17 | 50 | 0,20 | 49,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306204.0020.015 | • 0,2 | 0,10      | 1,5 | 4     | 0,17 | 50 | 0,20 | 49,00 | 2,07  | 2,23  | 2,51  | 2,75  |
| 306204.0020.020 | • 0,2 | 0,10      | 2   | 4     | 0,17 | 50 | 0,20 | 49,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306204.0030.010 | • 0,3 | 0,15      | 1   | 4     | 0,27 | 50 | 0,25 | 45,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306204.0030.015 | • 0,3 | 0,15      | 1,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,07  | 2,23  | 2,51  | 2,75  |
| 306204.0030.020 | • 0,3 | 0,15      | 2   | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306204.0030.025 | • 0,3 | 0,15      | 2,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 3,15  | 3,35  | 3,69  | 3,98  |
| 306204.0030.030 | • 0,3 | 0,15      | 3   | 4     | 0,27 | 50 | 0,25 | 45,00 | 3,69  | 3,91  | 4,27  | 4,58  |
| 306204.0040.010 | • 0,4 | 0,20      | 1   | 4     | 0,37 | 50 | 0,30 | 40,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306204.0040.020 | • 0,4 | 0,20      | 2   | 4     | 0,37 | 50 | 0,30 | 40,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306204.0040.030 | • 0,4 | 0,20      | 3   | 4     | 0,37 | 50 | 0,30 | 40,00 | 3,69  | 3,91  | 4,27  | 4,58  |
| 306204.0040.040 | • 0,4 | 0,20      | 4   | 4     | 0,37 | 50 | 0,30 | 40,00 | 4,75  | 5,01  | 5,41  | 5,75  |
| 306204.0050.010 | • 0,5 | 0,25      | 1   | 4     | 0,47 | 50 | 0,40 | 40,00 | 1,53  | 1,66  | 1,90  | 2,11  |
| 306204.0050.020 | • 0,5 | 0,25      | 2   | 4     | 0,47 | 50 | 0,40 | 40,00 | 2,61  | 2,80  | 3,10  | 3,37  |
| 306204.0050.030 | • 0,5 | 0,25      | 3   | 4     | 0,47 | 50 | 0,40 | 40,00 | 3,69  | 3,91  | 4,27  | 4,58  |
| 306204.0050.040 | • 0,5 | 0,25      | 4   | 4     | 0,47 | 50 | 0,40 | 40,00 | 4,75  | 5,01  | 5,41  | 5,75  |
| 306204.0050.050 | • 0,5 | 0,25      | 5   | 4     | 0,47 | 50 | 0,40 | 40,00 | 5,81  | 6,10  | 6,54  | 6,90  |
| 306204.0050.060 | • 0,5 | 0,25      | 6   | 4     | 0,47 | 50 | 0,40 | 40,00 | 6,86  | 7,18  | 7,66  | 8,04  |
| 306204.0060.020 | • 0,6 | 0,30      | 2   | 4     | 0,57 | 50 | 0,50 | 36,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306204.0060.030 | • 0,6 | 0,30      | 3   | 4     | 0,57 | 50 | 0,50 | 36,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306204.0060.040 | • 0,6 | 0,30      | 4   | 4     | 0,57 | 50 | 0,50 | 36,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306204.0060.050 | • 0,6 | 0,30      | 5   | 4     | 0,57 | 50 | 0,50 | 36,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306204.0060.060 | • 0,6 | 0,30      | 6   | 4     | 0,57 | 50 | 0,50 | 36,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306204.0060.080 | • 0,6 | 0,30      | 8   | 4     | 0,57 | 50 | 0,50 | 36,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306204.0080.020 | • 0,8 | 0,40      | 2   | 4     | 0,77 | 50 | 0,60 | 36,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306204.0080.040 | • 0,8 | 0,40      | 4   | 4     | 0,77 | 50 | 0,60 | 36,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306204.0080.060 | • 0,8 | 0,40      | 6   | 4     | 0,77 | 50 | 0,60 | 36,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306204.0080.080 | • 0,8 | 0,40      | 8   | 4     | 0,77 | 50 | 0,60 | 36,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306204.0080.100 | • 0,8 | 0,40      | 10  | 4     | 0,77 | 50 | 0,60 | 36,00 | 11,49 | 12,12 | 12,99 | 13,78 |



| Art.            |   | d1* | r ± 0,003 | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|---|-----|-----------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306204.0100.020 | • | 1,0 | 0,50      | 2  | 4     | 0,96 | 50 | 0,80 | 36,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306204.0100.030 | • | 1,0 | 0,50      | 3  | 4     | 0,96 | 50 | 0,80 | 36,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306204.0100.040 | • | 1,0 | 0,50      | 4  | 4     | 0,96 | 50 | 0,80 | 36,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306204.0100.050 | • | 1,0 | 0,50      | 5  | 4     | 0,96 | 50 | 0,80 | 36,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306204.0100.060 | • | 1,0 | 0,50      | 6  | 4     | 0,96 | 50 | 0,80 | 36,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306204.0100.080 | • | 1,0 | 0,50      | 8  | 4     | 0,96 | 50 | 0,80 | 36,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306204.0100.100 | • | 1,0 | 0,50      | 10 | 4     | 0,96 | 50 | 0,80 | 36,00 | 11,55 | 12,14 | 13,05 | 13,78 |
| 306204.0100.120 | • | 1,0 | 0,50      | 12 | 4     | 0,96 | 55 | 0,80 | 36,00 | 13,66 | 14,31 | 15,28 | 16,06 |
| 306204.0100.150 | • | 1,0 | 0,50      | 15 | 4     | 0,96 | 55 | 0,80 | 36,00 | 16,82 | 17,53 | 18,60 | 19,44 |
| 306204.0100.180 | • | 1,0 | 0,50      | 18 | 4     | 0,96 | 60 | 0,80 | 37,00 | 20,01 | 20,77 | 21,91 | 22,77 |
| 306204.0100.200 | • | 1,0 | 0,50      | 20 | 4     | 0,96 | 60 | 0,80 | 37,00 | 22,10 | 22,90 | 24,08 | 24,98 |
| 306204.0120.060 | • | 1,2 | 0,60      | 6  | 4     | 1,15 | 50 | 1,00 | 36,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306204.0120.120 | • | 1,2 | 0,60      | 12 | 4     | 1,15 | 55 | 1,00 | 36,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306204.0150.040 | • | 1,5 | 0,75      | 4  | 4     | 1,44 | 50 | 1,20 | 36,00 | 5,23  | 5,59  | 6,21  | 6,74  |
| 306204.0150.060 | • | 1,5 | 0,75      | 6  | 4     | 1,44 | 50 | 1,20 | 36,00 | 7,37  | 7,82  | 8,54  | 9,15  |
| 306204.0150.080 | • | 1,5 | 0,75      | 8  | 4     | 1,44 | 50 | 1,20 | 36,00 | 9,50  | 10,01 | 10,83 | 11,50 |
| 306204.0150.100 | • | 1,5 | 0,75      | 10 | 4     | 1,44 | 50 | 1,20 | 36,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306204.0150.120 | • | 1,5 | 0,75      | 12 | 4     | 1,44 | 55 | 1,20 | 36,00 | 13,72 | 14,35 | 15,31 | 16,09 |
| 306204.0150.140 | • | 1,5 | 0,75      | 14 | 4     | 1,44 | 55 | 1,20 | 36,00 | 15,83 | 16,60 | 17,53 | 18,34 |
| 306204.0150.160 | • | 1,5 | 0,75      | 16 | 4     | 1,44 | 55 | 1,20 | 36,00 | 17,92 | 18,64 | 19,72 | 20,58 |
| 306204.0150.180 | • | 1,5 | 0,75      | 18 | 4     | 1,44 | 60 | 1,20 | 37,00 | 20,01 | 20,77 | 21,91 | 22,80 |
| 306204.0150.200 | • | 1,5 | 0,75      | 20 | 4     | 1,44 | 60 | 1,20 | 37,00 | 22,10 | 22,90 | 24,08 |       |
| 306204.0200.040 | • | 2,0 | 1,00      | 4  | 4     | 1,92 | 50 | 1,50 | 36,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306204.0200.060 | • | 2,0 | 1,00      | 6  | 4     | 1,92 | 50 | 1,50 | 36,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306204.0200.080 | • | 2,0 | 1,00      | 8  | 4     | 1,92 | 50 | 1,50 | 36,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306204.0200.100 | • | 2,0 | 1,00      | 10 | 4     | 1,92 | 50 | 1,50 | 36,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306204.0200.120 | • | 2,0 | 1,00      | 12 | 4     | 1,92 | 55 | 1,50 | 36,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306204.0200.150 | • | 2,0 | 1,00      | 15 | 4     | 1,92 | 55 | 1,50 | 36,00 | 16,93 | 17,61 | 18,65 |       |
| 306204.0200.200 | • | 2,0 | 1,00      | 20 | 4     | 1,92 | 60 | 1,50 | 37,00 | 22,15 | 22,93 | 24,11 |       |

Darstellung der Radiuskontur eines Karnasch-Fräser

Picture of the radius shape accuracy from a Karnasch ball nose end mill







## High-Precision-Werkzeuge aus dem Hause Karnasch

## High-Precision-Tools from Karnasch

Metallverarbeitende Unternehmen brauchen die absolute Gewissheit, mit hochwertigen, leistungsstarken und prozesssicheren Werkzeugen zu arbeiten. Karnasch Professional Tools bietet das, worauf es ankommt!

Wir sind ein weltweit agierendes Unternehmen mit Hauptsitz im badischen Heddeshheim, das

- Hochleistungswerkzeuge zur Metallverarbeitung von herausragender Qualität produziert und vertreibt,
- seit 1961 auf dem Markt tätig ist und dementsprechend über große Erfahrung, umfassendes Know-how sowie überdurchschnittliche Kundenorientierung verfügt,
- durch intelligente Lagerhaltung jederzeit die sofortige Lieferbarkeit seiner Produkte garantiert,
- in vielen Regionen der Welt Vertriebspartner hat, damit auch für Ihre Auslandsniederlassungen eine permanente Versorgung und begleitender Service gewährleistet ist,
- Support groß schreibt und diesen Anspruch u.a. durch eine Service-Hotline auch erfüllt,
- mit der Eröffnung einer Niederlassung in Görsdorf (Brandenburg) bereits im Jahr 1992 auf gesamtdeutsche Präsenz gesetzt hat.

Weltweit zählen Kunden aus folgenden Bereichen auf Karnasch Professional Tools:

- Werkzeug- und Formenbau,
- Luft- und Raumfahrt,
- Automobilindustrie,
- Schiff- und Eisenbahnbau,
- Hoch-, Stahl- und Brückenbau.

Metal working companies require absolute certainty to work with high-quality, high-performance and reliable tools. Karnasch Professional Tools offers all that matters!

We are a family-run business that is actively involved on a worldwide scale, with our head office in Heddeshheim in Baden, which

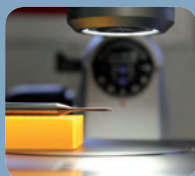
- produces and distributes excellent quality, high performance tools for metal working,
- has been active in the market since 1961 and has accordingly obtained invaluable experience, comprehensive know-how and above average customer orientation,
- guarantees immediate availability of our products at any time thanks to intelligent stock-keeping,
- has sales partners in many regions of the world, and can thus also ensure a continuous and accompanying service for your overseas branches.
- places an emphasis on support and fulfils this claim via, amongst other things, a service hotline.
- cemented our presence throughout Germany with the opening of a branch in Görsdorf (Brandenburg) in 1992.

**Our customers predominantly come from the following sectors:**

- Tool and mould making,
- Aviation and astronautics,
- The automotive industry,
- Shipbuilding and railway construction,
- Structural engineering, steel construction and bridge building.

Weitere Informationen zu unserer kompletten Produktpalette erhalten Sie auch im Internet unter:

[WWW.KARNASCH.COM](http://WWW.KARNASCH.COM)

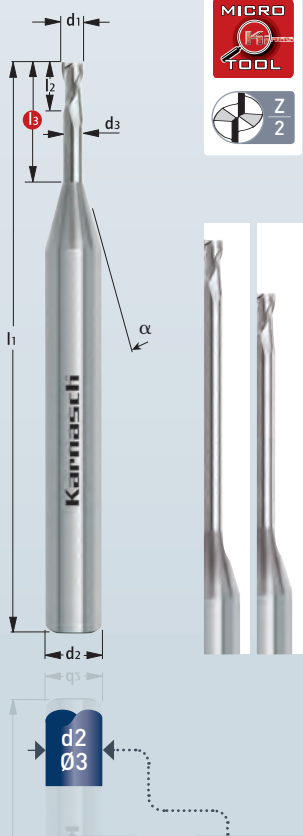




VHM-Micro-Schaftfräser, ohne Eckenradius, polierte Schneiden < 12 x D

PROFESSIONAL Art. 30.6209

- KUPFER  
copper
- MESSING  
brass
- ALU  
aluminium
- Ampco
- GOLD  
gold
- Kunststoff  
plastic
- MAKROLON
- Wachs  
Wax



- Solid carbide-micro-end mill, without corner radius, polished cutting edge 2-12xD
- Microfresa metal duro de mango, sin radio angular, cuchillos pulidos 2-12xD
- Твердосплавная концевая микро-фреза, без углового радиуса, полированные резцы 2-12xD

NEU / NEW

scharfkantig / sharp edge

d1\* = Ø 0,05 - Ø 0,12 tol ± 0,005

d1\* = Ø 0,15 - Ø 2,0 tol - 0,01

MICRO GRAIN KARNASCH NORM

SPEZIAL DIN 6535 Form HA

30°

HSC HPC

POLIERT POLISHED

MMKS

Schnittdaten  
Cutting data



i S. 253

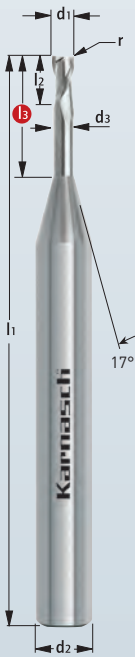
| Art.             | d1 *   | l3   | d2 h6 | d3   | α   | l1 | l2   | €      |
|------------------|--------|------|-------|------|-----|----|------|--------|
| 306209.0005.010  | • 0,05 | 0,10 | 3     | –    | 8°  | 40 | 0,10 | 108,00 |
| 306209.0006.012  | • 0,06 | 0,12 | 3     | –    | 8°  | 40 | 0,12 | 93,00  |
| 306209.0008.016  | • 0,08 | 0,16 | 3     | –    | 8°  | 40 | 0,16 | 79,00  |
| 306209.0010.020  | • 0,10 | 0,20 | 3     | –    | 10° | 40 | 0,20 | 66,00  |
| 306209.0012.024  | • 0,12 | 0,24 | 3     | –    | 10° | 40 | 0,24 | 66,00  |
| 306209.0015.030  | • 0,15 | 0,30 | 3     | –    | 10° | 40 | 0,30 | 56,00  |
| 306209.0020.0050 | • 0,20 | 0,50 | 3     | –    | 10° | 40 | 0,50 | 47,00  |
| 306209.0030.0080 | • 0,30 | 0,80 | 3     | –    | 10° | 40 | 0,80 | 32,00  |
| 306209.0040.0100 | • 0,40 | 1,00 | 3     | –    | 10° | 40 | 1,00 | 32,00  |
| 306209.0040.0200 | • 0,40 | 2,00 | 3     | 0,38 | 10° | 40 | 0,60 | 39,00  |
| 306209.0050.0150 | • 0,50 | 1,50 | 3     | –    | 10° | 40 | 1,50 | 25,00  |
| 306209.0050.0200 | • 0,50 | 2,00 | 3     | 0,48 | 10° | 40 | 0,70 | 39,00  |
| 306209.0050.0400 | • 0,50 | 4,00 | 3     | 0,48 | 10° | 40 | 0,70 | 39,00  |
| 306209.0050.0600 | • 0,50 | 6,00 | 3     | 0,48 | 10° | 60 | 0,70 | 60,00  |
| 306209.0060.0150 | • 0,60 | 1,50 | 3     | –    | 10° | 40 | 1,50 | 25,00  |
| 306209.0060.0400 | • 0,60 | 4,00 | 3     | 0,58 | 10° | 40 | 0,90 | 39,00  |
| 306209.0070.0200 | • 0,70 | 2,00 | 3     | –    | 10° | 40 | 2,00 | 25,00  |
| 306209.0070.0400 | • 0,70 | 4,00 | 3     | 0,68 | 10° | 40 | 1,00 | 39,00  |
| 306209.0075.0200 | • 0,75 | 2,00 | 3     | –    | 10° | 40 | 2,00 | 25,00  |
| 306209.0080.0200 | • 0,80 | 2,00 | 3     | –    | 10° | 40 | 2,00 | 25,00  |
| 306209.0080.0400 | • 0,80 | 4,00 | 3     | 0,77 | 10° | 40 | 1,20 | 39,00  |
| 306209.0080.0600 | • 0,80 | 6,00 | 3     | 0,77 | 10° | 40 | 1,20 | 50,00  |
| 306209.0080.0900 | • 0,80 | 9,00 | 3     | 0,77 | 10° | 60 | 1,20 | 60,00  |
| 306209.0085.0200 | • 0,85 | 2,00 | 3     | –    | 10° | 40 | 2,00 | 25,00  |
| 306209.0090.0250 | • 0,90 | 2,50 | 3     | –    | 10° | 40 | 2,50 | 25,00  |
| 306209.0090.0600 | • 0,90 | 6,00 | 3     | 0,87 | 10° | 40 | 1,30 | 50,00  |
| 306209.0095.0250 | • 0,95 | 2,50 | 3     | –    | 10° | 40 | 2,50 | 25,00  |

| Art.             | d1 *   | l3    | d2 h6 | d3   | α   | l1 | l2   | €     |
|------------------|--------|-------|-------|------|-----|----|------|-------|
| 306209.0100.0300 | • 1,00 | 3,00  | 3     | –    | 10° | 40 | 3,00 | 23,00 |
| 306209.0100.0400 | • 1,00 | 4,00  | 3     | 0,95 | 10° | 40 | 1,50 | 39,00 |
| 306209.0100.0600 | • 1,00 | 6,00  | 3     | 0,95 | 10° | 40 | 1,50 | 39,00 |
| 306209.0100.0900 | • 1,00 | 9,00  | 3     | 0,95 | 10° | 40 | 1,50 | 50,00 |
| 306209.0100.1200 | • 1,00 | 12,00 | 3     | 0,95 | 10° | 60 | 1,50 | 60,00 |
| 306209.0105.0300 | • 1,05 | 3,00  | 3     | –    | 10° | 40 | 3,00 | 27,00 |
| 306209.0110.0300 | • 1,10 | 3,00  | 3     | –    | 10° | 40 | 3,00 | 27,00 |
| 306209.0115.0300 | • 1,15 | 3,00  | 3     | –    | 10° | 40 | 3,00 | 27,00 |
| 306209.0120.0400 | • 1,20 | 4,00  | 3     | –    | 10° | 40 | 4,00 | 27,00 |
| 306209.0120.0600 | • 1,20 | 6,00  | 3     | 1,15 | 10° | 40 | 1,80 | 39,00 |
| 306209.0120.0900 | • 1,20 | 9,00  | 3     | 1,15 | 10° | 40 | 1,80 | 50,00 |
| 306209.0125.0400 | • 1,25 | 4,00  | 3     | –    | 10° | 40 | 4,00 | 27,00 |
| 306209.0140.0400 | • 1,40 | 4,00  | 3     | –    | 10° | 40 | 4,00 | 27,00 |
| 306209.0140.0600 | • 1,40 | 6,00  | 3     | 1,35 | 10° | 40 | 2,00 | 39,00 |
| 306209.0140.0900 | • 1,40 | 9,00  | 3     | 1,35 | 10° | 40 | 2,00 | 50,00 |
| 306209.0150.0400 | • 1,50 | 4,00  | 3     | –    | 10° | 40 | 4,00 | 23,00 |
| 306209.0150.0600 | • 1,50 | 6,00  | 3     | 1,44 | 10° | 40 | 2,20 | 39,00 |
| 306209.0150.0900 | • 1,50 | 9,00  | 3     | 1,44 | 10° | 40 | 2,20 | 50,00 |
| 306209.0150.1200 | • 1,50 | 12,00 | 3     | 1,44 | 10° | 60 | 2,20 | 60,00 |
| 306209.0160.0500 | • 1,60 | 5,00  | 3     | –    | 10° | 40 | 5,00 | 27,00 |
| 306209.0180.0900 | • 1,80 | 9,00  | 3     | 1,74 | 10° | 40 | 2,70 | 50,00 |
| 306209.0180.1200 | • 1,80 | 12,00 | 3     | 1,74 | 10° | 40 | 2,70 | 52,00 |
| 306209.0190.0500 | • 1,90 | 5,00  | 3     | –    | 20° | 40 | 5,00 | 27,00 |
| 306209.0200.0500 | • 2,00 | 5,00  | 3     | –    | 20° | 40 | 5,00 | 25,00 |
| 306209.0200.0900 | • 2,00 | 9,00  | 3     | 1,92 | 20° | 40 | 3,00 | 50,00 |
| 306209.0200.1200 | • 2,00 | 12,00 | 3     | 1,92 | 20° | 40 | 3,00 | 52,00 |
| 306209.0200.1500 | • 2,00 | 15,00 | 3     | 1,92 | 20° | 60 | 3,00 | 60,00 |

Sonderabmessungen auf Anfrage! / Special dimensions upon enquiry!

Art. 30.6212 PROFESSIONAL VHM-Micro-Schaftfräser mit Eckenradius, polierte Schneiden < 25xD

- KUPFER copper
- MESSING brass
- ALU aluminium
- Ampco
- GOLD gold
- Kunststoff plastic
- MAKROLON
- Wachs Wax



- Solid carbide end mills, with corner radius, with highly polished flutes 2-25 x D
- VHM microfresa de mango, con radio angular, cuchillos pulidos 2-25xD
- Твердосплавная концевая микро-фреза, с угловым радиусом, полированные резцы 2-25xD

NEU / NEW

tol. r = -0,004

d1\* = Ø 0,2 - Ø 5,9 tol -0,001/-0,010

d1\* = Ø 6,0 tol -0,005/-0,020

MICRO GRAIN KARNASCH NORM

SPEZIAL DIN 6535 Form HA

30°

HSC HPC

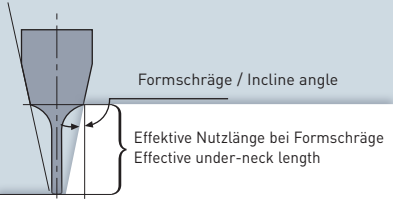
POLIERT POLISHED

MMKS

Schnittdaten  
Cutting data



i S. 254



| Art.               | d1*   | r - 0,004 | l3  | d2 h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|-------|-----------|-----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306212.0020.005.00 | • 0,2 | 0,05      | 0,5 | * 4   | 0,18 | 55 | 0,3 | 57,00 | 1,12  | 1,30  | 1,64  | 1,99  |
| 306212.0020.005.01 | • 0,2 | 0,05      | 1   | * 4   | 0,18 | 55 | 0,3 | 57,00 | 1,70  | 1,92  | 2,34  | 2,73  |
| 306212.0030.005.01 | • 0,3 | 0,05      | 1   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 1,70  | 1,92  | 2,34  | 2,73  |
| 306212.0030.005.02 | • 0,3 | 0,05      | 2   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306212.0030.005.03 | • 0,3 | 0,05      | 3   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306212.0030.005.05 | • 0,3 | 0,05      | 5   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 6,12  | 6,57  | 7,28  | 7,87  |
| 306212.0040.005.02 | • 0,4 | 0,05      | 2   | * 4   | 0,38 | 55 | 0,5 | 47,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306212.0040.005.04 | • 0,4 | 0,05      | 4   | * 4   | 0,38 | 55 | 0,5 | 47,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306212.0050.005.03 | • 0,5 | 0,05      | 3   | 4     | 0,48 | 55 | 0,6 | 39,00 | 3,94  | 4,30  | 4,89  | 5,40  |
| 306212.0050.005.04 | • 0,5 | 0,05      | 4   | * 4   | 0,48 | 55 | 0,6 | 39,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306212.0050.005.05 | • 0,5 | 0,05      | 5   | * 4   | 0,48 | 55 | 0,6 | 39,00 | 6,12  | 6,57  | 7,28  | 7,87  |
| 306212.0060.006.02 | • 0,6 | 0,06      | 2   | 4     | 0,58 | 55 | 0,8 | 34,00 | 2,83  | 3,13  | 3,64  | 4,09  |
| 306212.0060.006.04 | • 0,6 | 0,06      | 4   | 4     | 0,58 | 55 | 0,8 | 34,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306212.0060.006.06 | • 0,6 | 0,06      | 6   | 4     | 0,58 | 55 | 0,8 | 34,00 | 7,20  | 7,69  | 8,44  | 9,07  |
| 306212.0060.006.08 | • 0,6 | 0,06      | 8   | 4     | 0,58 | 55 | 0,8 | 34,00 | 9,35  | 9,90  | 10,74 | 11,43 |
| 306212.0070.007.06 | ▲ 0,7 | 0,07      | 6   | 4     | 0,68 | 55 | 0,9 | 34,00 | 7,24  | 7,72  | 8,46  | 9,08  |
| 306212.0070.007.10 | ▲ 0,7 | 0,07      | 10  | 4     | 0,68 | 55 | 0,9 | 34,00 | 11,51 | 12,11 | 13,02 | 13,76 |
| 306212.0080.008.04 | • 0,8 | 0,08      | 4   | 4     | 0,77 | 55 | 1,0 | 34,00 | 5,08  | 5,47  | 6,11  | 6,66  |
| 306212.0080.008.06 | • 0,8 | 0,08      | 6   | 4     | 0,77 | 55 | 1,0 | 34,00 | 7,24  | 7,72  | 8,46  | 9,08  |
| 306212.0080.008.08 | • 0,8 | 0,08      | 8   | 4     | 0,77 | 55 | 1,0 | 34,00 | 9,38  | 9,92  | 10,76 | 11,44 |
| 306212.0080.008.10 | • 0,8 | 0,08      | 10  | 4     | 0,77 | 55 | 1,0 | 34,00 | 11,51 | 12,11 | 13,02 | 13,75 |
| 306212.0090.009.06 | ▲ 0,9 | 0,09      | 6   | 4     | 0,87 | 55 | 1,1 | 34,00 | 7,24  | 7,71  | 8,46  | 9,08  |
| 306212.0090.009.12 | ▲ 0,9 | 0,09      | 12  | 4     | 0,87 | 55 | 1,1 | 34,00 | 13,63 | 14,28 | 15,25 | 16,04 |
| 306212.0100.010.03 | • 1,0 | 0,10      | 3   | 4     | 0,95 | 55 | 1,2 | 34,00 | 4,09  | 4,41  | 4,96  | 5,45  |
| 306212.0100.010.05 | • 1,0 | 0,10      | 5   | 4     | 0,95 | 55 | 1,2 | 34,00 | 6,25  | 6,67  | 7,34  | 7,92  |
| 306212.0100.010.07 | • 1,0 | 0,10      | 7   | 4     | 0,95 | 55 | 1,2 | 34,00 | 8,39  | 8,88  | 9,65  | 10,30 |
| 306212.0100.010.10 | • 1,0 | 0,10      | 10  | 4     | 0,95 | 55 | 1,2 | 34,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306212.0100.010.12 | • 1,0 | 0,10      | 12  | 4     | 0,95 | 55 | 1,2 | 34,00 | 13,69 | 14,32 | 15,29 | 16,06 |
| 306212.0100.010.15 | • 1,0 | 0,10      | 15  | 4     | 0,95 | 55 | 1,2 | 34,00 | 16,84 | 17,55 | 18,60 | 19,44 |
| 306212.0100.010.20 | • 1,0 | 0,10      | 20  | 4     | 0,95 | 55 | 1,2 | 34,00 | 22,07 | 22,88 | 24,06 | 24,98 |
| 306212.0100.010.25 | • 1,0 | 0,10      | 25  | 4     | 0,95 | 60 | 1,2 | 34,00 | 27,27 | 28,17 | 29,46 | -     |
| 306212.0100.030.05 | • 1,0 | 0,30      | 5   | 4     | 0,95 | 55 | 1,2 | 34,00 | 6,24  | 6,64  | 7,31  | 7,87  |
| 306212.0100.030.10 | • 1,0 | 0,30      | 10  | 4     | 0,95 | 55 | 1,2 | 34,00 | 11,57 | 12,14 | 13,03 | 13,75 |
| 306212.0100.030.15 | • 1,0 | 0,30      | 15  | 4     | 0,95 | 55 | 1,2 | 34,00 | 16,83 | 17,53 | 18,58 | 19,41 |

\* Ø 0,2 - Ø 0,5 - Laufende Produktion wird geändert auf Schaft d2 h5 4 mm  
\* Ø 0,2 - Ø 0,5 - Running production changed the shank to d2 h5 4 mm

| Art.               |   | d1* | r - 0,004 | l3 | d2 h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|---|-----|-----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306212.0120.012.06 | • | 1,2 | 0,12      | 6  | 4     | 1,15 | 55 | 1,4 | 34,00 | 7,32  | 7,77  | 8,50  | 9,11  |
| 306212.0120.012.08 | • | 1,2 | 0,12      | 8  | 4     | 1,15 | 55 | 1,4 | 34,00 | 9,46  | 9,98  | 10,79 | 11,47 |
| 306212.0120.012.10 | • | 1,2 | 0,12      | 10 | 4     | 1,15 | 55 | 1,4 | 34,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306212.0120.012.12 | • | 1,2 | 0,12      | 12 | 4     | 1,15 | 55 | 1,4 | 34,00 | 13,69 | 14,32 | 15,28 | 16,06 |
| 306212.0120.012.18 | • | 1,2 | 0,12      | 18 | 4     | 1,15 | 55 | 1,4 | 34,00 | 19,98 | 20,75 | 21,88 | 22,77 |
| 306212.0120.012.25 | ▲ | 1,2 | 0,12      | 25 | 4     | 1,15 | 60 | 1,4 | 34,00 | 27,27 | 28,17 | 29,46 | —     |
| 306212.0140.014.08 | ▲ | 1,4 | 0,14      | 8  | 4     | 1,35 | 55 | 1,6 | 34,00 | 9,45  | 9,97  | 10,79 | 11,46 |
| 306212.0140.014.16 | ▲ | 1,4 | 0,14      | 16 | 4     | 1,35 | 55 | 1,6 | 34,00 | 17,89 | 18,61 | 19,70 | 20,55 |
| 306212.0150.015.04 | • | 1,5 | 0,15      | 4  | 4     | 1,44 | 55 | 1,8 | 34,00 | 5,22  | 5,57  | 6,18  | 6,71  |
| 306212.0150.015.06 | • | 1,5 | 0,15      | 6  | 4     | 1,44 | 55 | 1,8 | 34,00 | 7,36  | 7,80  | 8,52  | 9,12  |
| 306212.0150.015.08 | • | 1,5 | 0,15      | 8  | 4     | 1,44 | 55 | 1,8 | 34,00 | 9,49  | 10,00 | 10,81 | 11,48 |
| 306212.0150.015.10 | • | 1,5 | 0,15      | 10 | 4     | 1,44 | 55 | 1,8 | 34,00 | 11,61 | 12,18 | 13,06 | 13,79 |
| 306212.0150.015.12 | • | 1,5 | 0,15      | 12 | 4     | 1,44 | 55 | 1,8 | 34,00 | 13,72 | 14,34 | 15,30 | 16,07 |
| 306212.0150.015.16 | • | 1,5 | 0,15      | 16 | 4     | 1,44 | 55 | 1,8 | 34,00 | 17,91 | 18,63 | 19,71 | 20,56 |
| 306212.0150.015.20 | • | 1,5 | 0,15      | 20 | 4     | 1,44 | 55 | 1,8 | 34,00 | 22,09 | 22,89 | 24,07 | —     |
| 306212.0150.030.06 | ▲ | 1,5 | 0,30      | 6  | 4     | 1,44 | 55 | 1,8 | 34,00 | 7,35  | 7,79  | 8,49  | 9,09  |
| 306212.0150.030.12 | ▲ | 1,5 | 0,30      | 12 | 4     | 1,44 | 55 | 1,8 | 34,00 | 13,71 | 14,33 | 15,28 | 16,05 |
| 306212.0160.016.08 | ▲ | 1,6 | 0,16      | 8  | 4     | 1,54 | 55 | 1,9 | 34,00 | 9,49  | 10,00 | 10,81 | 11,47 |
| 306212.0160.016.16 | ▲ | 1,6 | 0,16      | 16 | 4     | 1,54 | 55 | 1,9 | 34,00 | 17,91 | 18,63 | 19,71 | 20,56 |
| 306212.0200.020.05 | • | 2,0 | 0,20      | 5  | 4     | 1,92 | 65 | 2,0 | 34,00 | 6,37  | 6,75  | 7,40  | 7,95  |
| 306212.0200.020.08 | • | 2,0 | 0,20      | 8  | 4     | 1,92 | 65 | 2,0 | 34,00 | 9,55  | 10,05 | 10,84 | 11,50 |
| 306212.0200.020.10 | • | 2,0 | 0,20      | 10 | 4     | 1,92 | 65 | 2,0 | 34,00 | 11,67 | 12,22 | 13,09 | 13,81 |
| 306212.0200.020.12 | • | 2,0 | 0,20      | 12 | 4     | 1,92 | 65 | 2,0 | 34,00 | 13,77 | 14,38 | 15,32 | 16,09 |
| 306212.0200.020.15 | • | 2,0 | 0,20      | 15 | 4     | 1,92 | 65 | 2,0 | 34,00 | 16,92 | 17,60 | 18,63 | —     |
| 306212.0200.020.20 | • | 2,0 | 0,20      | 20 | 4     | 1,92 | 65 | 2,0 | 34,00 | 22,14 | 22,92 | 24,09 | —     |
| 306212.0200.020.25 | • | 2,0 | 0,20      | 25 | 4     | 1,92 | 75 | 2,0 | 35,00 | 27,34 | 28,21 | —     | —     |
| 306212.0200.020.30 | • | 2,0 | 0,20      | 30 | 4     | 1,92 | 75 | 2,0 | 35,00 | 32,52 | 33,47 | —     | —     |
| 306212.0200.030.10 | ▲ | 2,0 | 0,30      | 10 | 4     | 1,92 | 65 | 2,0 | 34,00 | 11,66 | 12,21 | 13,08 | 13,79 |
| 306212.0200.030.15 | ▲ | 2,0 | 0,30      | 15 | 4     | 1,92 | 65 | 2,0 | 34,00 | 16,91 | 17,59 | 18,62 | —     |
| 306212.0200.030.20 | ▲ | 2,0 | 0,30      | 20 | 4     | 1,92 | 65 | 2,0 | 34,00 | 22,13 | 22,92 | 24,08 | —     |
| 306212.0200.050.10 | • | 2,0 | 0,50      | 10 | 4     | 1,92 | 65 | 2,0 | 34,00 | 11,65 | 12,20 | 13,06 | 13,76 |
| 306212.0200.050.15 | • | 2,0 | 0,50      | 15 | 4     | 1,92 | 65 | 2,0 | 34,00 | 16,91 | 17,58 | 18,60 | 19,42 |
| 306212.0200.050.20 | • | 2,0 | 0,50      | 20 | 4     | 1,92 | 65 | 2,0 | 34,00 | 22,13 | 22,90 | 24,06 | —     |
| 306212.0250.025.10 | ▲ | 2,5 | 0,25      | 10 | 4     | 2,42 | 65 | 2,5 | 35,00 | 11,73 | 12,26 | 13,12 | 13,83 |
| 306212.0250.025.20 | ▲ | 2,5 | 0,25      | 20 | 4     | 2,42 | 65 | 2,5 | 35,00 | 22,18 | 22,95 | —     | —     |
| 306212.0300.030.10 | • | 3,0 | 0,30      | 10 | 4     | 2,90 | 65 | 3,0 | 35,00 | 11,72 | 12,26 | 13,11 | —     |
| 306212.0300.030.15 | • | 3,0 | 0,30      | 15 | 4     | 2,90 | 65 | 3,0 | 35,00 | 16,97 | 17,63 | —     | —     |
| 306212.0300.030.20 | • | 3,0 | 0,30      | 20 | 4     | 2,90 | 65 | 3,0 | 35,00 | 22,18 | 22,95 | —     | —     |
| 306212.0300.030.25 | • | 3,0 | 0,30      | 25 | 4     | 2,90 | 75 | 3,0 | 40,00 | 27,38 | 28,23 | —     | —     |
| 306212.0300.030.30 | • | 3,0 | 0,30      | 30 | 4     | 2,90 | 75 | 3,0 | 40,00 | 32,55 | —     | —     | —     |
| 306212.0300.050.15 | • | 3,0 | 0,50      | 15 | 4     | 2,90 | 65 | 3,0 | 35,00 | 16,96 | 17,62 | —     | —     |
| 306212.0300.050.20 | • | 3,0 | 0,50      | 20 | 4     | 2,90 | 65 | 3,0 | 35,00 | 22,17 | 22,94 | —     | —     |
| 306212.0400.030.10 | • | 4,0 | 0,30      | 10 | 6     | 3,90 | 65 | 4,0 | 37,00 | 11,72 | 12,26 | 13,11 | 13,82 |
| 306212.0400.030.15 | • | 4,0 | 0,30      | 15 | 6     | 3,90 | 65 | 4,0 | 37,00 | 16,97 | 17,63 | 18,65 | —     |
| 306212.0400.030.20 | • | 4,0 | 0,30      | 20 | 6     | 3,90 | 65 | 4,0 | 37,00 | 22,18 | 22,95 | 24,10 | —     |
| 306212.0400.030.25 | • | 4,0 | 0,30      | 25 | 6     | 3,90 | 75 | 4,0 | 38,00 | 27,38 | 28,23 | —     | —     |
| 306212.0400.030.30 | • | 4,0 | 0,30      | 30 | 6     | 3,90 | 75 | 4,0 | 38,00 | 32,55 | —     | —     | —     |
| 306212.0400.050.20 | • | 4,0 | 0,50      | 20 | 6     | 3,90 | 65 | 4,0 | 37,00 | 22,17 | 22,94 | 24,09 | —     |
| 306212.0400.050.30 | • | 4,0 | 0,50      | 30 | 6     | 3,90 | 75 | 4,0 | 38,00 | 32,55 | 33,48 | —     | —     |
| 306212.0500.030.20 | • | 5,0 | 0,30      | 20 | 6     | 4,90 | 65 | 5,0 | 37,00 | 22,17 | 22,94 | —     | —     |
| 306212.0500.030.30 | • | 5,0 | 0,30      | 30 | 6     | 4,90 | 75 | 5,0 | 38,00 | 32,55 | —     | —     | —     |
| 306212.0500.030.40 | • | 5,0 | 0,30      | 40 | 6     | 4,90 | 90 | 5,0 | 41,00 | 42,87 | —     | —     | —     |
| 306212.0500.050.20 | ▲ | 5,0 | 0,50      | 20 | 6     | 4,90 | 65 | 5,0 | 37,00 | 22,17 | 22,94 | —     | —     |
| 306212.0600.030.20 | • | 6,0 | 0,30      | 20 | 6     | 5,90 | 65 | 6,0 | 37,00 | —     | —     | —     | —     |
| 306212.0600.030.30 | • | 6,0 | 0,30      | 30 | 6     | 5,90 | 75 | 6,0 | 38,00 | —     | —     | —     | —     |
| 306212.0600.030.40 | • | 6,0 | 0,30      | 40 | 6     | 5,90 | 90 | 6,0 | 41,00 | —     | —     | —     | —     |
| 306212.0600.030.50 | • | 6,0 | 0,30      | 50 | 6     | 5,90 | 90 | 6,0 | 41,00 | —     | —     | —     | —     |
| 306212.0600.050.20 | • | 6,0 | 0,50      | 20 | 6     | 5,90 | 65 | 6,0 | 37,00 | —     | —     | —     | —     |
| 306212.0600.050.30 | • | 6,0 | 0,50      | 30 | 6     | 5,90 | 75 | 6,0 | 38,00 | —     | —     | —     | —     |
| 306212.0600.060.20 | ▲ | 6,0 | 0,60      | 20 | 6     | 5,90 | 65 | 6,0 | 37,00 | —     | —     | —     | —     |
| 306212.0600.060.30 | ▲ | 6,0 | 0,60      | 30 | 6     | 5,90 | 75 | 6,0 | 38,00 | —     | —     | —     | —     |
| 306212.0600.100.25 | • | 6,0 | 1,00      | 25 | 6     | 5,90 | 65 | 6,0 | 38,00 | —     | —     | —     | —     |

30.6212 - Ø 1,0 x 15 r=0,1

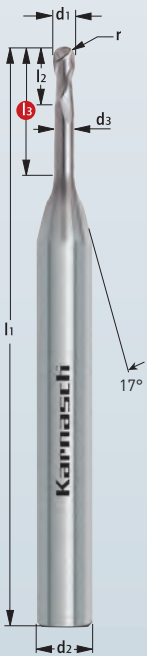
Stirnseitig  
On the front side



100-fache Vergrößerung  
100-times magnification

Art. **30.6213** **PROFESSIONAL** VHM-Micro-3D-Radiusfräser mit Kugelstirn, polierte Schneiden < 25xD

- KUPFER  
copper
- MESSING  
brass
- ALU  
aluminium
- Ampco
- GOLD  
gold
- Kunststoff  
plastic
- MAKROLON
- Wachs  
Wax



- Solid Carbide ball nose end mills with highly polished flutes 2-25xD
- Microfresa metal duro de radio de 3D, con frente esférico, cuchillos pulidos 2-25xD
- Твердосплавная радиусная микро-фреза 3D, с шаровым торцом, полированные резцы 2-25xD

**NEU / NEW**

tol. r = ± 0,003

d1\* = Ø 0,1 - Ø 5,9 tol -0,001 / -0,010

d1\* = Ø 6,0 tol -0,005 / -0,020

**MICRO GRAIN** KARNASCH NORM

**SPEZIAL** DIN 6535 Form HA

30°

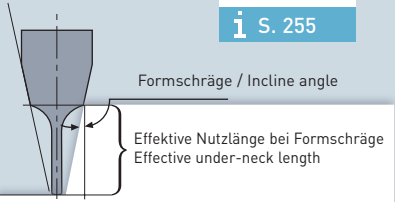
HSC HPC

POLIERT POLISHED

MMKS

Schnittdaten  
Cutting data

i S. 255



| Art.            | d1*   | r ± 0,003 | l3  | d2 h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|-----------|-----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306213.0020.005 | • 0,2 | 0,10      | 0,5 | * 4   | 0,18 | 55 | 0,3 | 57,00 | 1,11  | 1,28  | 1,62  | 1,96  |
| 306213.0020.01  | • 0,2 | 0,10      | 1   | * 4   | 0,18 | 55 | 0,3 | 57,00 | 1,69  | 1,91  | 2,32  | 2,71  |
| 306213.0030.01  | • 0,3 | 0,15      | 1   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 1,68  | 1,90  | 2,30  | 2,68  |
| 306213.0030.02  | • 0,3 | 0,15      | 2   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 2,81  | 3,11  | 3,61  | 4,06  |
| 306213.0030.03  | • 0,3 | 0,15      | 3   | * 4   | 0,28 | 55 | 0,4 | 47,00 | 9,93  | 4,28  | 4,86  | 5,36  |
| 306213.0030.05  | • 0,3 | 0,15      | 5   | * 4   | 0,28 | 55 | 0,5 | 47,00 | 6,11  | 6,56  | 7,26  | 7,85  |
| 306213.0040.02  | • 0,4 | 0,20      | 2   | * 4   | 0,38 | 55 | 0,5 | 47,00 | 2,81  | 3,10  | 3,60  | 4,05  |
| 306213.0040.04  | • 0,4 | 0,20      | 4   | * 4   | 0,38 | 55 | 0,5 | 47,00 | 5,02  | 5,42  | 6,06  | 6,61  |
| 306213.0040.06  | • 0,4 | 0,20      | 6   | * 4   | 0,38 | 55 | 0,5 | 47,00 | 7,19  | 7,67  | 8,42  | 9,04  |
| 306213.0050.03  | • 0,5 | 0,25      | 3   | * 4   | 0,48 | 55 | 0,6 | 39,00 | 3,92  | 4,26  | 4,84  | 5,34  |
| 306213.0050.04  | • 0,5 | 0,25      | 4   | * 4   | 0,48 | 55 | 0,6 | 39,00 | 5,01  | 5,41  | 6,05  | 6,59  |
| 306213.0050.05  | • 0,5 | 0,25      | 5   | * 4   | 0,48 | 55 | 0,6 | 39,00 | 6,10  | 6,54  | 7,24  | 7,82  |
| 306213.0060.02  | • 0,6 | 0,30      | 2   | 4     | 0,58 | 55 | 0,8 | 34,00 | 2,80  | 3,08  | 3,57  | 4,01  |
| 306213.0060.04  | • 0,6 | 0,30      | 4   | 4     | 0,58 | 55 | 0,8 | 34,00 | 5,01  | 5,40  | 6,04  | 6,58  |
| 306213.0060.06  | • 0,6 | 0,30      | 6   | 4     | 0,58 | 55 | 0,8 | 34,00 | 7,18  | 7,66  | 8,40  | 9,02  |
| 306213.0060.08  | • 0,6 | 0,30      | 8   | 4     | 0,58 | 55 | 0,8 | 34,00 | 9,33  | 9,87  | 10,71 | 11,39 |
| 306213.0080.04  | • 0,8 | 0,40      | 4   | 4     | 0,77 | 55 | 1,0 | 34,00 | 5,05  | 5,43  | 6,05  | 6,58  |
| 306213.0080.06  | • 0,8 | 0,40      | 6   | 4     | 0,77 | 55 | 1,0 | 34,00 | 7,22  | 7,68  | 8,41  | 9,02  |
| 306213.0080.08  | • 0,8 | 0,40      | 8   | 4     | 0,77 | 55 | 1,0 | 34,00 | 9,36  | 9,89  | 10,71 | 11,39 |
| 306213.0080.10  | • 0,8 | 0,40      | 10  | 4     | 0,77 | 55 | 1,0 | 34,00 | 11,49 | 12,08 | 12,98 | 13,71 |
| 306213.0090.06  | ▲ 0,9 | 0,45      | 6   | 4     | 0,87 | 55 | 1,1 | 34,00 | 7,21  | 7,67  | 8,40  | 9,01  |
| 306213.0100.03  | • 1,0 | 0,50      | 3   | 4     | 0,95 | 55 | 1,2 | 34,00 | 4,06  | 4,36  | 4,88  | 5,35  |
| 306213.0100.05  | • 1,0 | 0,50      | 5   | 4     | 0,95 | 55 | 1,2 | 34,00 | 6,22  | 6,62  | 7,27  | 7,83  |
| 306213.0100.07  | • 1,0 | 0,50      | 7   | 4     | 0,95 | 55 | 1,2 | 34,00 | 8,37  | 8,84  | 9,60  | 10,23 |
| 306213.0100.10  | • 1,0 | 0,50      | 10  | 4     | 0,95 | 55 | 1,2 | 34,00 | 11,55 | 12,12 | 13,00 | 13,72 |
| 306213.0100.12  | • 1,0 | 0,50      | 12  | 4     | 0,95 | 55 | 1,2 | 34,00 | 13,67 | 14,29 | 15,24 | 16,01 |
| 306213.0100.15  | • 1,0 | 0,50      | 15  | 4     | 0,95 | 55 | 1,2 | 34,00 | 16,82 | 17,52 | 18,56 | 19,39 |
| 306213.0100.20  | • 1,0 | 0,50      | 20  | 4     | 0,95 | 55 | 1,2 | 34,00 | 22,05 | 22,85 | 24,03 | 24,94 |
| 306213.0100.25  | • 1,0 | 0,50      | 25  | 4     | 0,95 | 60 | 1,2 | 34,00 | 27,26 | 28,15 | 29,43 | -     |
| 306213.0120.06  | ▲ 1,2 | 0,60      | 6   | 4     | 1,15 | 55 | 1,4 | 34,00 | 7,29  | 7,72  | 8,42  | 9,02  |
| 306213.0120.08  | • 1,2 | 0,60      | 8   | 4     | 1,15 | 55 | 1,4 | 34,00 | 9,42  | 9,93  | 10,73 | 11,38 |
| 306213.0120.10  | • 1,2 | 0,60      | 10  | 4     | 1,15 | 55 | 1,4 | 34,00 | 11,55 | 12,11 | 12,99 | 13,71 |
| 306213.0120.12  | • 1,2 | 0,60      | 12  | 4     | 1,15 | 55 | 1,4 | 34,00 | 13,66 | 14,28 | 15,23 | 15,99 |
| 306213.0120.18  | ▲ 1,2 | 0,60      | 18  | 4     | 1,15 | 55 | 1,4 | 34,00 | 19,96 | 20,72 | 21,84 | 22,72 |
| 306213.0120.25  | ▲ 1,2 | 0,60      | 25  | 4     | 1,15 | 60 | 1,4 | 34,00 | 27,26 | 28,14 | 29,42 | -     |

\* Ø 0,2 - Ø 0,5 – Laufende Produktion wird geändert auf Schaft d2 h5 4 mm  
\* Ø 0,2 - Ø 0,5 – Running production changed the shank to d2 h5 4 mm



| Art.           | d1*   | r ± 0,003 | l3 | d2 h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|----------------|-------|-----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306213.0140.08 | ▲ 1,4 | 0,70      | 8  | 4     | 1,35 | 55 | 1,6 | 34,00 | 9,42  | 9,92  | 10,71 | 11,37 |
| 306213.0140.16 | ▲ 1,4 | 0,70      | 16 | 4     | 1,35 | 55 | 1,6 | 34,00 | 17,86 | 18,57 | 19,64 | 20,48 |
| 306213.0150.04 | ● 1,5 | 0,75      | 4  | 4     | 1,44 | 55 | 1,8 | 34,00 | 5,17  | 5,50  | 6,07  | 6,57  |
| 306213.0150.06 | ● 1,5 | 0,75      | 6  | 4     | 1,44 | 55 | 1,8 | 34,00 | 7,32  | 7,74  | 8,42  | 9,01  |
| 306213.0150.08 | ● 1,5 | 0,75      | 8  | 4     | 1,44 | 55 | 1,8 | 34,00 | 9,45  | 9,94  | 10,72 | 11,38 |
| 306213.0150.10 | ● 1,5 | 0,75      | 10 | 4     | 1,44 | 55 | 1,8 | 34,00 | 11,57 | 12,13 | 12,99 | 13,70 |
| 306213.0150.12 | ● 1,5 | 0,75      | 12 | 4     | 1,44 | 55 | 1,8 | 34,00 | 13,68 | 14,29 | 15,23 | 15,99 |
| 306213.0150.16 | ● 1,5 | 0,75      | 16 | 4     | 1,44 | 55 | 1,8 | 34,00 | 17,89 | 18,59 | 19,65 | 20,49 |
| 306213.0150.20 | ● 1,5 | 0,75      | 20 | 4     | 1,44 | 55 | 1,8 | 34,00 | 22,07 | 22,85 | 24,02 | –     |
| 306213.0150.25 | ● 1,5 | 0,75      | 25 | 4     | 1,44 | 60 | 1,8 | 34,00 | 27,27 | 28,15 | 29,42 | –     |
| 306213.0160.08 | ▲ 1,6 | 0,80      | 8  | 4     | 1,54 | 55 | 1,9 | 34,00 | 9,45  | 9,94  | 10,72 | 11,37 |
| 306213.0160.16 | ▲ 1,6 | 0,80      | 16 | 4     | 1,54 | 55 | 1,9 | 34,00 | 17,88 | 18,59 | 19,65 | 20,48 |
| 306213.0180.10 | ▲ 1,8 | 0,90      | 10 | 4     | 1,74 | 65 | 2,0 | 34,00 | 11,56 | 12,11 | 12,97 | 13,67 |
| 306213.0200.05 | ● 2,0 | 1,00      | 5  | 4     | 1,92 | 65 | 2,0 | 34,00 | 6,31  | 6,66  | 7,26  | 7,78  |
| 306213.0200.08 | ● 2,0 | 1,00      | 8  | 4     | 1,92 | 65 | 2,0 | 34,00 | 9,51  | 9,97  | 10,73 | 11,37 |
| 306213.0200.10 | ● 2,0 | 1,00      | 10 | 4     | 1,92 | 65 | 2,0 | 34,00 | 11,62 | 12,15 | 12,99 | 13,69 |
| 306213.0200.12 | ● 2,0 | 1,00      | 12 | 4     | 1,92 | 65 | 2,0 | 34,00 | 13,73 | 14,32 | 15,23 | 15,98 |
| 306213.0200.15 | ● 2,0 | 1,00      | 15 | 4     | 1,92 | 65 | 2,0 | 34,00 | 16,88 | 17,54 | 18,55 | 19,36 |
| 306213.0200.20 | ● 2,0 | 1,00      | 20 | 4     | 1,92 | 65 | 2,0 | 34,00 | 22,11 | 22,87 | 24,02 | –     |
| 306213.0200.25 | ● 2,0 | 1,00      | 25 | 4     | 1,92 | 75 | 2,0 | 35,00 | 27,31 | 28,17 | –     | –     |
| 306213.0200.30 | ● 2,0 | 1,00      | 30 | 4     | 1,92 | 75 | 2,0 | 35,00 | 32,49 | 33,43 | –     | –     |
| 306213.0250.10 | ▲ 2,5 | 1,25      | 10 | 4     | 2,42 | 65 | 2,5 | 34,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306213.0250.20 | ▲ 2,5 | 1,25      | 20 | 4     | 2,42 | 65 | 2,5 | 34,00 | 22,09 | 22,86 | –     | –     |
| 306213.0300.05 | ● 3,0 | 1,50      | 5  | 4     | 2,90 | 65 | 3,0 | 35,00 | 6,36  | 6,67  | 7,22  | 7,72  |
| 306213.0300.10 | ● 3,0 | 1,50      | 10 | 4     | 2,90 | 65 | 3,0 | 35,00 | 11,66 | 12,16 | 12,97 | –     |
| 306213.0300.15 | ● 3,0 | 1,50      | 15 | 4     | 2,90 | 65 | 3,0 | 35,00 | 16,91 | 17,55 | –     | –     |
| 306213.0300.20 | ● 3,0 | 1,50      | 20 | 4     | 2,90 | 65 | 3,0 | 35,00 | 22,13 | 22,88 | –     | –     |
| 306213.0300.25 | ● 3,0 | 1,50      | 25 | 4     | 2,90 | 75 | 3,0 | 40,00 | 27,33 | 28,17 | –     | –     |
| 306213.0300.30 | ● 3,0 | 1,50      | 30 | 4     | 2,90 | 75 | 3,0 | 40,00 | 32,51 | –     | –     | –     |
| 306213.0400.10 | ● 4,0 | 2,00      | 10 | 6     | 3,90 | 65 | 4,0 | 37,00 | 11,63 | 12,12 | 12,90 | 13,56 |
| 306213.0400.15 | ● 4,0 | 2,00      | 15 | 6     | 3,90 | 65 | 4,0 | 37,00 | 16,89 | 17,51 | 18,48 | –     |
| 306213.0400.20 | ● 4,0 | 2,00      | 20 | 6     | 3,90 | 65 | 4,0 | 37,00 | 22,11 | 22,85 | 23,96 | –     |
| 306213.0400.25 | ● 4,0 | 2,00      | 25 | 6     | 3,90 | 75 | 4,0 | 38,00 | 27,31 | 28,14 | –     | –     |
| 306213.0400.30 | ● 4,0 | 2,00      | 30 | 6     | 3,90 | 75 | 4,0 | 38,00 | 32,49 | 33,41 | –     | –     |
| 306213.0500.10 | ▲ 5,0 | 2,50      | 10 | 6     | 4,90 | 65 | 5,0 | 37,00 | 11,60 | 12,07 | 12,84 | –     |
| 306213.0500.20 | ● 5,0 | 2,50      | 20 | 6     | 4,90 | 65 | 5,0 | 37,00 | 22,09 | 22,82 | –     | –     |
| 306213.0500.30 | ● 5,0 | 2,50      | 30 | 6     | 4,90 | 75 | 5,0 | 38,00 | 32,48 | –     | –     | –     |
| 306213.0500.40 | ● 5,0 | 2,50      | 40 | 6     | 4,90 | 90 | 5,0 | 41,00 | 42,81 | –     | –     | –     |
| 306213.0600.10 | ▲ 6,0 | 3,00      | 10 | 6     | 5,90 | 65 | 6,0 | 37,00 | –     | –     | –     | –     |
| 306213.0600.20 | ● 6,0 | 3,00      | 20 | 6     | 5,90 | 65 | 6,0 | 37,00 | –     | –     | –     | –     |
| 306213.0600.30 | ● 6,0 | 3,00      | 30 | 6     | 5,90 | 75 | 6,0 | 38,00 | –     | –     | –     | –     |
| 306213.0600.40 | ● 6,0 | 3,00      | 40 | 6     | 5,90 | 90 | 6,0 | 41,00 | –     | –     | –     | –     |
| 306213.0600.50 | ● 6,0 | 3,00      | 50 | 6     | 5,90 | 90 | 6,0 | 41,00 | –     | –     | –     | –     |



Art. 30.6215 VHM-Schaftfräser mit Eckenradius, lang

ALU  
aluminium

Kunststoff  
plastic

ALU  
< 6% Si

MAKROLON

ALU  
< 12% Si

UHMW  
PE

MESSING  
brass

Wachs  
Wax

KUPFER  
copper

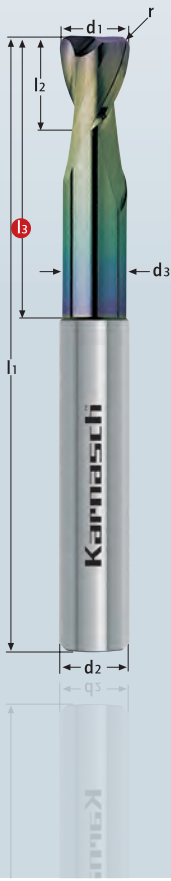
Ampco

TITAN

Nickel  
< 500  
N/mm<sup>2</sup>

Bronze  
Brass

GFK-CFK  
GFK-CFK



- Solid Carbide end mills with corner radius, long
- Fresa de metal duro mango con radio angular, larga
- Твердосплавная концевая фреза с угловым радиусом, длинная

| Art.           | Ød1 e8 | r ± 0,01 | l3 | d2 h5 | d3   | l1  | l2 | €      |
|----------------|--------|----------|----|-------|------|-----|----|--------|
| 306215.0100.01 | • 1    | 0,1      | 15 | 4     | 0,9  | 60  | 2  | 51,00  |
| 306215.0200.02 | • 2    | 0,2      | 20 | 4     | 1,8  | 60  | 3  | 51,00  |
| 306215.0300.03 | • 3    | 0,3      | 20 | 4     | 2,7  | 60  | 5  | 48,00  |
| 306215.0400.04 | • 4    | 0,4      | 20 | 4     | 3,7  | 60  | 5  | 46,00  |
| 306215.0500.05 | • 5    | 0,5      | 20 | 5     | 4,6  | 60  | 6  | 47,00  |
| 306215.0600.03 | • 6    | 0,3      | 25 | 6     | 5,5  | 65  | 7  | 49,00  |
| 306215.0600.10 | • 6    | 1,0      | 25 | 6     | 5,5  | 65  | 7  | 49,00  |
| 306215.0800.03 | • 8    | 0,3      | 30 | 8     | 7,4  | 70  | 9  | 63,00  |
| 306215.0800.10 | • 8    | 1,0      | 30 | 8     | 7,4  | 70  | 9  | 63,00  |
| 306215.1000.03 | • 10   | 0,3      | 40 | 10    | 9,2  | 85  | 11 | 85,00  |
| 306215.1000.15 | • 10   | 1,5      | 40 | 10    | 9,2  | 85  | 11 | 85,00  |
| 306215.1200.05 | • 12   | 0,5      | 45 | 12    | 11,0 | 92  | 12 | 111,00 |
| 306215.1200.15 | • 12   | 1,5      | 45 | 12    | 11,0 | 92  | 12 | 111,00 |
| 306215.1600.05 | • 16   | 0,5      | 55 | 16    | 15,0 | 110 | 16 | 189,00 |
| 306215.1600.20 | • 16   | 2,0      | 55 | 16    | 15,0 | 110 | 16 | 189,00 |

MICRO  
GRAIN

KARNASCH  
NORM

W

DIN 6535  
Form HA

HSC  
HPC

NHC  
7000

Schnittdaten  
Cutting data



i S. 306

Art. 30.6217 VHM-3D-Radiusfräser mit Kugelstirn, lang

ALU  
aluminium

Kunststoff  
plastic

ALU  
< 6% Si

MAKROLON

ALU  
< 12% Si

UHMW  
PE

MESSING  
brass

Wachs  
Wax

KUPFER  
copper

Ampco

TITAN

Nickel  
< 500  
N/mm<sup>2</sup>

Bronze  
Brass

GFK-CFK  
GFK-CFK



- Solid carbide ball nose end mills, long
- VHM fresa de radio con frente esférico, larga
- Твердосплавная концевая фреза с шаровым торцом, длинная

d1\* = Ø 1,0 - Ø 12,0 tol -0,004 / -0,012

| Art.           | Ød1 *  | r ± 0,004 | l3 | d2 h5 | d3    | l1  | l2  | α  | €      |
|----------------|--------|-----------|----|-------|-------|-----|-----|----|--------|
| 306217.0100.05 | • 1,0  | 0,5       | 5  | 6     | 0,95  | 60  | 1   | 12 | 43,00  |
| 306217.0100.10 | • 1,0  | 0,5       | 10 | 6     | 0,95  | 60  | 1   | 12 | 43,00  |
| 306217.0100.14 | • 1,0  | 0,5       | 14 | 4     | 0,95  | 45  | 0,7 | 12 | 37,00  |
| 306217.0100.15 | • 1,0  | 0,5       | 15 | 6     | 0,95  | 60  | 1   | 12 | 43,00  |
| 306217.0100.18 | • 1,0  | 0,5       | 18 | 4     | 0,95  | 45  | 0,7 | 12 | 37,00  |
| 306217.0200.05 | • 2,0  | 1,0       | 5  | 6     | 1,95  | 60  | 2   | 12 | 43,00  |
| 306217.0200.10 | • 2,0  | 1,0       | 10 | 6     | 1,95  | 60  | 2   | 12 | 43,00  |
| 306217.0200.14 | • 2,0  | 1,0       | 14 | 4     | 1,95  | 45  | 1,2 | 12 | 37,00  |
| 306217.0200.15 | • 2,0  | 1,0       | 15 | 6     | 1,95  | 60  | 2   | 12 | 43,00  |
| 306217.0200.18 | • 2,0  | 1,0       | 18 | 4     | 1,95  | 45  | 1,2 | 12 | 37,00  |
| 306217.0200.20 | • 2,0  | 1,0       | 20 | 6     | 1,95  | 60  | 2   | 12 | 43,00  |
| 306217.0300.14 | • 3,0  | 1,5       | 14 | 4     | 2,90  | 45  | 1,7 | 12 | 38,00  |
| 306217.0300.18 | • 3,0  | 1,5       | 18 | 4     | 2,90  | 45  | 1,7 | 12 | 38,00  |
| 306217.0300.25 | • 3,0  | 1,5       | 25 | 6     | 2,90  | 70  | 3   | 12 | 46,00  |
| 306217.0400.14 | • 4,0  | 2,0       | 14 | 6     | 3,90  | 45  | 2,2 | 12 | 43,00  |
| 306217.0400.18 | • 4,0  | 2,0       | 18 | 6     | 3,90  | 45  | 2,2 | 12 | 43,00  |
| 306217.0400.25 | • 4,0  | 2,0       | 25 | 6     | 3,90  | 70  | 4   | 12 | 47,00  |
| 306217.0600.30 | • 6,0  | 3,0       | 30 | 6     | 5,80  | 80  | 6   | 12 | 47,00  |
| 306217.0800.35 | • 8,0  | 4,0       | 35 | 8     | 7,80  | 80  | 8   | 12 | 65,00  |
| 306217.1000.40 | • 10,0 | 5,0       | 40 | 10    | 9,70  | 100 | 10  | 12 | 90,00  |
| 306217.1200.45 | • 12,0 | 6,0       | 45 | 12    | 11,60 | 100 | 12  | 12 | 106,00 |

MICRO  
GRAIN

KARNASCH  
NORM

W

DIN 6535  
Form HA

HSC  
HPC

NHC  
7000

Schnittdaten  
Cutting data

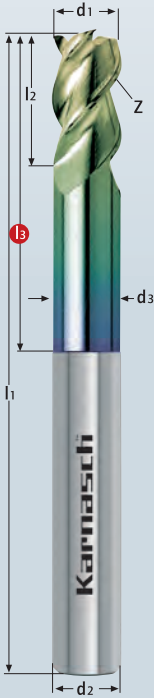


i S. 302

VHM-Schaftfräser, lang

Art. **30.6228**

- ALU  
aluminium
- ALU  
< 6% Si
- MESSING  
brass
- KUPFER  
copper
- Ampco
- Kunststoff  
plastic
- MAKROLON
- UHMW  
PE
- Wachs  
Wax



- Solid Carbide end mills, long
- Fresa de metal duro mango, larga
- Твердосплавная концевая фреза, длинная

**MICRO GRAIN**

**KARNASCH NORM**

**W**

DIN 6535  
Form HA

40°

**HSC HPC**

**NHC 7000**

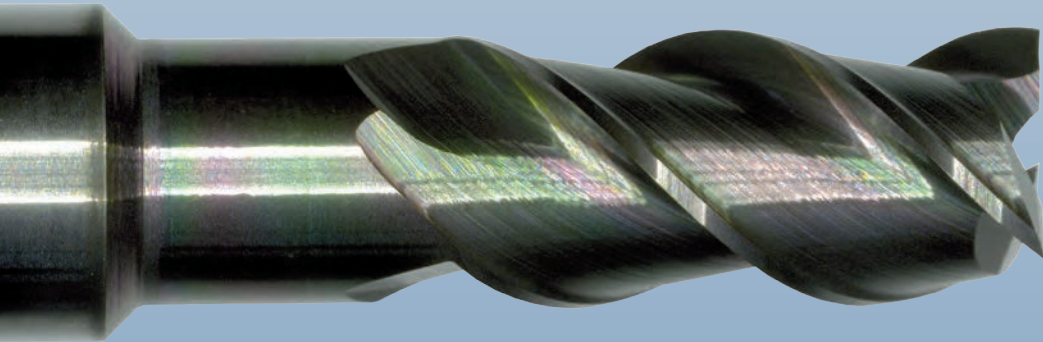
| Art.           | Ød1 e8 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|----------------|--------|----|-------|------|-----|----|---|--------|
| 306228.0200.06 | • 2    | 6  | 6     | 1,8  | 57  | 4  | 3 | 55,00  |
| 306228.0300.10 | • 3    | 10 | 6     | 2,7  | 57  | 6  | 3 | 57,00  |
| 306228.0400.14 | • 4    | 14 | 6     | 3,7  | 57  | 8  | 3 | 57,00  |
| 306228.0500.16 | • 5    | 16 | 6     | 4,7  | 57  | 10 | 3 | 57,00  |
| 306228.0600.20 | • 6    | 20 | 6     | 5,7  | 57  | 12 | 3 | 57,00  |
| 306228.0600.30 | • 6    | 30 | 6     | 5,7  | 70  | 12 | 3 | 59,00  |
| 306228.0600.40 | • 6    | 40 | 6     | 5,7  | 80  | 12 | 3 | 64,00  |
| 306228.0800.35 | • 8    | 35 | 8     | 7,7  | 80  | 16 | 3 | 88,00  |
| 306228.0800.45 | • 8    | 45 | 8     | 7,7  | 90  | 16 | 3 | 88,00  |
| 306228.0800.55 | • 8    | 55 | 8     | 7,7  | 100 | 16 | 3 | 89,00  |
| 306228.1000.35 | • 10   | 35 | 10    | 9,7  | 80  | 20 | 3 | 115,00 |
| 306228.1000.45 | • 10   | 45 | 10    | 9,7  | 90  | 20 | 3 | 115,00 |
| 306228.1000.55 | • 10   | 55 | 10    | 9,7  | 100 | 20 | 3 | 116,00 |
| 306228.1200.35 | • 12   | 35 | 12    | 11,5 | 80  | 24 | 4 | 140,00 |
| 306228.1200.55 | • 12   | 55 | 12    | 11,5 | 100 | 24 | 4 | 143,00 |
| 306228.1200.70 | • 12   | 70 | 12    | 11,5 | 120 | 24 | 4 | 153,00 |

Schnittdaten  
Cutting data

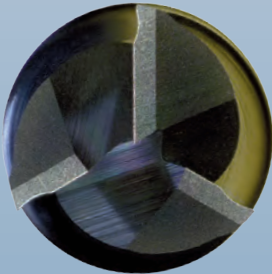


i S. 296

30.6228 - Ø 5,0 x 16



Stirnseitig  
On the front side



Z 20 x 30 Vergrößerung  
Magnification



Art. 30.6222 VHM-Schruppfräser, lang

ALU  
aluminium

Kunststoff  
plastic

ALU  
< 6% Si

MAKROLON

ALU  
< 12% Si

UHMW  
PE

MESSING  
brass

KUPFER  
copper

Ampco

TITAN

Nickel  
< 500  
N/mm<sup>2</sup>

Bronze  
Brass

GFK-CFK  
GFK-CFK



- Solid Carbide roughing end mills, long
- Fresa de metal duro desbastar, larga
- Твердосплавная обдирочная фреза, длинная



| Art.            | Ød1 e8 | r ±0,01 | l3 | d2 h5 | d3   | l1  | l2 | Z | €      |
|-----------------|--------|---------|----|-------|------|-----|----|---|--------|
| 306222.0500.018 | • 5    | 0,15    | 18 | 6     | 4,7  | 57  | 13 | 3 | 64,00  |
| 306222.0500.030 | • 5    | 0,15    | 30 | 6     | 4,7  | 80  | 8  | 3 | 74,00  |
| 306222.0600.018 | • 6    | 0,20    | 18 | 6     | 5,7  | 57  | 13 | 3 | 72,00  |
| 306222.0600.042 | • 6    | 0,20    | 42 | 6     | 5,7  | 80  | 10 | 3 | 82,00  |
| 306222.0800.025 | • 8    | 0,25    | 25 | 8     | 7,4  | 63  | 21 | 3 | 85,00  |
| 306222.0800.062 | • 8    | 0,25    | 62 | 8     | 7,4  | 100 | 13 | 3 | 98,00  |
| 306222.1000.030 | • 10   | 0,30    | 30 | 10    | 9,2  | 72  | 22 | 3 | 102,00 |
| 306222.1000.058 | • 10   | 0,30    | 58 | 10    | 9,2  | 100 | 16 | 3 | 126,00 |
| 306222.1200.036 | • 12   | 0,35    | 36 | 12    | 11,0 | 83  | 26 | 3 | 143,00 |

MICRO  
GRAIN

KARNASCH  
NORM

W/MR

DIN 6535  
Form HA

HSC  
HPC

NHC  
7000

Oil Emul  
MMS Air

Schnittdaten  
Cutting data



i S. 252

Art. 30.6223 VHM-HPC-Schaftfräser, lang

ALU  
aluminium

Kunststoff  
plastic

ALU  
< 6% Si

MAKROLON

ALU  
< 12% Si

UHMW  
PE

MESSING  
brass

KUPFER  
copper

Ampco

TITAN

Nickel  
< 500  
N/mm<sup>2</sup>

Bronze  
Brass

GFK-CFK  
GFK-CFK



- Solid Carbide HPC end mills, long
- Fresa frontal larga metal duro-HPC
- твердосплавная ХПЦ концевая фреза, длинная



Werkzeug ist gewuchtet!  
Tool is balanced!

Wuchtgüte G 2,5  
Balancing quality G 2,5

| Ød1 | Drehzahl n max. |
|-----|-----------------|
| 3-5 | 45.000          |
| 6-8 | 35.000          |
| 10  | 25.000          |
| 12  | 16.000          |

Hinweis: Voraussetzung für das Erreichen einer Gesamtwuchtgüte von ≤ G2,5 ist eine gewuchtete Werkzeugaufnahme mit Wuchtgüte G2,5.

| Art.            | Ød1 f8 | l3 | d2 h5 | d3   | l1  | l2 | Z | €      |
|-----------------|--------|----|-------|------|-----|----|---|--------|
| 306223.0300.012 | • 3    | 12 | 6     | 2,7  | 57  | 8  | 3 | 48,00  |
| 306223.0300.018 | • 3    | 18 | 6     | 2,7  | 80  | 5  | 3 | 60,00  |
| 306223.0400.018 | • 4    | 18 | 6     | 3,7  | 57  | 11 | 3 | 48,00  |
| 306223.0400.024 | • 4    | 24 | 6     | 3,7  | 80  | 6  | 3 | 60,00  |
| 306223.0500.018 | • 5    | 18 | 6     | 4,7  | 57  | 13 | 3 | 49,00  |
| 306223.0500.030 | • 5    | 30 | 6     | 4,7  | 80  | 8  | 3 | 61,00  |
| 306223.0600.018 | • 6    | 18 | 6     | 5,7  | 57  | 13 | 3 | 49,00  |
| 306223.0600.042 | • 6    | 42 | 6     | 5,7  | 80  | 13 | 3 | 64,00  |
| 306223.0800.025 | • 8    | 25 | 8     | 7,4  | 63  | 21 | 3 | 58,00  |
| 306223.0800.062 | • 8    | 62 | 8     | 7,4  | 100 | 21 | 3 | 81,00  |
| 306223.1000.030 | • 10   | 30 | 10    | 9,2  | 72  | 22 | 3 | 93,00  |
| 306223.1000.058 | • 10   | 58 | 10    | 9,2  | 100 | 22 | 3 | 118,00 |
| 306223.1200.036 | • 12   | 36 | 12    | 11,0 | 83  | 26 | 3 | 125,00 |
| 306223.1200.073 | • 12   | 73 | 12    | 11,0 | 120 | 26 | 3 | 170,00 |

MICRO  
GRAIN

KARNASCH  
NORM

W

DIN 6535  
Form HA

DIFF.

45°

HSC  
HPC

NHC  
7000

Oil Emul  
MMS Air

UGT

G 2,5

Schnittdaten  
Cutting data



i S. 252



VHM-Schaftfräser, lang, Superfinish

Art. **30.6224**

ALU  
aluminium

Kunststoff  
plastic

ALU  
< 6% Si

MAKROLON

ALU  
< 12% Si

UHMW  
PE

MESSING  
brass

KUPFER  
copper

Ampco

TITAN

Nickel  
< 500  
N/mm<sup>2</sup>

Bronze  
Brass

GFK-CFK  
GFK-CFK



- Solid Carbide roughing end mills, long, superfinish
- Fresa de metal duro desbastar, larga, superfinish
- Твердосплавная обдирочная фреза, длинная, суперфиниш

Werkzeug ist gewuchtet!  
Tool is balanced!

Wuchtgüte G 2,5  
Balancing quality G 2,5

| Ød1 | Drehzahl n max. |
|-----|-----------------|
| 6-8 | 35.000          |
| 10  | 25.000          |
| 12  | 16.000          |

Hinweis: Voraussetzung für das Erreichen einer Gesamtwuchtgüte von ≤ G2,5 ist eine gewuchtete Werkzeugaufnahme mit Wuchtgüte G2,5.

| Art.            | Ød1 f8 | l3 | d2 h5 | d3   | l1  | l2 | Z | €      |
|-----------------|--------|----|-------|------|-----|----|---|--------|
| 306224.0600.020 | • 6    | 20 | 6     | 5,7  | 58  | 16 | 6 | 48,00  |
| 306224.0600.042 | • 6    | 42 | 6     | 5,7  | 80  | 16 | 6 | 63,00  |
| 306224.0800.026 | • 8    | 26 | 8     | 7,4  | 64  | 19 | 6 | 55,00  |
| 306224.0800.062 | • 8    | 62 | 8     | 7,4  | 100 | 19 | 6 | 78,00  |
| 306224.1000.032 | • 10   | 32 | 10    | 9,2  | 74  | 25 | 6 | 90,00  |
| 306224.1000.058 | • 10   | 58 | 10    | 9,2  | 100 | 25 | 6 | 113,00 |
| 306224.1200.037 | • 12   | 37 | 12    | 11,0 | 84  | 30 | 6 | 123,00 |
| 306224.1200.073 | • 12   | 73 | 12    | 11,0 | 120 | 30 | 6 | 174,00 |

MICRO GRAIN

KARNASCH NORM

W

DIN 6535 Form HA

G 2,5

n<sub>max</sub>

Schnittdaten  
Cutting data



i S. 252

VHM-Schrupfräser, lang

Art. **30.6232**

ALU  
aluminium

Kunststoff  
plastic

HOLZ  
wood

KUPFER-  
weich  
COPPER-  
soft



- Solid carbide roughing end mills, long
- Fresa de metal duro desbastar, larga, HSC
- Твердосплавная обдирочная фреза, длинная, HSC

| Art.        | Ød1 h10 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|-------------|---------|----|-------|------|-----|----|---|--------|
| 306232.0600 | • 6     | 21 | 6     | 5,8  | 65  | 16 | 2 | 64,00  |
| 306232.0800 | • 8     | 27 | 8     | 7,8  | 70  | 22 | 2 | 74,00  |
| 306232.1000 | • 10    | 32 | 10    | 9,8  | 72  | 25 | 2 | 97,00  |
| 306232.1200 | • 12    | 38 | 12    | 11,8 | 83  | 28 | 3 | 129,00 |
| 306232.1600 | • 16    | 44 | 16    | 15,8 | 92  | 36 | 3 | 217,00 |
| 306232.1800 | ▲ 18    | 44 | 18    | 17,8 | 92  | 36 | 3 | 240,00 |
| 306232.2000 | • 20    | 54 | 20    | 19,8 | 104 | 41 | 3 | 348,00 |

MICRO GRAIN

KARNASCH NORM

W/MR

DIN 6535 Form HA

G 2,5

n<sub>max</sub>

Schnittdaten  
Cutting data



i S. 246

# SPIEGELBEARBEITUNG MIRROR FINISH TOOLS

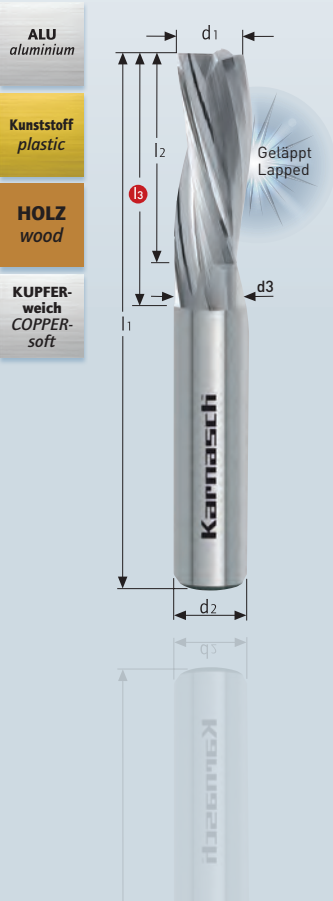
→ ND – MCD Tools

Siehe Seite 232 bis 238



VHM-Schlichtfräser lang, linksspirale – rechtsschneidend, lang

Art. **30.6233**



- Solid carbide end mills, left spiral - right hand cutting, long
- Fresa de metal duro alisar, HSC, espirala izquierdas - con corte a decheras, larga
- Твердосплавная чистовая фреза, длинная, HSC, Левосторонняя спираль - правозаходная

**MICRO GRAIN** KARNASCH NORM

**W/M** DIN 6535 Form HA

20°

HSC HPC

GELÄPPT LAPPED

OK OK OK OK OK OK

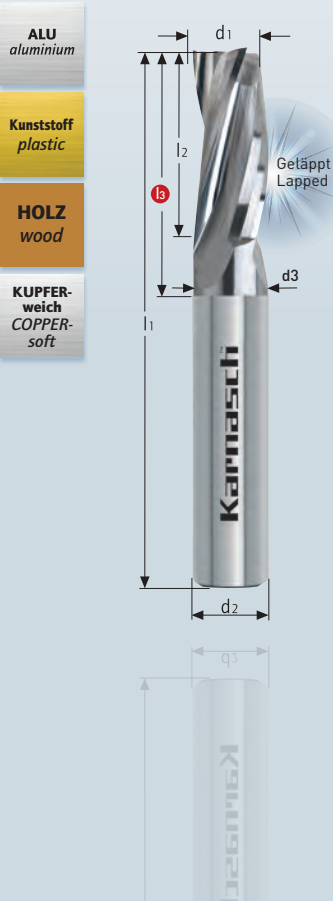
Schnittdaten  
Cutting data



| Art.        | Ød1 e8 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|-------------|--------|----|-------|------|-----|----|---|--------|
| 306233.0400 | • 4    | 20 | 6     | 3,8  | 65  | 11 | 2 | 51,00  |
| 306233.0500 | • 5    | 20 | 6     | 4,8  | 65  | 13 | 2 | 51,00  |
| 306233.0600 | • 6    | 21 | 6     | 5,8  | 65  | 16 | 2 | 51,00  |
| 306233.0800 | • 8    | 27 | 8     | 7,8  | 70  | 22 | 2 | 57,00  |
| 306233.1000 | • 10   | 32 | 10    | 9,8  | 72  | 25 | 2 | 80,00  |
| 306233.1200 | • 12   | 38 | 12    | 11,8 | 83  | 28 | 3 | 101,00 |
| 306233.1600 | • 16   | 44 | 16    | 15,8 | 92  | 36 | 3 | 172,00 |
| 306233.2000 | • 20   | 54 | 20    | 19,8 | 104 | 41 | 3 | 295,00 |

VHM-Schlichtfräser, lang, rechtsspirale – rechtsschneidend, lang

Art. **30.6234**



- Solid carbide end mills, long, right spiral - right hand cutting, long
- Fresa de metal duro alisar, HSC, espirala derecho - con corte a decheras, larga
- Твердосплавная чистовая фреза, длинная, HSC, Левосторонняя спираль - правозаходная

**MICRO GRAIN** KARNASCH NORM

**W/M** DIN 6535 Form HA

20°

HSC HPC

GELÄPPT LAPPED

OK OK OK OK OK OK

Schnittdaten  
Cutting data



| Art.        | Ød1 e8 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|-------------|--------|----|-------|------|-----|----|---|--------|
| 306234.0400 | • 4    | 20 | 6     | 3,8  | 65  | 11 | 2 | 48,00  |
| 306234.0500 | • 5    | 20 | 6     | 4,8  | 65  | 13 | 2 | 48,00  |
| 306234.0600 | • 6    | 21 | 6     | 5,8  | 65  | 16 | 2 | 48,00  |
| 306234.0800 | • 8    | 27 | 8     | 7,8  | 70  | 22 | 2 | 54,00  |
| 306234.1000 | • 10   | 32 | 10    | 9,8  | 72  | 25 | 2 | 76,00  |
| 306234.1200 | • 12   | 38 | 12    | 11,8 | 83  | 28 | 3 | 98,00  |
| 306234.1600 | • 16   | 44 | 16    | 15,8 | 92  | 36 | 3 | 167,00 |
| 306234.2000 | • 20   | 54 | 20    | 19,8 | 104 | 41 | 3 | 281,00 |

Art. 30.6255 PROFESSIONAL VHM-Micro Schaftfräser, < 15xD Schnitttiefe, Schaft 4mm

- HRC < 70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm ferritic
- INOX  
stainless steel  
> 900 N/mm martensitic
- INOX  
stainless steel  
< 900 N/mm austenitic
- NI-ALLOYS  
< 900 N/mm
- GG/G  
cast iron
- TITAN



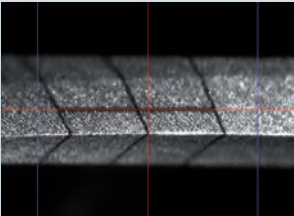
- Solid carbide miniatur end mills, < 15xD diameter cutting depth, shank 4mm
- Microfresa metal duro < 15xD profundidad de corte, mango 4mm
- Твердосплавная концевая микро, хвостовик 4 mm

NEU / NEW

scharfkantig / sharp edge

d1\* = Ø 0,1 - Ø 2,0 tol 0,000 / -0,008

Mit definierter Kantenverrundung  
With a defined edge preparation



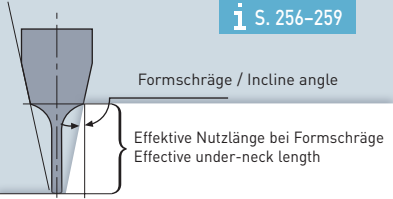
MICRO GRAIN KARNASCH NORM

N/M DIN 6535 Form HA

30°

Schnittdaten  
Cutting data

i S. 256-259



| Art.            | d1*   | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306255.0010.002 | • 0,1 | 0,2 | 4     | 0,08 | 45 | 0,15 | 58,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306255.0010.003 | • 0,1 | 0,3 | 4     | 0,08 | 45 | 0,15 | 58,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306255.0010.004 | • 0,1 | 0,4 | 4     | 0,08 | 45 | 0,15 | 58,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306255.0010.005 | • 0,1 | 0,5 | 4     | 0,08 | 45 | 0,15 | 58,00 | 1,13  | 1,31  | 1,67  | 2,02  |
| 306255.0020.005 | • 0,2 | 0,5 | 4     | 0,17 | 50 | 0,30 | 49,00 | 1,22  | 1,38  | 1,72  | 2,07  |
| 306255.0020.010 | • 0,2 | 1   | 4     | 0,17 | 50 | 0,30 | 49,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306255.0020.015 | • 0,2 | 1,5 | 4     | 0,17 | 50 | 0,30 | 49,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306255.0020.020 | • 0,2 | 2   | 4     | 0,17 | 50 | 0,30 | 49,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306255.0030.010 | • 0,3 | 1   | 4     | 0,27 | 50 | 0,45 | 45,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306255.0030.015 | • 0,3 | 1,5 | 4     | 0,27 | 50 | 0,45 | 45,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306255.0030.020 | • 0,3 | 2   | 4     | 0,27 | 50 | 0,45 | 45,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306255.0030.025 | • 0,3 | 2,5 | 4     | 0,27 | 50 | 0,45 | 45,00 | 3,45  | 3,77  | 4,31  | 4,79  |
| 306255.0030.030 | • 0,3 | 3   | 4     | 0,27 | 50 | 0,45 | 45,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306255.0040.010 | • 0,4 | 1   | 4     | 0,37 | 50 | 0,60 | 40,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306255.0040.015 | • 0,4 | 1,5 | 4     | 0,37 | 50 | 0,60 | 40,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306255.0040.020 | • 0,4 | 2   | 4     | 0,37 | 50 | 0,60 | 40,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306255.0040.030 | • 0,4 | 3   | 4     | 0,37 | 50 | 0,60 | 40,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306255.0040.040 | • 0,4 | 4   | 4     | 0,37 | 50 | 0,60 | 40,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306255.0050.010 | • 0,5 | 1   | 4     | 0,47 | 50 | 0,75 | 40,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306255.0050.020 | • 0,5 | 2   | 4     | 0,47 | 50 | 0,75 | 40,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306255.0050.030 | • 0,5 | 3   | 4     | 0,47 | 50 | 0,75 | 40,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306255.0050.040 | • 0,5 | 4   | 4     | 0,47 | 50 | 0,75 | 40,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306255.0050.050 | • 0,5 | 5   | 4     | 0,47 | 50 | 0,75 | 40,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306255.0050.060 | • 0,5 | 6   | 4     | 0,47 | 50 | 0,75 | 40,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306255.0060.020 | • 0,6 | 2   | 4     | 0,57 | 50 | 0,90 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306255.0060.030 | • 0,6 | 3   | 4     | 0,57 | 50 | 0,90 | 39,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306255.0060.040 | • 0,6 | 4   | 4     | 0,57 | 50 | 0,90 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306255.0060.050 | • 0,6 | 5   | 4     | 0,57 | 50 | 0,90 | 39,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306255.0060.060 | • 0,6 | 6   | 4     | 0,57 | 50 | 0,90 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306255.0060.080 | • 0,6 | 8   | 4     | 0,57 | 50 | 0,90 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306255.0080.040 | • 0,8 | 4   | 4     | 0,77 | 50 | 1,20 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306255.0080.060 | • 0,8 | 6   | 4     | 0,77 | 50 | 1,20 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306255.0080.080 | • 0,8 | 8   | 4     | 0,77 | 50 | 1,20 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306255.0100.020 | • 1,0 | 2   | 4     | 0,96 | 50 | 1,50 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306255.0100.030 | • 1,0 | 3   | 4     | 0,96 | 50 | 1,50 | 39,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306255.0100.040 | • 1,0 | 4   | 4     | 0,96 | 50 | 1,50 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306255.0100.050 | • 1,0 | 5   | 4     | 0,96 | 50 | 1,50 | 39,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306255.0100.060 | • 1,0 | 6   | 4     | 0,96 | 50 | 1,50 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306255.0100.080 | • 1,0 | 8   | 4     | 0,96 | 50 | 1,50 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306255.0100.100 | • 1,0 | 10  | 4     | 0,96 | 50 | 1,50 | 39,00 | 11,55 | 12,14 | 13,05 | 13,78 |
| 306255.0100.120 | • 1,0 | 12  | 4     | 0,96 | 55 | 1,50 | 39,00 | 13,66 | 14,31 | 15,28 | 16,06 |
| 306255.0100.150 | • 1,0 | 15  | 4     | 0,96 | 55 | 1,50 | 39,00 | 16,82 | 17,52 | 18,60 | 19,44 |

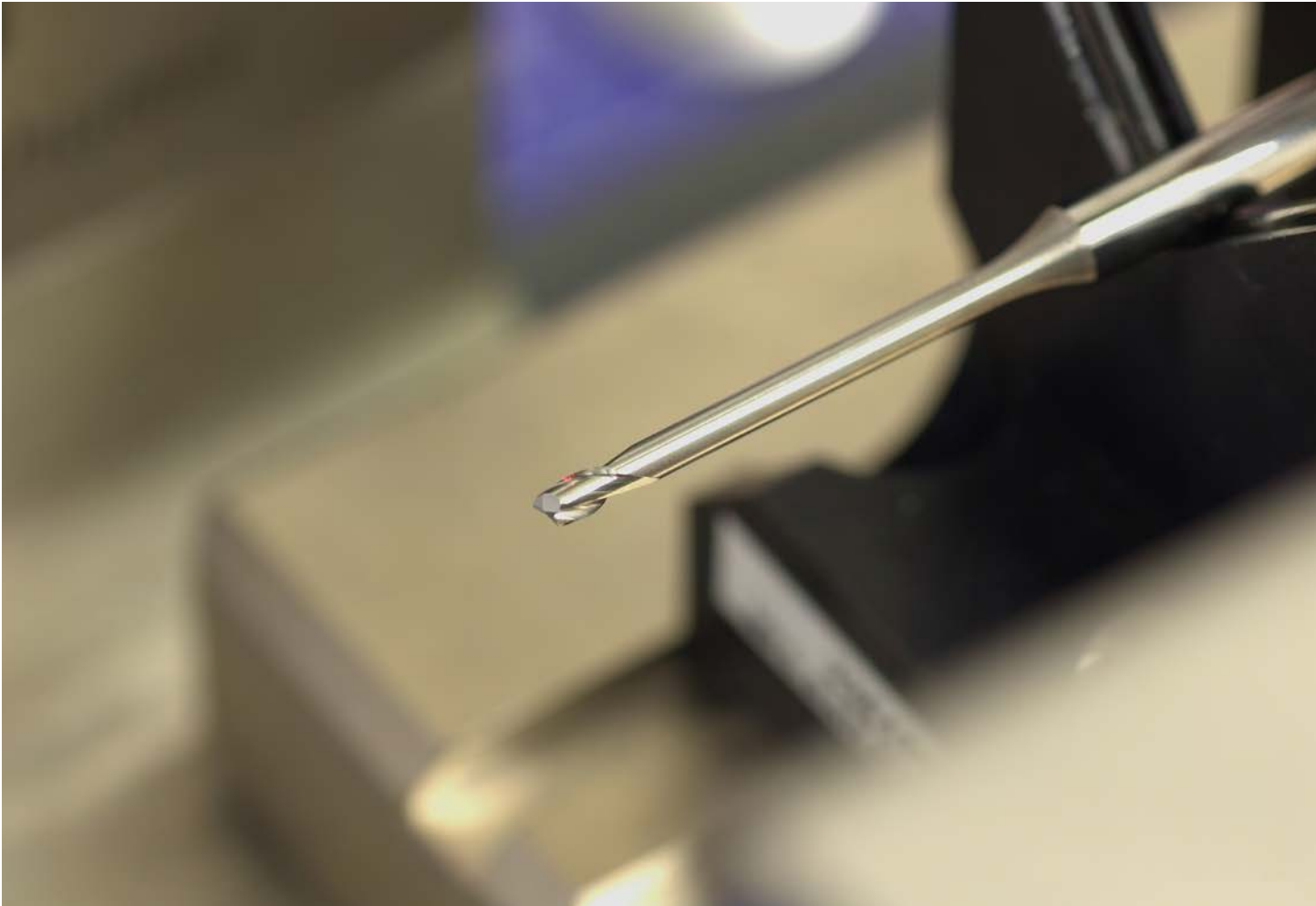




PROFESSIONAL  
★ ★ ★

Art. **30.6255**

| Art.            | d1*   | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306255.0120.060 | • 1,2 | 6  | 4     | 1,15 | 50 | 1,80 | 38,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306255.0120.120 | • 1,2 | 12 | 4     | 1,15 | 55 | 1,80 | 38,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306255.0150.040 | • 1,5 | 4  | 4     | 1,44 | 50 | 2,25 | 38,00 | 5,23  | 5,59  | 6,21  | 6,74  |
| 306255.0150.060 | • 1,5 | 6  | 4     | 1,44 | 50 | 2,25 | 38,00 | 7,37  | 7,82  | 8,54  | 9,15  |
| 306255.0150.080 | • 1,5 | 8  | 4     | 1,44 | 50 | 2,25 | 38,00 | 9,50  | 10,01 | 10,83 | 11,50 |
| 306255.0150.100 | • 1,5 | 10 | 4     | 1,44 | 50 | 2,25 | 38,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306255.0150.120 | • 1,5 | 12 | 4     | 1,44 | 55 | 2,25 | 38,00 | 13,72 | 14,35 | 15,31 | 16,09 |
| 306255.0150.140 | • 1,5 | 14 | 4     | 1,44 | 55 | 2,25 | 38,00 | 15,83 | 16,50 | 17,53 | 18,34 |
| 306255.0150.160 | • 1,5 | 16 | 4     | 1,44 | 55 | 2,25 | 38,00 | 17,92 | 18,64 | 19,72 | 20,58 |
| 306255.0150.180 | • 1,5 | 18 | 4     | 1,44 | 60 | 2,25 | 39,00 | 20,01 | 20,77 | 21,91 | 22,80 |
| 306255.0150.200 | • 1,5 | 20 | 4     | 1,44 | 60 | 2,25 | 39,00 | 22,10 | 22,90 | 24,08 | –     |
| 306255.0200.040 | • 2,0 | 4  | 4     | 1,92 | 50 | 3,00 | 38,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306255.0200.060 | • 2,0 | 6  | 4     | 1,92 | 50 | 3,00 | 38,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306255.0200.080 | • 2,0 | 8  | 4     | 1,92 | 50 | 3,00 | 38,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306255.0200.100 | • 2,0 | 10 | 4     | 1,92 | 50 | 3,00 | 38,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306255.0200.120 | • 2,0 | 12 | 4     | 1,92 | 55 | 3,00 | 38,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306255.0200.150 | • 2,0 | 15 | 4     | 1,92 | 55 | 3,00 | 38,00 | 16,93 | 17,61 | 18,65 | –     |
| 306255.0200.200 | • 2,0 | 20 | 4     | 1,92 | 60 | 3,00 | 39,00 | 22,15 | 22,93 | 24,11 | –     |



Art. 30.6256 PROFESSIONAL VHM-Micro Schaftfräser mit Eckenradius, < 15xD Schnitttiefe, Schaft 4mm

- HRC<70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm ferritic
- INOX  
stainless steel  
> 900 N/mm martensitic
- INOX  
stainless steel  
< 900 N/mm austenitic
- NI-ALLOYS  
< 900 N/mm
- GG/G  
cast iron
- TITAN



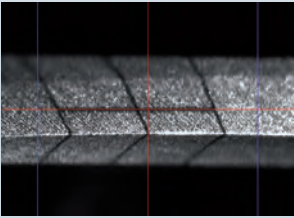
- Solid carbide miniatur end mills with corner radius, < 15xD diameter cutting depth, shank 4mm
- Microfresa metal duro con radio angular, < 15xD profundidad de corte, mango 4mm
- Твердосплавная концевая микро-фреза с угловым радиусом, глубина распила < 15xD, хвостовик 4mm

NEU / NEW

tol. r = -0,004

d1\* = Ø 0,1 - Ø 2,0 tol -0,000 / -0,008

Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO GRAIN KARNASCH NORM

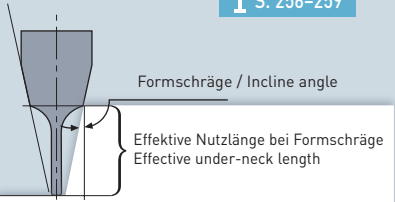
N/M DIN 6535 Form HA

HHC HSC HPC

HXC-NANO<sup>3</sup>

Schnittdaten  
Cutting data

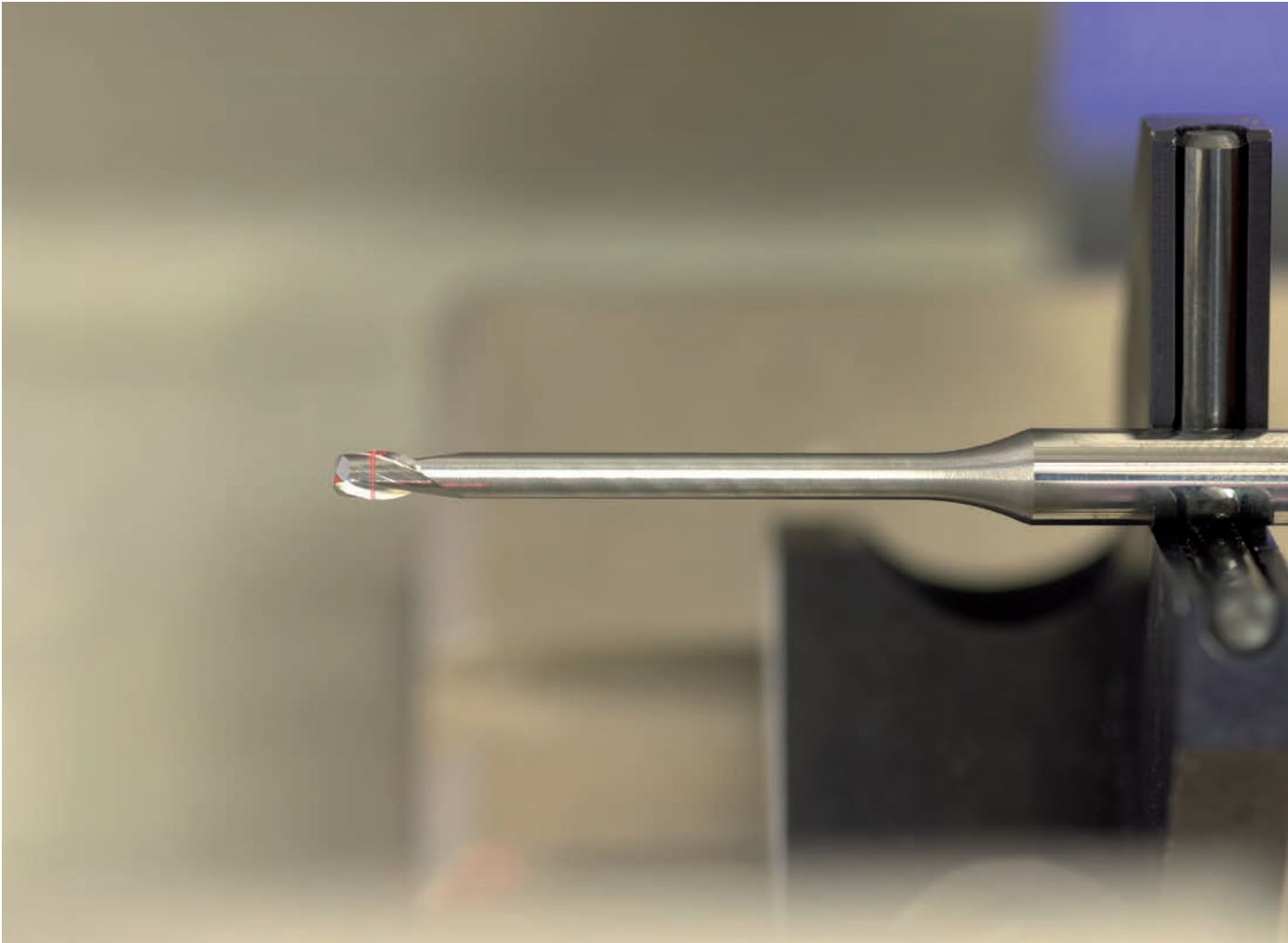
i S. 256-259



| Art.                | d1*   | r -0,004 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|-------|----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306256.0010.002.002 | • 0,1 | 0,02     | 0,2 | 4     | 0,08 | 45 | 0,10 | 58,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306256.0010.002.003 | • 0,1 | 0,02     | 0,3 | 4     | 0,08 | 45 | 0,10 | 58,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306256.0010.002.004 | • 0,1 | 0,02     | 0,4 | 4     | 0,08 | 45 | 0,10 | 58,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306256.0020.005.005 | • 0,2 | 0,05     | 0,5 | 4     | 0,17 | 50 | 0,15 | 49,00 | 1,22  | 1,38  | 1,72  | 2,07  |
| 306256.0020.005.010 | • 0,2 | 0,05     | 1   | 4     | 0,17 | 50 | 0,15 | 49,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306256.0020.005.015 | • 0,2 | 0,05     | 1,5 | 4     | 0,17 | 50 | 0,15 | 49,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306256.0020.005.020 | • 0,2 | 0,05     | 2   | 4     | 0,17 | 50 | 0,15 | 45,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306256.0030.005.010 | • 0,3 | 0,05     | 1   | 4     | 0,27 | 50 | 0,25 | 45,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306256.0030.005.015 | • 0,3 | 0,05     | 1,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306256.0030.005.020 | • 0,3 | 0,05     | 2   | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306256.0030.005.025 | • 0,3 | 0,05     | 2,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 3,45  | 3,77  | 4,31  | 4,79  |
| 306256.0030.005.030 | • 0,3 | 0,05     | 3   | 4     | 0,27 | 50 | 0,25 | 45,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306256.0040.010.010 | • 0,4 | 0,10     | 1   | 4     | 0,37 | 50 | 0,30 | 40,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306256.0040.010.015 | • 0,4 | 0,10     | 1,5 | 4     | 0,37 | 50 | 0,30 | 40,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306256.0040.010.020 | • 0,4 | 0,10     | 2   | 4     | 0,37 | 50 | 0,30 | 40,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306256.0040.010.030 | • 0,4 | 0,10     | 3   | 4     | 0,37 | 50 | 0,30 | 40,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306256.0040.010.040 | • 0,4 | 0,10     | 4   | 4     | 0,37 | 50 | 0,30 | 40,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306256.0050.010.010 | • 0,5 | 0,10     | 1   | 4     | 0,47 | 50 | 0,35 | 40,00 | 1,78  | 2,00  | 2,40  | 2,73  |
| 306256.0050.010.020 | • 0,5 | 0,10     | 2   | 4     | 0,47 | 50 | 0,35 | 40,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306256.0050.010.030 | • 0,5 | 0,10     | 3   | 4     | 0,47 | 50 | 0,35 | 40,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306256.0050.010.040 | • 0,5 | 0,10     | 4   | 4     | 0,47 | 50 | 0,35 | 40,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306256.0050.010.050 | • 0,5 | 0,10     | 5   | 4     | 0,47 | 50 | 0,35 | 40,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306256.0050.010.060 | • 0,5 | 0,10     | 6   | 4     | 0,47 | 50 | 0,35 | 40,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306256.0060.010.020 | • 0,6 | 0,10     | 2   | 4     | 0,57 | 50 | 0,40 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306256.0060.010.030 | • 0,6 | 0,10     | 3   | 4     | 0,57 | 50 | 0,40 | 39,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306256.0060.010.040 | • 0,6 | 0,10     | 4   | 4     | 0,57 | 50 | 0,40 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306256.0060.010.050 | • 0,6 | 0,10     | 5   | 4     | 0,57 | 50 | 0,40 | 39,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306256.0060.010.060 | • 0,6 | 0,10     | 6   | 4     | 0,57 | 50 | 0,40 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306256.0060.010.080 | • 0,6 | 0,10     | 8   | 4     | 0,57 | 50 | 0,40 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306256.0080.020.020 | • 0,8 | 0,20     | 2   | 4     | 0,77 | 50 | 0,50 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306256.0080.020.040 | • 0,8 | 0,20     | 4   | 4     | 0,77 | 50 | 0,50 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306256.0080.020.050 | • 0,8 | 0,20     | 5   | 4     | 0,77 | 50 | 0,50 | 39,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306256.0080.020.060 | • 0,8 | 0,20     | 6   | 4     | 0,77 | 50 | 0,50 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306256.0080.020.080 | • 0,8 | 0,20     | 8   | 4     | 0,77 | 50 | 0,50 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306256.0080.020.100 | • 0,8 | 0,20     | 10  | 4     | 0,77 | 50 | 0,50 | 39,00 | 11,49 | 12,12 | 12,99 | 13,71 |

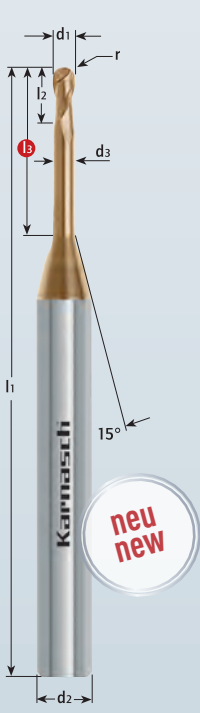


| Art.                | d1*   | r -0,004 | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|-------|----------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306256.0100.020.020 | • 1,0 | 0,20     | 2  | 4     | 0,96 | 50 | 0,80 | 39,00 | 2,96  | 3,23  | 3,73  | 4,17  |
| 306256.0100.020.030 | • 1,0 | 0,20     | 3  | 4     | 0,96 | 50 | 0,80 | 39,00 | 4,05  | 4,39  | 4,96  | 5,45  |
| 306256.0100.020.040 | • 1,0 | 0,20     | 4  | 4     | 0,96 | 50 | 0,80 | 39,00 | 5,14  | 5,52  | 6,15  | 6,70  |
| 306256.0100.020.050 | • 1,0 | 0,20     | 5  | 4     | 0,96 | 50 | 0,80 | 39,00 | 6,22  | 6,64  | 7,33  | 7,92  |
| 306256.0100.020.060 | • 1,0 | 0,20     | 6  | 4     | 0,96 | 50 | 0,80 | 39,00 | 7,29  | 7,76  | 8,50  | 9,12  |
| 306256.0100.020.070 | • 1,0 | 0,20     | 7  | 4     | 0,96 | 50 | 0,80 | 39,00 | 8,36  | 8,86  | 9,65  | 10,30 |
| 306256.0100.020.080 | • 1,0 | 0,20     | 8  | 4     | 0,96 | 50 | 0,80 | 39,00 | 9,43  | 9,96  | 10,79 | 11,47 |
| 306256.0100.020.090 | • 1,0 | 0,20     | 9  | 4     | 0,96 | 50 | 0,80 | 39,00 | 10,49 | 11,05 | 11,92 | 12,63 |
| 306256.0100.020.100 | • 1,0 | 0,20     | 10 | 4     | 0,96 | 50 | 0,80 | 39,00 | 11,55 | 12,14 | 13,05 | 13,78 |
| 306256.0100.020.120 | • 1,0 | 0,20     | 12 | 4     | 0,96 | 55 | 0,80 | 39,00 | 13,66 | 14,31 | 15,28 | 16,06 |
| 306256.0100.020.150 | • 1,0 | 0,20     | 15 | 4     | 0,96 | 55 | 0,80 | 39,00 | 16,82 | 17,53 | 18,60 | 19,44 |
| 306256.0120.020.060 | • 1,2 | 0,20     | 6  | 4     | 1,15 | 50 | 1,00 | 38,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306256.0120.020.120 | • 1,2 | 0,20     | 12 | 4     | 1,15 | 55 | 1,00 | 38,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306256.0150.020.040 | • 1,5 | 0,20     | 4  | 4     | 1,44 | 50 | 1,35 | 38,00 | 5,23  | 5,59  | 6,21  | 6,74  |
| 306256.0150.020.060 | • 1,5 | 0,20     | 6  | 4     | 1,44 | 50 | 1,35 | 38,00 | 7,37  | 7,82  | 8,54  | 9,15  |
| 306256.0150.020.080 | • 1,5 | 0,20     | 8  | 4     | 1,44 | 50 | 1,35 | 38,00 | 9,50  | 10,01 | 10,83 | 11,50 |
| 306256.0150.020.100 | • 1,5 | 0,20     | 10 | 4     | 1,44 | 50 | 1,35 | 38,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306256.0150.020.120 | • 1,5 | 0,20     | 12 | 4     | 1,44 | 55 | 1,35 | 38,00 | 13,72 | 14,35 | 15,31 | 16,09 |
| 306256.0150.020.140 | • 1,5 | 0,20     | 14 | 4     | 1,44 | 55 | 1,35 | 38,00 | 15,83 | 16,60 | 17,53 | 18,34 |
| 306256.0150.020.160 | • 1,5 | 0,20     | 16 | 4     | 1,44 | 55 | 1,35 | 38,00 | 17,92 | 18,64 | 19,72 | 20,58 |
| 306256.0150.020.180 | • 1,5 | 0,20     | 18 | 4     | 1,44 | 60 | 1,35 | 39,00 | 20,01 | 20,77 | 21,91 | 22,80 |
| 306256.0150.020.200 | • 1,5 | 0,20     | 20 | 4     | 1,44 | 60 | 1,35 | 39,00 | 22,10 | 22,90 | 24,08 | -     |
| 306256.0200.020.040 | • 2,0 | 0,20     | 4  | 4     | 1,92 | 50 | 1,70 | 38,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306256.0200.020.060 | • 2,0 | 0,20     | 6  | 4     | 1,92 | 50 | 1,70 | 38,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306256.0200.020.080 | • 2,0 | 0,20     | 8  | 4     | 1,92 | 50 | 1,70 | 38,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306256.0200.020.100 | • 2,0 | 0,20     | 10 | 4     | 1,92 | 50 | 1,70 | 38,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306256.0200.020.120 | • 2,0 | 0,20     | 12 | 4     | 1,92 | 55 | 1,70 | 38,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306256.0200.020.150 | • 2,0 | 0,20     | 15 | 4     | 1,92 | 55 | 1,70 | 38,00 | 16,93 | 17,61 | 18,65 | -     |
| 306256.0200.020.200 | • 2,0 | 0,20     | 20 | 4     | 1,92 | 60 | 1,70 | 39,00 | 22,15 | 22,93 | 24,11 | -     |
| 306256.0200.050.040 | • 2,0 | 0,50     | 4  | 4     | 1,92 | 50 | 1,70 | 38,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306256.0200.050.060 | • 2,0 | 0,50     | 6  | 4     | 1,92 | 50 | 1,70 | 38,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306256.0200.050.080 | • 2,0 | 0,50     | 8  | 4     | 1,92 | 50 | 1,70 | 38,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306256.0200.050.100 | • 2,0 | 0,50     | 10 | 4     | 1,92 | 50 | 1,70 | 38,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306256.0200.050.120 | • 2,0 | 0,50     | 12 | 4     | 1,92 | 55 | 1,70 | 38,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306256.0200.050.150 | • 2,0 | 0,50     | 15 | 4     | 1,92 | 55 | 1,70 | 38,00 | 16,93 | 17,61 | 18,65 | -     |
| 306256.0200.050.200 | • 2,0 | 0,50     | 20 | 4     | 1,92 | 60 | 1,70 | 39,00 | 22,15 | 22,93 | 24,11 | -     |

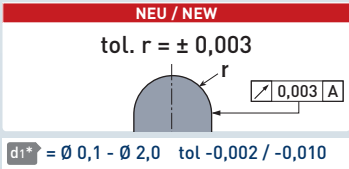


Art. **30.6257** **PROFESSIONAL** VHM-Micro-3D Mini-Radiusfräser, < 15xD Schnitttiefe, Schaft 4mm

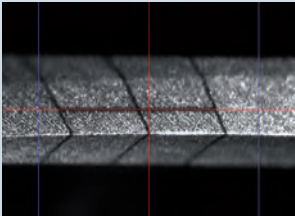
- HRC<70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm ferritic
- INOX  
stainless steel  
> 900 N/mm martensitic
- INOX  
stainless steel  
< 900 N/mm austenitic
- NI-ALLOYS  
< 900 N/mm
- GG/G  
cast iron
- TITAN



- Solid carbide miniatur ball nose slot mill, < 15xD diameter cutting depth, shank 4 mm
- Microfresa metal duro con radio de 3D, < 15xD profundidad de corte, mango 4mm
- Твердосплавная радиусная мини-фреза 3D, глубина распила < 15xD, хвостовик 4mm



Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO GRAIN KARNASCH NORM

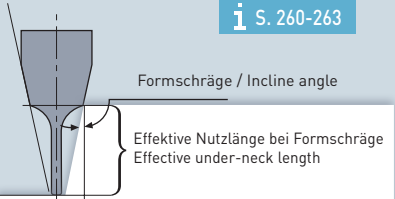
N/M DIN 6535 Form HA

20°

HHC HSC HPC

HXC-NANO<sup>3</sup>

Schnittdaten  
Cutting data



| Art.            | d1*   | r ± 0,003 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|-----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306257.0010     | • 0,1 | 0,05      | -   | 4     | 0,08 | 50 | 0,08 | 58,00 | -     | -     | -     | -     |
| 306257.0010.002 | • 0,1 | 0,05      | 0,2 | 4     | 0,08 | 45 | 0,08 | 58,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306257.0010.003 | • 0,1 | 0,05      | 0,3 | 4     | 0,08 | 45 | 0,08 | 58,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306257.0010.004 | • 0,1 | 0,05      | 0,4 | 4     | 0,08 | 45 | 0,08 | 58,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306257.0010.005 | • 0,1 | 0,05      | 0,5 | 4     | 0,08 | 45 | 0,08 | 58,00 | 1,13  | 1,31  | 1,67  | 2,02  |
| 306257.0020     | • 0,2 | 0,10      | -   | 4     | -    | 50 | 0,20 | 49,00 | -     | -     | -     | -     |
| 306257.0020.005 | • 0,2 | 0,10      | 0,5 | 4     | 0,17 | 50 | 0,20 | 49,00 | 1,22  | 1,38  | 1,72  | 2,07  |
| 306257.0020.010 | • 0,2 | 0,10      | 1   | 4     | 0,17 | 50 | 0,20 | 49,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306257.0020.015 | • 0,2 | 0,10      | 1,5 | 4     | 0,17 | 50 | 0,20 | 49,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306257.0020.020 | • 0,2 | 0,10      | 2   | 4     | 0,17 | 50 | 0,20 | 49,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306257.0030     | • 0,3 | 0,15      | -   | 4     | -    | 50 | 0,30 | 45,00 | -     | -     | -     | -     |
| 306257.0030.010 | • 0,3 | 0,15      | 1   | 4     | 0,27 | 50 | 0,25 | 45,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306257.0030.015 | • 0,3 | 0,15      | 1,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,34  | 2,60  | 3,06  | 3,48  |
| 306257.0030.020 | • 0,3 | 0,15      | 2   | 4     | 0,27 | 50 | 0,25 | 45,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306257.0030.025 | • 0,3 | 0,15      | 2,5 | 4     | 0,27 | 50 | 0,25 | 45,00 | 3,45  | 3,77  | 4,31  | 4,79  |
| 306257.0030.030 | • 0,3 | 0,15      | 3   | 4     | 0,27 | 50 | 0,25 | 45,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306257.0040     | • 0,4 | 0,20      | -   | 4     | -    | 50 | 0,40 | 40,00 | -     | -     | -     | -     |
| 306257.0040.010 | • 0,4 | 0,20      | 1   | 4     | 0,37 | 50 | 0,30 | 40,00 | 1,78  | 2,00  | 2,40  | 2,79  |
| 306257.0040.020 | • 0,4 | 0,20      | 2   | 4     | 0,37 | 50 | 0,30 | 40,00 | 2,90  | 3,19  | 6,69  | 4,14  |
| 306257.0040.030 | • 0,4 | 0,20      | 3   | 4     | 0,37 | 50 | 0,30 | 40,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306257.0040.040 | • 0,4 | 0,20      | 4   | 4     | 0,37 | 50 | 0,30 | 40,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306257.0050     | • 0,5 | 0,25      | -   | 4     | -    | 50 | 0,50 | 40,00 | -     | -     | -     | -     |
| 306257.0050.010 | • 0,5 | 0,25      | 1   | 4     | 0,47 | 50 | 0,40 | 40,00 | 1,78  | 2,00  | 2,40  | 2,73  |
| 306257.0050.020 | • 0,5 | 0,25      | 2   | 4     | 0,47 | 50 | 0,40 | 40,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306257.0050.030 | • 0,5 | 0,25      | 3   | 4     | 0,47 | 50 | 0,40 | 40,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306257.0050.040 | • 0,5 | 0,25      | 4   | 4     | 0,47 | 50 | 0,40 | 40,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306257.0050.050 | • 0,5 | 0,25      | 5   | 4     | 0,47 | 50 | 0,40 | 40,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306257.0050.060 | • 0,5 | 0,25      | 6   | 4     | 0,47 | 50 | 0,40 | 40,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306257.0060     | • 0,6 | 0,30      | -   | 4     | -    | 50 | 0,60 | 36,00 | -     | -     | -     | -     |
| 306257.0060.020 | • 0,6 | 0,30      | 2   | 4     | 0,57 | 50 | 0,50 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306257.0060.030 | • 0,6 | 0,30      | 3   | 4     | 0,57 | 50 | 0,50 | 39,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306257.0060.040 | • 0,6 | 0,30      | 4   | 4     | 0,57 | 50 | 0,50 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306257.0060.050 | • 0,6 | 0,30      | 5   | 4     | 0,57 | 50 | 0,50 | 39,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306257.0060.060 | • 0,6 | 0,30      | 6   | 4     | 0,57 | 50 | 0,50 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306257.0060.080 | • 0,6 | 0,30      | 8   | 4     | 0,57 | 50 | 0,50 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306257.0080     | • 0,8 | 0,40      | -   | 4     | -    | 50 | 0,80 | 36,00 | -     | -     | -     | -     |
| 306257.0080.020 | • 0,8 | 0,40      | 2   | 4     | 0,77 | 50 | 0,60 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306257.0080.040 | • 0,8 | 0,40      | 4   | 4     | 0,77 | 50 | 0,60 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306257.0080.060 | • 0,8 | 0,40      | 6   | 4     | 0,77 | 50 | 0,60 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306257.0080.080 | • 0,8 | 0,40      | 8   | 4     | 0,77 | 50 | 0,60 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306257.0080.100 | • 0,8 | 0,40      | 10  | 4     | 0,77 | 50 | 0,60 | 39,00 | 11,49 | 12,12 | 12,99 | 13,78 |

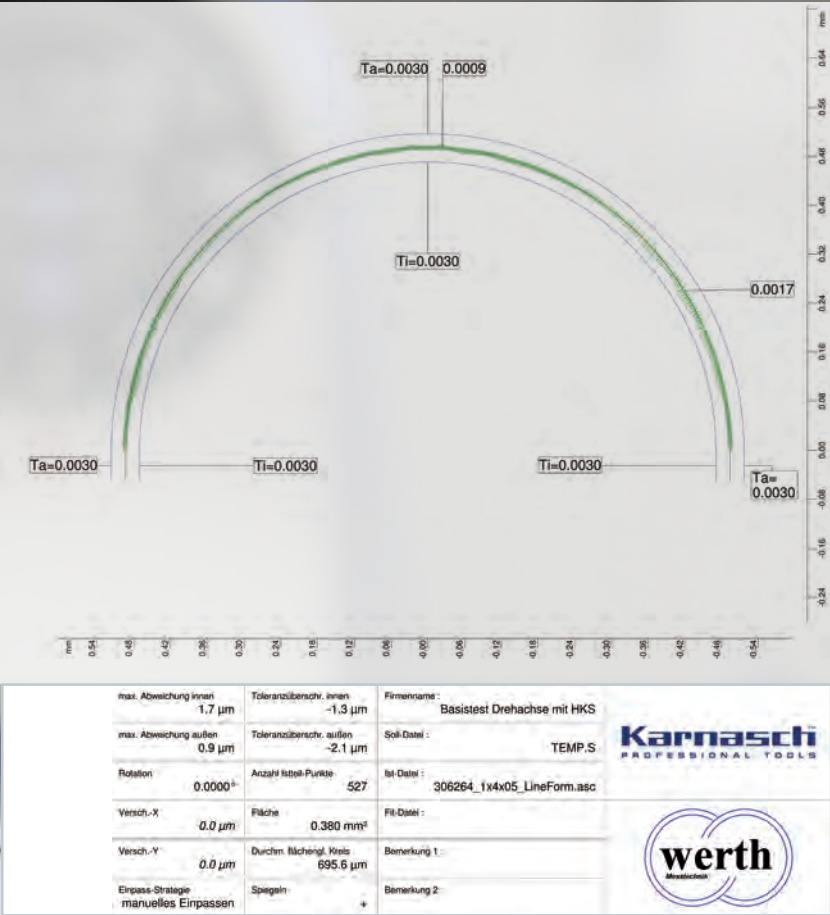
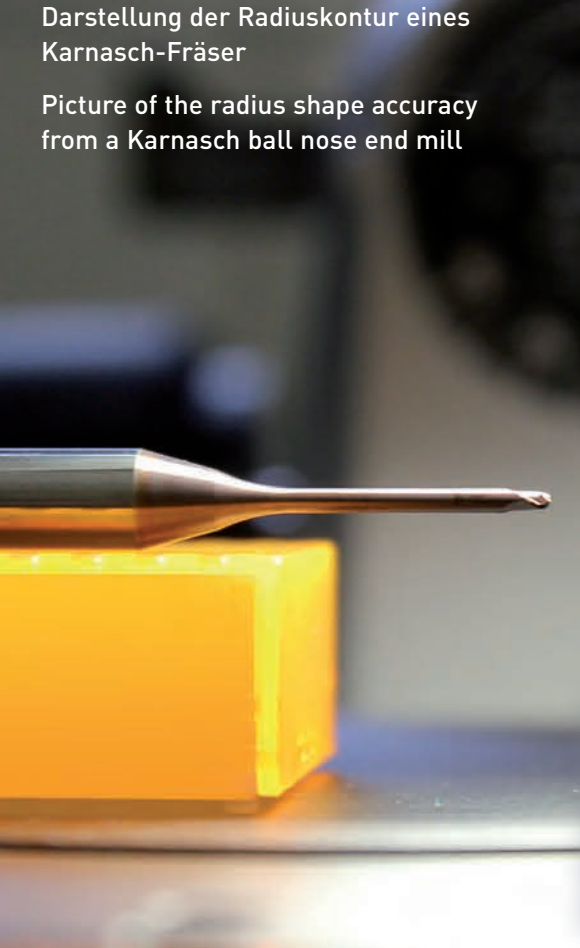




| Art.            | d1*   | r ± 0,003 | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|-----------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306257.0100.020 | • 1,0 | 0,50      | 2  | 4     | 0,96 | 50 | 0,80 | 39,00 | 2,90  | 3,19  | 3,69  | 4,14  |
| 306257.0100.030 | • 1,0 | 0,50      | 3  | 4     | 0,96 | 50 | 0,80 | 39,00 | 4,00  | 4,34  | 4,92  | 5,43  |
| 306257.0100.040 | • 1,0 | 0,50      | 4  | 4     | 0,96 | 50 | 0,80 | 39,00 | 5,09  | 5,48  | 6,13  | 6,68  |
| 306257.0100.050 | • 1,0 | 0,50      | 5  | 4     | 0,96 | 50 | 0,80 | 39,00 | 6,17  | 6,61  | 7,31  | 7,90  |
| 306257.0100.060 | • 1,0 | 0,50      | 6  | 4     | 0,96 | 50 | 0,80 | 39,00 | 7,25  | 7,72  | 8,47  | 9,10  |
| 306257.0100.080 | • 1,0 | 0,50      | 8  | 4     | 0,96 | 50 | 0,80 | 39,00 | 9,39  | 9,93  | 10,77 | 11,45 |
| 306257.0100.100 | • 1,0 | 0,50      | 10 | 4     | 0,96 | 50 | 0,80 | 39,00 | 11,55 | 12,14 | 13,05 | 13,78 |
| 306257.0100.120 | • 1,0 | 0,50      | 12 | 4     | 0,96 | 55 | 0,80 | 39,00 | 13,66 | 14,31 | 15,28 | 16,06 |
| 306257.0100.150 | • 1,0 | 0,50      | 15 | 4     | 0,96 | 55 | 0,80 | 39,00 | 16,82 | 17,53 | 18,60 | 19,44 |
| 306257.0100.180 | • 1,0 | 0,50      | 18 | 4     | 0,96 | 60 | 0,80 | 40,00 | 20,01 | 20,77 | 21,91 | 22,77 |
| 306257.0100.200 | • 1,0 | 0,50      | 20 | 4     | 0,96 | 60 | 0,80 | 40,00 | 22,10 | 22,90 | 24,08 | 24,98 |
| 306257.0120.060 | • 1,2 | 0,60      | 6  | 4     | 1,15 | 50 | 1,00 | 38,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306257.0120.120 | • 1,2 | 0,60      | 12 | 4     | 1,15 | 55 | 1,00 | 38,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306257.0150.040 | • 1,5 | 0,75      | 4  | 4     | 1,44 | 50 | 1,20 | 38,00 | 5,23  | 5,59  | 6,21  | 6,74  |
| 306257.0150.060 | • 1,5 | 0,75      | 6  | 4     | 1,44 | 50 | 1,20 | 38,00 | 7,37  | 7,82  | 8,54  | 9,15  |
| 306257.0150.080 | • 1,5 | 0,75      | 8  | 4     | 1,44 | 50 | 1,20 | 38,00 | 9,50  | 10,01 | 10,83 | 11,50 |
| 306257.0150.100 | • 1,5 | 0,75      | 10 | 4     | 1,44 | 50 | 1,20 | 38,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306257.0150.120 | • 1,5 | 0,75      | 12 | 4     | 1,44 | 55 | 1,20 | 38,00 | 13,72 | 14,35 | 15,31 | 16,09 |
| 306257.0150.140 | • 1,5 | 0,75      | 14 | 4     | 1,44 | 55 | 1,20 | 38,00 | 15,83 | 16,60 | 17,53 | 18,34 |
| 306257.0150.160 | • 1,5 | 0,75      | 16 | 4     | 1,44 | 55 | 1,20 | 38,00 | 17,92 | 18,64 | 19,72 | 20,58 |
| 306257.0150.180 | • 1,5 | 0,75      | 18 | 4     | 1,44 | 60 | 1,20 | 39,00 | 20,01 | 20,77 | 21,91 | 22,80 |
| 306257.0150.200 | • 1,5 | 0,75      | 20 | 4     | 1,44 | 60 | 1,20 | 39,00 | 22,10 | 22,90 | 24,08 |       |
| 306257.0200.040 | • 2,0 | 1,00      | 4  | 4     | 1,92 | 50 | 1,50 | 38,00 | 5,31  | 5,66  | 6,26  | 6,78  |
| 306257.0200.060 | • 2,0 | 1,00      | 6  | 4     | 1,92 | 50 | 1,50 | 38,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306257.0200.080 | • 2,0 | 1,00      | 8  | 4     | 1,92 | 50 | 1,50 | 38,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306257.0200.100 | • 2,0 | 1,00      | 10 | 4     | 1,92 | 50 | 1,50 | 38,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306257.0200.120 | • 2,0 | 1,00      | 12 | 4     | 1,92 | 55 | 1,50 | 38,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306257.0200.150 | • 2,0 | 1,00      | 15 | 4     | 1,92 | 55 | 1,50 | 38,00 | 16,93 | 17,61 | 18,65 |       |
| 306257.0200.200 | • 2,0 | 1,00      | 20 | 4     | 1,92 | 60 | 1,50 | 39,00 | 22,15 | 22,93 | 24,11 |       |

Darstellung der Radiuskontur eines Karnasch-Fräser

Picture of the radius shape accuracy from a Karnasch ball nose end mill



Art. 30.6261 PROFESSIONAL VHM-Micro Schaftfräser mit Eckenradius, < 30 x D Schnitttiefe, Schaft 6 mm

- HRC<70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- NI-ALLOYS  
< 900 N/mm
- GG/G  
cast iron



- Solid carbide miniatur end mills with corner radius, 2-30 x diameter cutting depth, shank 6 mm
- Microfresa metal duro con radio angular, 2-30xD profundidad de corte, mango 6mm
- Твердосплавная концевая микро-фреза с угловым радиусом, глубина распила 2-30xD, хвостовик 6 мм

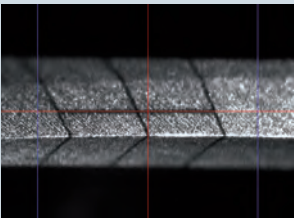
NEU / NEW

tol. r = -0,004

d1\* = Ø 0,2 - Ø 5,9 tol -0,002 / -0,010

d1\* = Ø 6,0 tol -0,004 / -0,016

Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO GRAIN KARNASCH NORM

N/M DIN 6535 Form HA

30°

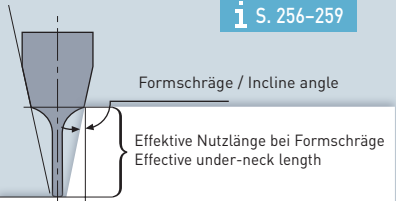
HHC HSC HPC

HXC-NANO<sup>3</sup>

Schnittdaten  
Cutting data



i S. 256-259



| Art.                | d1*   | r - 0,004 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|-------|-----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306261.0020.005.005 | • 0,2 | 0,05      | 0,5 | 6     | 0,18 | 55 | 0,30 | 51,50 | 1,12  | 1,30  | 1,64  | 1,99  |
| 306261.0020.005.01  | • 0,2 | 0,05      | 1   | 6     | 0,18 | 55 | 0,30 | 51,50 | 1,70  | 1,92  | 2,34  | 2,73  |
| 306261.0030.005.01  | • 0,3 | 0,05      | 1   | 6     | 0,28 | 55 | 0,45 | 46,50 | 1,70  | 1,92  | 2,34  | 2,73  |
| 306261.0030.005.02  | • 0,3 | 0,05      | 2   | 6     | 0,28 | 55 | 0,45 | 46,50 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306261.0030.005.03  | • 0,3 | 0,05      | 3   | 6     | 0,28 | 55 | 0,45 | 46,50 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306261.0030.005.05  | ▲ 0,3 | 0,05      | 5   | 6     | 0,28 | 55 | 0,45 | 46,50 | 6,12  | 6,57  | 7,28  | 7,87  |
| 306261.0040.005.02  | • 0,4 | 0,05      | 2   | 6     | 0,38 | 55 | 0,60 | 42,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306261.0040.005.03  | • 0,4 | 0,05      | 3   | 6     | 0,38 | 55 | 0,60 | 42,00 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306261.0040.005.04  | • 0,4 | 0,05      | 4   | 6     | 0,38 | 55 | 0,60 | 42,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306261.0040.005.05  | ▲ 0,4 | 0,05      | 5   | 6     | 0,38 | 55 | 0,60 | 42,00 | 6,12  | 6,57  | 7,28  | 7,87  |
| 306261.0040.005.06  | ▲ 0,4 | 0,05      | 6   | 6     | 0,38 | 55 | 0,60 | 42,00 | 7,20  | 7,69  | 8,44  | 9,07  |
| 306261.0050.005.02  | • 0,5 | 0,05      | 2   | 6     | 0,48 | 55 | 0,70 | 42,00 | 3,33  | 3,55  | 3,98  | 4,38  |
| 306261.0050.005.03  | • 0,5 | 0,05      | 3   | 6     | 0,48 | 55 | 0,70 | 42,00 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306261.0050.005.04  | • 0,5 | 0,05      | 4   | 6     | 0,48 | 55 | 0,70 | 42,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306261.0050.005.05  | ▲ 0,5 | 0,05      | 5   | 6     | 0,48 | 55 | 0,70 | 42,00 | 6,12  | 6,57  | 7,28  | 7,87  |
| 306261.0060.006.02  | • 0,6 | 0,06      | 2   | 6     | 0,58 | 55 | 0,90 | 40,00 | 2,83  | 3,13  | 3,64  | 4,09  |
| 306261.0060.006.03  | • 0,6 | 0,06      | 3   | 6     | 0,58 | 55 | 0,90 | 40,00 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306261.0060.006.04  | • 0,6 | 0,06      | 4   | 6     | 0,58 | 55 | 0,90 | 40,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306261.0060.006.06  | • 0,6 | 0,06      | 6   | 6     | 0,58 | 55 | 0,90 | 40,00 | 7,20  | 7,69  | 8,44  | 9,07  |
| 306261.0060.006.08  | ▲ 0,6 | 0,06      | 8   | 6     | 0,58 | 55 | 0,90 | 40,00 | 9,35  | 9,90  | 10,74 | 11,43 |
| 306261.0070.007.08  | ▲ 0,7 | 0,07      | 8   | 6     | 0,67 | 55 | 1,10 | 38,50 | 9,38  | 9,92  | 10,76 | 11,44 |
| 306261.0080.008.02  | • 0,8 | 0,08      | 2   | 6     | 0,77 | 55 | 1,20 | 40,00 | 2,89  | 3,17  | 3,67  | 4,12  |
| 306261.0080.008.04  | • 0,8 | 0,08      | 4   | 6     | 0,77 | 55 | 1,20 | 40,00 | 5,08  | 5,47  | 6,11  | 6,66  |
| 306261.0080.008.05  | • 0,8 | 0,08      | 5   | 6     | 0,77 | 55 | 1,20 | 40,00 | 6,17  | 6,60  | 7,30  | 7,88  |
| 306261.0080.008.06  | • 0,8 | 0,08      | 6   | 6     | 0,77 | 55 | 1,20 | 40,00 | 7,24  | 7,72  | 8,46  | 9,08  |
| 306261.0080.008.07  | ▲ 0,8 | 0,08      | 7   | 6     | 0,77 | 55 | 1,20 | 38,50 | 8,32  | 8,82  | 9,62  | 10,27 |
| 306261.0080.008.08  | • 0,8 | 0,08      | 8   | 6     | 0,77 | 55 | 1,20 | 40,00 | 9,38  | 9,92  | 10,76 | 11,44 |
| 306261.0080.008.10  | • 0,8 | 0,08      | 10  | 6     | 0,77 | 65 | 1,20 | 40,00 | 11,51 | 12,11 | 13,02 | 13,75 |
| 306261.0090.009.12  | ▲ 0,9 | 0,09      | 12  | 6     | 0,87 | 65 | 1,30 | 38,50 | 13,63 | 14,28 | 15,25 | 16,04 |
| 306261.0100.010.03  | • 1,0 | 0,10      | 3   | 6     | 0,95 | 55 | 1,60 | 40,00 | 4,09  | 4,41  | 4,96  | 5,45  |
| 306261.0100.010.04  | • 1,0 | 0,10      | 4   | 6     | 0,95 | 55 | 1,60 | 40,00 | 5,18  | 5,54  | 6,16  | 6,70  |
| 306261.0100.010.05  | • 1,0 | 0,10      | 5   | 6     | 0,95 | 55 | 1,60 | 40,00 | 6,25  | 6,67  | 7,34  | 7,92  |
| 306261.0100.010.06  | • 1,0 | 0,10      | 6   | 6     | 0,95 | 55 | 1,60 | 40,00 | 7,32  | 7,78  | 8,50  | 9,11  |
| 306261.0100.010.07  | • 1,0 | 0,10      | 7   | 6     | 0,95 | 55 | 1,60 | 40,00 | 8,39  | 8,88  | 9,65  | 10,30 |
| 306261.0100.010.08  | • 1,0 | 0,10      | 8   | 6     | 0,95 | 55 | 1,60 | 40,00 | 9,46  | 9,98  | 10,79 | 11,47 |
| 306261.0100.010.10  | • 1,0 | 0,10      | 10  | 6     | 0,95 | 65 | 1,60 | 40,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306261.0100.010.12  | • 1,0 | 0,10      | 12  | 6     | 0,95 | 65 | 1,60 | 40,00 | 13,69 | 14,32 | 15,29 | 16,06 |
| 306261.0100.010.15  | • 1,0 | 0,10      | 15  | 6     | 0,95 | 65 | 1,60 | 40,00 | 16,84 | 17,55 | 18,60 | 19,44 |
| 306261.0100.010.20  | • 1,0 | 0,10      | 20  | 6     | 0,95 | 65 | 1,60 | 41,00 | 22,07 | 22,88 | 24,06 | 24,98 |
| 306261.0100.010.25  | ▲ 1,0 | 0,10      | 25  | 6     | 0,95 | 70 | 1,60 | 39,50 | 27,27 | 28,17 | 29,46 | 30,45 |



| Art.               | d1*   | r - 0,004 | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|-------|-----------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306261.0100.030.04 | • 1,0 | 0,30      | 4  | 6     | 0,95 | 55 | 1,60 | 40,00 | 5,16  | 5,52  | 6,13  | 6,65  |
| 306261.0100.030.08 | • 1,0 | 0,30      | 8  | 6     | 0,95 | 55 | 1,60 | 40,00 | 9,44  | 9,96  | 10,77 | 11,44 |
| 306261.0100.030.12 | • 1,0 | 0,30      | 12 | 6     | 0,95 | 65 | 1,60 | 40,00 | 13,68 | 14,31 | 15,26 | 16,03 |
| 306261.0120.012.06 | • 1,2 | 0,12      | 6  | 6     | 1,15 | 55 | 1,90 | 39,00 | 7,32  | 7,77  | 8,50  | 9,11  |
| 306261.0120.012.08 | • 1,2 | 0,12      | 8  | 6     | 1,15 | 55 | 1,90 | 39,00 | 9,46  | 9,98  | 10,79 | 11,47 |
| 306261.0120.012.10 | • 1,2 | 0,12      | 10 | 6     | 1,15 | 65 | 1,90 | 39,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306261.0120.012.12 | • 1,2 | 0,12      | 12 | 6     | 1,15 | 65 | 1,90 | 39,00 | 13,69 | 14,32 | 15,28 | 16,06 |
| 306261.0120.012.15 | ▲ 1,2 | 0,12      | 15 | 6     | 1,15 | 65 | 1,90 | 37,50 | 16,84 | 17,54 | 18,60 | 19,43 |
| 306261.0120.012.20 | ▲ 1,2 | 0,12      | 20 | 6     | 1,15 | 65 | 1,90 | 37,50 | 22,07 | 22,87 | 24,06 | 24,98 |
| 306261.0120.012.25 | ▲ 1,2 | 0,12      | 25 | 6     | 1,15 | 70 | 1,90 | 39,50 | 27,27 | 28,17 | 29,46 | 30,45 |
| 306261.0120.030.06 | • 1,2 | 0,30      | 6  | 6     | 1,15 | 55 | 1,90 | 39,00 | 7,31  | 7,75  | 8,47  | 9,08  |
| 306261.0120.030.10 | • 1,2 | 0,30      | 10 | 6     | 1,15 | 65 | 1,90 | 39,00 | 11,57 | 12,14 | 13,03 | 13,75 |
| 306261.0120.030.15 | ▲ 1,2 | 0,30      | 15 | 6     | 1,15 | 65 | 1,90 | 37,50 | 16,83 | 17,53 | 18,58 | 19,41 |
| 306261.0140.014.08 | • 1,4 | 0,14      | 8  | 6     | 1,35 | 55 | 2,20 | 39,00 | 9,45  | 9,97  | 10,79 | 11,46 |
| 306261.0140.014.15 | • 1,4 | 0,14      | 15 | 6     | 1,35 | 65 | 2,20 | 39,00 | 16,84 | 17,54 | 18,60 | 19,43 |
| 306261.0150.015.06 | • 1,5 | 0,15      | 6  | 6     | 1,44 | 55 | 2,40 | 39,00 | 7,36  | 7,80  | 8,52  | 9,12  |
| 306261.0150.015.08 | • 1,5 | 0,15      | 8  | 6     | 1,44 | 55 | 2,40 | 39,00 | 9,49  | 10,00 | 10,81 | 11,48 |
| 306261.0150.015.10 | • 1,5 | 0,15      | 10 | 6     | 1,44 | 65 | 2,40 | 39,00 | 11,61 | 12,18 | 13,06 | 13,79 |
| 306261.0150.015.12 | • 1,5 | 0,15      | 12 | 6     | 1,44 | 65 | 2,40 | 39,00 | 13,72 | 14,34 | 15,30 | 16,07 |
| 306261.0150.015.15 | • 1,5 | 0,15      | 15 | 6     | 1,44 | 65 | 2,40 | 39,00 | 16,87 | 17,56 | 18,61 | 19,44 |
| 306261.0150.015.20 | • 1,5 | 0,15      | 20 | 6     | 1,44 | 65 | 2,40 | 40,00 | 22,09 | 22,89 | 24,07 | 24,99 |
| 306261.0150.015.30 | ▲ 1,5 | 0,15      | 30 | 6     | 1,44 | 75 | 2,40 | 40,50 | 32,48 | 33,44 | 34,82 | 35,87 |
| 306261.0150.030.06 | • 1,5 | 0,30      | 6  | 6     | 1,44 | 55 | 2,40 | 39,00 | 7,35  | 7,79  | 8,49  | 9,09  |
| 306261.0150.030.12 | • 1,5 | 0,30      | 12 | 6     | 1,44 | 65 | 2,40 | 39,00 | 13,71 | 14,33 | 15,28 | 16,05 |
| 306261.0150.030.20 | • 1,5 | 0,30      | 20 | 6     | 1,44 | 65 | 2,40 | 40,00 | 22,09 | 22,88 | 24,06 | 24,97 |
| 306261.0160.016.08 | ▲ 1,6 | 0,16      | 8  | 6     | 1,54 | 55 | 2,50 | 36,50 | 9,49  | 10,00 | 10,81 | 11,47 |
| 306261.0160.016.15 | ▲ 1,6 | 0,16      | 15 | 6     | 1,54 | 65 | 2,50 | 37,50 | 16,87 | 17,56 | 18,61 | 19,44 |
| 306261.0180.018.10 | • 1,8 | 0,18      | 10 | 6     | 1,74 | 65 | 2,60 | 39,00 | 11,61 | 12,17 | 13,06 | 13,78 |
| 306261.0180.018.20 | • 1,8 | 0,18      | 20 | 6     | 1,74 | 65 | 2,60 | 40,00 | 22,09 | 22,89 | 24,07 | 24,98 |
| 306261.0200.020.06 | • 2,0 | 0,20      | 6  | 6     | 1,92 | 55 | 2,80 | 39,00 | 7,43  | 7,86  | 8,55  | 9,15  |
| 306261.0200.020.08 | • 2,0 | 0,20      | 8  | 6     | 1,92 | 55 | 2,80 | 39,00 | 9,55  | 10,05 | 10,84 | 11,50 |
| 306261.0200.020.10 | • 2,0 | 0,20      | 10 | 6     | 1,92 | 65 | 2,80 | 39,00 | 11,67 | 12,22 | 13,09 | 13,81 |
| 306261.0200.020.12 | • 2,0 | 0,20      | 12 | 6     | 1,92 | 65 | 2,80 | 39,00 | 13,77 | 14,38 | 15,32 | 16,09 |
| 306261.0200.020.15 | • 2,0 | 0,20      | 15 | 6     | 1,92 | 65 | 2,80 | 39,00 | 16,92 | 17,60 | 18,63 | 19,46 |
| 306261.0200.020.20 | • 2,0 | 0,20      | 20 | 6     | 1,92 | 65 | 2,80 | 40,00 | 22,14 | 22,92 | 24,09 | 25,00 |
| 306261.0200.020.25 | • 2,0 | 0,20      | 25 | 6     | 1,92 | 70 | 2,80 | 40,00 | 27,34 | 28,21 | 29,49 | 30,47 |
| 306261.0200.020.30 | • 2,0 | 0,20      | 30 | 6     | 1,92 | 75 | 2,80 | 40,50 | 32,35 | 33,47 | 34,84 | 35,88 |
| 306261.0200.030.25 | ▲ 2,0 | 0,30      | 25 | 6     | 1,92 | 70 | 2,80 | 39,50 | 27,33 | 28,20 | 29,48 | 30,46 |
| 306261.0200.050.08 | • 2,0 | 0,50      | 8  | 6     | 1,92 | 55 | 2,80 | 39,00 | 9,54  | 10,02 | 10,80 | 11,45 |
| 306261.0200.050.15 | • 2,0 | 0,50      | 15 | 6     | 1,92 | 65 | 2,80 | 39,00 | 16,91 | 17,58 | 18,60 | 19,42 |
| 306261.0200.050.25 | • 2,0 | 0,50      | 25 | 6     | 1,92 | 70 | 2,80 | 40,00 | 27,33 | 28,19 | 29,46 | 30,44 |
| 306261.0250.025.10 | • 2,5 | 0,25      | 10 | 6     | 2,40 | 65 | 2,50 | 37,50 | 11,73 | 12,26 | 13,12 | 13,83 |
| 306261.0250.025.15 | • 2,5 | 0,25      | 15 | 6     | 2,40 | 65 | 2,50 | 37,50 | 16,97 | 17,64 | 18,66 | 19,48 |
| 306261.0250.025.20 | • 2,5 | 0,25      | 20 | 6     | 2,40 | 65 | 2,50 | 37,50 | 22,18 | 22,95 | 24,11 | 25,01 |
| 306261.0250.025.25 | • 2,5 | 0,25      | 25 | 6     | 2,40 | 70 | 2,50 | 39,50 | 27,38 | 28,24 | 29,50 | 30,48 |
| 306261.0300.030.10 | • 3,0 | 0,30      | 10 | 6     | 2,90 | 65 | 3,00 | 37,50 | 11,72 | 12,26 | 13,11 | 13,82 |
| 306261.0300.030.20 | • 3,0 | 0,30      | 20 | 6     | 2,90 | 65 | 3,00 | 37,50 | 22,18 | 22,95 | 24,10 | 25,01 |
| 306261.0300.030.30 | • 3,0 | 0,30      | 30 | 6     | 2,90 | 75 | 3,00 | 40,50 | 32,55 | 33,49 | 34,85 | –     |
| 306261.0300.050.10 | • 3,0 | 0,50      | 10 | 6     | 2,90 | 65 | 3,00 | 37,50 | 11,71 | 12,24 | 13,09 | 13,79 |
| 306261.0300.050.15 | • 3,0 | 0,50      | 15 | 6     | 2,90 | 65 | 3,00 | 37,50 | 16,96 | 17,62 | 18,63 | 19,45 |
| 306261.0300.050.20 | • 3,0 | 0,50      | 20 | 6     | 2,90 | 65 | 3,00 | 37,50 | 22,17 | 22,94 | 24,09 | 24,99 |
| 306261.0300.050.25 | • 3,0 | 0,50      | 25 | 6     | 2,90 | 70 | 3,00 | 39,50 | 27,37 | 28,22 | 29,49 | –     |
| 306261.0300.050.30 | • 3,0 | 0,50      | 30 | 6     | 2,90 | 75 | 3,00 | 40,50 | 32,55 | 33,48 | 34,84 | –     |
| 306261.0400.050.10 | • 4,0 | 0,50      | 10 | 6     | 3,90 | 65 | 4,00 | 37,50 | 11,71 | 12,24 | 13,09 | 13,79 |
| 306261.0400.050.15 | • 4,0 | 0,50      | 15 | 6     | 3,90 | 65 | 4,00 | 37,50 | 16,96 | 17,62 | 18,63 | 19,45 |
| 306261.0400.050.20 | • 4,0 | 0,50      | 20 | 6     | 3,90 | 65 | 4,00 | 37,50 | 22,17 | 22,94 | 24,09 | –     |
| 306261.0400.050.25 | • 4,0 | 0,50      | 25 | 6     | 3,90 | 70 | 4,00 | 39,50 | 27,37 | 28,22 | –     | –     |
| 306261.0400.050.30 | • 4,0 | 0,50      | 30 | 6     | 3,90 | 75 | 4,00 | 40,50 | 32,55 | 33,48 | –     | –     |
| 306261.0500.050.10 | ▲ 5,0 | 0,50      | 10 | 6     | 4,90 | 65 | 5,00 | 37,50 | 11,71 | 12,24 | 13,09 | –     |
| 306261.0500.050.15 | • 5,0 | 0,50      | 15 | 6     | 4,90 | 65 | 5,00 | 37,50 | 16,96 | 17,62 | –     | –     |
| 306261.0500.050.20 | • 5,0 | 0,50      | 20 | 6     | 4,90 | 65 | 5,00 | 37,50 | 22,17 | 22,94 | –     | –     |
| 306261.0500.050.30 | • 5,0 | 0,50      | 30 | 6     | 4,90 | 75 | 5,00 | 40,50 | 32,55 | –     | –     | –     |
| 306261.0500.050.40 | • 5,0 | 0,50      | 40 | 6     | 4,90 | 90 | 5,00 | 40,50 | 42,87 | –     | –     | –     |
| 306261.0600.050.10 | • 6,0 | 0,50      | 10 | 6     | 5,90 | 65 | 6,00 | 37,50 | –     | –     | –     | –     |
| 306261.0600.050.15 | • 6,0 | 0,50      | 15 | 6     | 5,90 | 65 | 6,00 | 37,50 | –     | –     | –     | –     |
| 306261.0600.050.20 | • 6,0 | 0,50      | 20 | 6     | 5,90 | 65 | 6,00 | 37,50 | –     | –     | –     | –     |
| 306261.0600.050.30 | • 6,0 | 0,50      | 30 | 6     | 5,90 | 75 | 6,00 | 40,50 | –     | –     | –     | –     |
| 306261.0600.050.40 | • 6,0 | 0,50      | 40 | 6     | 5,90 | 90 | 6,00 | 40,50 | –     | –     | –     | –     |
| 306261.0600.050.50 | ▲ 6,0 | 0,50      | 50 | 6     | 5,90 | 90 | 6,00 | 41,50 | –     | –     | –     | –     |

Art. 30.6262 VHM-Torusfräser, < 15xD Schnitttiefe

HRC < 52  
STAHL  
steel  
< 1670 N/mm



- 
- Solid carbide end mills with corner radius, long
- 
- Fresa metal duro de mango con radio angular, larga
- 
- Твердосплавная концевая фреза с угловым радиусом, длинная

MICRO GRAIN

KARNASCH NORM

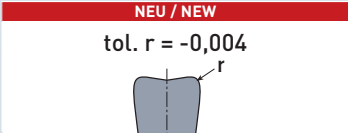
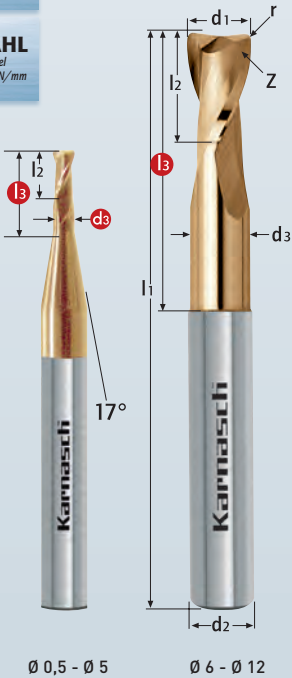
N/M

DIN 6335 Form HA

25°

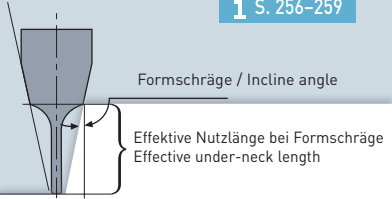
HHC HSC HPC

HXC-NANO<sup>3</sup>



Schnittdaten  
Cutting data

i S. 256-259



| Art.               | d1 e8  | r - 0,004 | l3 | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|--------|-----------|----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306262.0050.005.02 | • 0,5  | 0,05      | 2  | 4     | 0,48 | 45 | 0,7  | 39,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306262.0050.005.06 | • 0,5  | 0,05      | 6  | 4     | 0,48 | 45 | 0,7  | 39,00 | 7,20  | 7,69  | 8,44  | 9,07  |
| 306262.0060.006.02 | • 0,6  | 0,06      | 2  | 4     | 0,57 | 45 | 0,9  | 39,00 | 2,89  | 3,18  | 3,67  | 4,12  |
| 306262.0060.006.08 | • 0,6  | 0,06      | 8  | 4     | 0,57 | 45 | 0,9  | 39,00 | 9,39  | 9,93  | 10,76 | 11,44 |
| 306262.0080.008.04 | • 0,8  | 0,08      | 4  | 4     | 0,77 | 45 | 1,2  | 39,00 | 5,08  | 5,47  | 6,11  | 6,66  |
| 306262.0080.008.06 | • 0,8  | 0,08      | 6  | 4     | 0,77 | 45 | 1,2  | 39,00 | 7,24  | 7,72  | 8,46  | 9,08  |
| 306262.0080.008.08 | • 0,8  | 0,08      | 8  | 4     | 0,77 | 45 | 1,2  | 39,00 | 9,38  | 9,92  | 10,76 | 11,44 |
| 306262.0100.010.06 | • 1,0  | 0,10      | 6  | 4     | 0,95 | 45 | 1,6  | 39,00 | 7,32  | 7,78  | 8,5   | 9,11  |
| 306262.0100.010.10 | • 1,0  | 0,10      | 10 | 4     | 0,95 | 45 | 1,6  | 39,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306262.0100.010.15 | • 1,0  | 0,10      | 15 | 4     | 0,95 | 45 | 1,6  | 39,00 | 16,84 | 17,55 | 18,60 | 19,44 |
| 306262.0120.012.06 | • 1,2  | 0,12      | 6  | 4     | 1,15 | 50 | 1,9  | 37,00 | 7,32  | 7,77  | 8,50  | 9,11  |
| 306262.0120.012.12 | • 1,2  | 0,12      | 12 | 4     | 1,15 | 50 | 1,9  | 37,00 | 13,69 | 14,32 | 15,28 | 16,06 |
| 306262.0150.015.06 | • 1,5  | 0,15      | 6  | 4     | 1,45 | 55 | 2,4  | 37,00 | 7,32  | 7,77  | 8,50  | 9,11  |
| 306262.0150.015.08 | • 1,5  | 0,15      | 8  | 4     | 1,45 | 55 | 2,4  | 37,00 | 9,45  | 9,97  | 10,79 | 11,46 |
| 306262.0150.015.15 | • 1,5  | 0,15      | 15 | 4     | 1,45 | 55 | 2,4  | 37,00 | 16,84 | 17,54 | 18,60 | 19,43 |
| 306262.0150.015.20 | • 1,5  | 0,15      | 20 | 4     | 1,45 | 55 | 2,4  | 37,00 | 22,07 | 22,87 | 24,06 | -     |
| 306262.0200.020.06 | • 2,0  | 0,20      | 6  | 4     | 1,95 | 60 | 2,8  | 37,00 | 7,32  | 7,77  | 8,49  | 9,10  |
| 306262.0200.020.08 | • 2,0  | 0,20      | 8  | 4     | 1,95 | 60 | 2,8  | 37,00 | 9,45  | 9,97  | 10,78 | 11,45 |
| 306262.0200.020.10 | • 2,0  | 0,20      | 10 | 4     | 1,95 | 60 | 2,8  | 37,00 | 11,57 | 12,15 | 13,04 | 13,77 |
| 306262.0200.020.15 | • 2,0  | 0,20      | 15 | 4     | 1,95 | 60 | 2,8  | 37,00 | 16,84 | 17,54 | 18,59 | -     |
| 306262.0200.020.20 | • 2,0  | 0,20      | 20 | 4     | 1,95 | 60 | 2,8  | 37,00 | 22,07 | 22,87 | 24,05 | -     |
| 306262.0250.025.08 | • 2,5  | 0,25      | 8  | 4     | 2,40 | 60 | 3,5  | 37,00 | 9,62  | 10,09 | 10,87 | 11,52 |
| 306262.0250.025.15 | • 2,5  | 0,25      | 15 | 4     | 2,40 | 60 | 3,5  | 37,00 | 16,97 | 17,64 | 18,66 | -     |
| 306262.0300.030.10 | • 3,0  | 0,30      | 10 | 6     | 2,90 | 60 | 4,0  | 50,00 | 11,72 | 12,26 | 13,11 | 13,82 |
| 306262.0300.030.15 | • 3,0  | 0,30      | 15 | 6     | 2,90 | 60 | 4,0  | 50,00 | 16,97 | 17,63 | 18,65 | 19,47 |
| 306262.0300.030.20 | • 3,0  | 0,30      | 20 | 6     | 2,90 | 65 | 4,0  | 51,00 | 22,18 | 22,95 | 24,10 | 25,01 |
| 306262.0300.030.25 | • 3,0  | 0,30      | 25 | 6     | 2,90 | 65 | 4,0  | 51,00 | 27,38 | 28,23 | 29,50 | -     |
| 306262.0300.050.10 | • 3,0  | 0,50      | 10 | 6     | 2,80 | 60 | 5,0  | 47,00 | -     | -     | -     | -     |
| 306262.0400.040.10 | • 4,0  | 0,40      | 10 | 6     | 3,90 | 70 | 5,0  | 54,00 | 11,72 | 12,25 | 13,10 | 13,81 |
| 306262.0400.040.15 | • 4,0  | 0,40      | 15 | 6     | 3,90 | 70 | 5,0  | 54,00 | 16,96 | 17,62 | 18,64 | 19,46 |
| 306262.0400.040.20 | • 4,0  | 0,40      | 20 | 6     | 3,90 | 70 | 5,0  | 55,00 | 22,18 | 22,95 | 24,10 | -     |
| 306262.0400.040.25 | • 4,0  | 0,40      | 25 | 6     | 3,90 | 70 | 5,0  | 55,00 | 27,37 | 28,23 | -     | -     |
| 306262.0500.050.15 | • 5,0  | 0,50      | 15 | 6     | 4,90 | 70 | 6,0  | 55,00 | 11,71 | 12,24 | 13,09 | 13,79 |
| 306262.0500.050.20 | • 5,0  | 0,50      | 20 | 6     | 4,90 | 70 | 6,0  | 55,00 | 16,96 | 17,62 | 18,63 | 19,45 |
| 306262.0500.050.25 | • 5,0  | 0,50      | 25 | 6     | 4,90 | 70 | 6,0  | 55,00 | 22,17 | 22,94 | 24,09 | -     |
| 306262.0600.050.20 | • 6,0  | 0,50      | 20 | 6     | 5,80 | 60 | 9,0  | 62,00 | 27,37 | 28,22 | -     | -     |
| 306262.0600.050.30 | • 6,0  | 0,50      | 30 | 6     | 5,80 | 70 | 9,0  | 65,00 | 16,96 | 17,62 | -     | -     |
| 306262.0600.100.20 | • 6,0  | 1,00      | 20 | 6     | 5,80 | 60 | 9,0  | 62,00 | 22,17 | 22,94 | -     | -     |
| 306262.0600.100.30 | • 6,0  | 1,00      | 30 | 6     | 5,80 | 70 | 9,0  | 65,00 | 27,37 | 28,22 | -     | -     |
| 306262.0800.050.30 | • 8,0  | 0,50      | 30 | 8     | 7,80 | 70 | 12,0 | 73,00 | -     | -     | -     | -     |
| 306262.0800.100.30 | • 8,0  | 1,00      | 30 | 8     | 7,80 | 70 | 12,0 | 73,00 | -     | -     | -     | -     |
| 306262.1000.050.40 | • 10,0 | 0,50      | 40 | 10    | 9,80 | 90 | 15,0 | 93,00 | -     | -     | -     | -     |
| 306262.1000.100.40 | • 10,0 | 1,00      | 40 | 10    | 9,80 | 90 | 15,0 | 93,00 | -     | -     | -     | -     |



IHR PARTNER FÜR: Metallindustrie Automobilindustrie Flugzeugindustrie Schiffbau Schienenbau Formenbau Forschung und Entwicklung

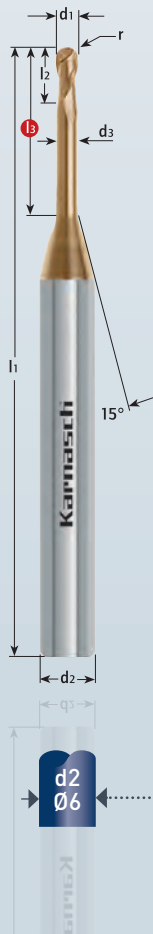
Eine große Vision braucht einen  
zuverlässigen Partner.

KARNASCH – Made for Professionals



Art. 30.6264 PROFESSIONAL VHM-Micro-3D Mini-Radiusfräser, < 30 x D Schnitttiefe, Schaft 6 mm

- HRC<70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- NI-ALLOYS  
< 900 N/mm
- GG/G  
cast iron



- Solid carbide miniatur ball nose slot mill, 2-30 x diameter cutting depth, shank 6 mm
- Microfresa metal duro con radio de 3D, 2-30xD profundidad de corte, mango 6mm
- Твердосплавная радиусная мини-фреза 3D, глубина распила 2-30xD, хвостовик 6 мм

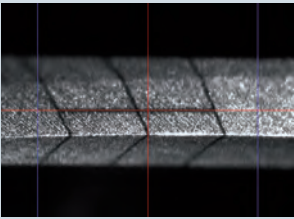
NEU / NEW

tol. r max = ± 0,003

d1\* = Ø 0,2 - Ø 5,9    tol -0,002 / -0,010

d1\* = Ø 6,0    tol -0,004 / -0,016

Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO GRAIN KARNASCH NORM

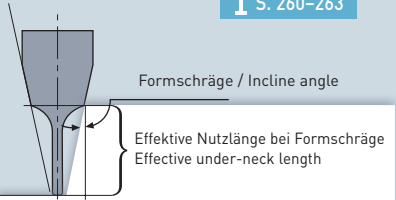
N/M DIN 6535 Form HA

30°

Schnittdaten  
Cutting data



i S. 260-263



| Art.            | d1*   | r ± 0,003 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|-----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306264.0020.005 | • 0,2 | 0,10      | 0,5 | 6     | 0,18 | 55 | 0,20 | 51,00 | 1,11  | 1,28  | 1,62  | 1,96  |
| 306264.0020.01  | • 0,2 | 0,10      | 1   | 6     | 0,18 | 55 | 0,20 | 51,00 | 1,69  | 1,91  | 2,32  | 2,71  |
| 306264.0030.01  | • 0,3 | 0,15      | 1   | 6     | 0,28 | 55 | 0,25 | 46,50 | 1,68  | 1,90  | 2,30  | 2,68  |
| 306264.0030.02  | • 0,3 | 0,15      | 2   | 6     | 0,28 | 55 | 0,25 | 46,50 | 2,81  | 3,11  | 3,61  | 4,06  |
| 306264.0030.03  | • 0,3 | 0,15      | 3   | 6     | 0,28 | 55 | 0,25 | 46,50 | 3,93  | 4,28  | 4,86  | 5,36  |
| 306264.0030.05  | ▲ 0,3 | 0,15      | 5   | 6     | 0,28 | 55 | 0,25 | 46,50 | 6,11  | 6,56  | 7,26  | 7,85  |
| 306264.0040.02  | • 0,4 | 0,20      | 2   | 6     | 0,38 | 55 | 0,30 | 42,00 | 2,81  | 3,10  | 3,60  | 4,05  |
| 306264.0040.03  | • 0,4 | 0,20      | 3   | 6     | 0,38 | 55 | 0,30 | 42,00 | 3,92  | 4,27  | 4,85  | 5,35  |
| 306264.0040.04  | • 0,4 | 0,20      | 4   | 6     | 0,38 | 55 | 0,30 | 42,00 | 6,11  | 6,55  | 7,25  | 7,83  |
| 306264.0040.05  | ▲ 0,4 | 0,20      | 5   | 6     | 0,38 | 55 | 0,30 | 42,00 | 5,02  | 5,42  | 6,06  | 6,61  |
| 306264.0040.06  | • 0,4 | 0,20      | 6   | 6     | 0,38 | 55 | 0,30 | 42,00 | 7,19  | 7,67  | 8,42  | 9,04  |
| 306264.0050.02  | • 0,5 | 0,25      | 2   | 6     | 0,48 | 55 | 0,40 | 42,00 | 2,80  | 3,09  | 3,59  | 4,03  |
| 306264.0050.03  | • 0,5 | 0,25      | 3   | 6     | 0,48 | 55 | 0,40 | 42,00 | 3,92  | 4,26  | 4,84  | 5,34  |
| 306264.0050.04  | • 0,5 | 0,25      | 4   | 6     | 0,48 | 55 | 0,40 | 42,00 | 5,01  | 5,41  | 6,05  | 6,59  |
| 306264.0050.05  | • 0,5 | 0,25      | 5   | 6     | 0,48 | 55 | 0,40 | 42,00 | 6,10  | 6,54  | 7,24  | 7,82  |
| 306264.0050.06  | ▲ 0,5 | 0,25      | 6   | 6     | 0,48 | 55 | 0,40 | 42,00 | 7,19  | 7,66  | 8,41  | 9,03  |
| 306264.0060.02  | • 0,6 | 0,30      | 2   | 6     | 0,58 | 55 | 0,50 | 40,00 | 2,80  | 3,08  | 3,57  | 4,10  |
| 306264.0060.03  | • 0,6 | 0,30      | 3   | 6     | 0,58 | 55 | 0,50 | 40,00 | 3,91  | 4,25  | 4,83  | 5,32  |
| 306264.0060.04  | • 0,6 | 0,30      | 4   | 6     | 0,58 | 55 | 0,50 | 40,00 | 5,01  | 5,40  | 6,04  | 6,58  |
| 306264.0060.05  | • 0,6 | 0,30      | 5   | 6     | 0,58 | 55 | 0,50 | 40,00 | 6,10  | 6,54  | 7,23  | 7,81  |
| 306264.0060.06  | • 0,6 | 0,30      | 6   | 6     | 0,58 | 55 | 0,50 | 40,00 | 7,18  | 7,66  | 8,40  | 9,02  |
| 306264.0060.08  | • 0,6 | 0,30      | 8   | 6     | 0,58 | 55 | 0,50 | 40,00 | 9,33  | 9,87  | 10,71 | 11,39 |
| 306264.0080.02  | • 0,8 | 0,40      | 2   | 6     | 0,77 | 55 | 0,60 | 40,00 | 2,85  | 3,12  | 3,58  | 4,01  |
| 306264.0080.04  | • 0,8 | 0,40      | 4   | 6     | 0,77 | 55 | 0,60 | 40,00 | 5,05  | 5,43  | 6,05  | 6,58  |
| 306264.0080.05  | • 0,8 | 0,40      | 5   | 6     | 0,77 | 55 | 0,60 | 40,00 | 6,14  | 6,56  | 7,24  | 7,81  |
| 306264.0080.06  | • 0,8 | 0,40      | 6   | 6     | 0,77 | 55 | 0,60 | 40,00 | 7,22  | 7,68  | 8,41  | 9,02  |
| 306264.0080.07  | ▲ 0,8 | 0,40      | 7   | 6     | 0,77 | 55 | 0,60 | 38,50 | 8,29  | 8,79  | 9,57  | 10,21 |
| 306264.0080.08  | • 0,8 | 0,40      | 8   | 6     | 0,77 | 55 | 0,60 | 40,00 | 9,36  | 9,89  | 10,71 | 11,39 |
| 306264.0080.10  | • 0,8 | 0,40      | 10  | 6     | 0,77 | 65 | 0,60 | 40,00 | 11,49 | 12,08 | 12,98 | 13,71 |
| 306264.0090.06  | ▲ 0,9 | 0,45      | 6   | 6     | 0,87 | 55 | 0,70 | 38,50 | 7,21  | 7,67  | 8,40  | 9,01  |
| 306264.0090.12  | ▲ 0,9 | 0,45      | 12  | 6     | 0,87 | 65 | 0,70 | 38,50 | 13,61 | 14,25 | 15,21 | 15,99 |
| 306264.0100.03  | • 1,0 | 0,50      | 3   | 6     | 0,95 | 55 | 0,80 | 40,00 | 4,06  | 4,36  | 4,88  | 5,35  |
| 306264.0100.04  | • 1,0 | 0,50      | 4   | 6     | 0,95 | 55 | 0,80 | 40,00 | 5,14  | 5,49  | 6,09  | 6,60  |
| 306264.0100.05  | • 1,0 | 0,50      | 5   | 6     | 0,95 | 55 | 0,80 | 40,00 | 6,22  | 6,62  | 7,27  | 7,83  |
| 306264.0100.06  | • 1,0 | 0,50      | 6   | 6     | 0,95 | 55 | 0,80 | 40,00 | 7,30  | 7,73  | 8,44  | 9,04  |
| 306264.0100.07  | • 1,0 | 0,50      | 7   | 6     | 0,95 | 55 | 0,80 | 40,00 | 8,37  | 8,84  | 9,60  | 10,23 |
| 306264.0100.08  | • 1,0 | 0,50      | 8   | 6     | 0,95 | 55 | 0,80 | 40,00 | 9,43  | 9,94  | 10,74 | 11,40 |
| 306264.0100.10  | • 1,0 | 0,50      | 10  | 6     | 0,95 | 65 | 0,80 | 40,00 | 11,55 | 12,12 | 13,00 | 13,72 |
| 306264.0100.12  | • 1,0 | 0,50      | 12  | 6     | 0,95 | 65 | 0,80 | 40,00 | 13,67 | 14,29 | 15,24 | 16,01 |
| 306264.0100.15  | • 1,0 | 0,50      | 15  | 6     | 0,95 | 65 | 0,80 | 40,00 | 16,82 | 17,52 | 18,56 | 19,39 |
| 306264.0100.20  | • 1,0 | 0,50      | 20  | 6     | 0,95 | 65 | 0,80 | 41,00 | 22,05 | 22,85 | 24,03 | 24,94 |



PROFESSIONAL  
★ ★ ★

Art. **30.6264**

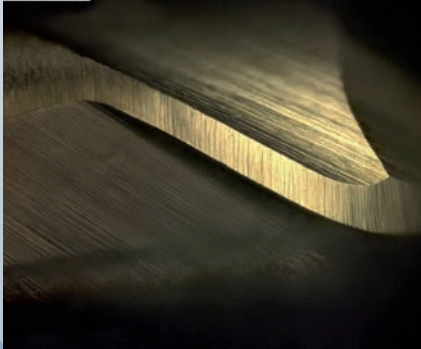
| Art.              | d1*   | r ± 0,003 | l3  | d2 h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-------------------|-------|-----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306264.0120.05    | • 1,2 | 0,60      | 5   | 6     | 1,15 | 55 | 1,00 | 39,00 | –     | –     | –     | –     |
| 306264.0120.06    | • 1,2 | 0,60      | 6   | 6     | 1,15 | 55 | 1,00 | 39,00 | 7,29  | 7,72  | 8,42  | 9,02  |
| 306264.0120.08    | • 1,2 | 0,60      | 8   | 6     | 1,15 | 55 | 1,00 | 39,00 | 9,42  | 9,93  | 10,73 | 11,38 |
| 306264.0120.10    | • 1,2 | 0,60      | 10  | 6     | 1,15 | 65 | 1,00 | 39,00 | 11,55 | 12,11 | 12,99 | 13,71 |
| 306264.0120.12    | • 1,2 | 0,60      | 12  | 6     | 1,15 | 65 | 1,00 | 39,00 | 13,66 | 14,28 | 15,23 | 15,99 |
| 306264.0120.15    | • 1,2 | 0,60      | 15  | 6     | 1,15 | 65 | 1,00 | 39,00 | 16,82 | 17,51 | 18,55 | 19,38 |
| 306264.0120.20    | • 1,2 | 0,60      | 20  | 6     | 1,15 | 65 | 1,00 | 40,00 | 22,05 | 22,85 | 24,02 | 24,93 |
| 306264.0120.25    | • 1,2 | 0,60      | 25  | 6     | 1,15 | 70 | 1,00 | 40,00 | 27,26 | 28,14 | 29,42 | 30,41 |
| 306264.0140.15    | ▲ 1,4 | 0,70      | 15  | 6     | 1,35 | 65 | 1,10 | 37,50 | 16,81 | 17,50 | 18,54 | 19,37 |
| 306264.0150.025   | • 1,5 | 0,75      | 2,5 | 6     | 1,45 | 55 | 1,50 | 36,50 | –     | –     | –     | –     |
| 306264.0150.06    | • 1,5 | 0,75      | 6   | 6     | 1,44 | 55 | 1,20 | 39,00 | 7,32  | 7,74  | 8,42  | 9,01  |
| 306264.0150.08    | • 1,5 | 0,75      | 8   | 6     | 1,44 | 55 | 1,20 | 39,00 | 9,45  | 9,94  | 10,72 | 11,38 |
| 306264.0150.10    | • 1,5 | 0,75      | 10  | 6     | 1,44 | 65 | 1,20 | 39,00 | 11,57 | 12,13 | 12,99 | 13,70 |
| 306264.0150.12    | • 1,5 | 0,75      | 12  | 6     | 1,44 | 65 | 1,20 | 39,00 | 13,68 | 14,29 | 15,23 | 15,99 |
| 306264.0150.15    | • 1,5 | 0,75      | 15  | 6     | 1,44 | 65 | 1,20 | 39,00 | 16,84 | 17,52 | 18,55 | 19,37 |
| 306264.0150.20    | • 1,5 | 0,75      | 20  | 6     | 1,44 | 65 | 1,20 | 40,00 | 22,07 | 22,85 | 24,02 | 24,93 |
| 306264.0160.08    | ▲ 1,6 | 0,80      | 8   | 6     | 1,54 | 55 | 1,30 | 36,50 | 9,45  | 9,94  | 10,72 | 11,37 |
| 306264.0160.15    | ▲ 1,6 | 0,80      | 15  | 6     | 1,54 | 65 | 1,30 | 37,50 | 16,84 | 17,52 | 18,55 | 19,36 |
| 306264.0180.10    | ▲ 1,8 | 0,90      | 10  | 6     | 1,74 | 65 | 1,40 | 37,50 | 11,56 | 12,11 | 12,97 | 13,67 |
| 306264.0180.20    | ▲ 1,8 | 0,90      | 20  | 6     | 1,74 | 65 | 1,40 | 37,50 | 22,06 | 22,84 | 24,00 | 24,91 |
| 306264.0200.06    | • 2,0 | 1,00      | 6   | 6     | 1,92 | 55 | 1,50 | 39,00 | 7,38  | 7,77  | 8,43  | 8,99  |
| 306264.0200.08    | • 2,0 | 1,00      | 8   | 6     | 1,92 | 55 | 1,50 | 39,00 | 9,51  | 9,97  | 10,73 | 11,37 |
| 306264.0200.10    | • 2,0 | 1,00      | 10  | 6     | 1,92 | 65 | 1,50 | 39,00 | 11,62 | 12,15 | 12,99 | 13,69 |
| 306264.0200.12    | • 2,0 | 1,00      | 12  | 6     | 1,92 | 65 | 1,50 | 39,00 | 13,73 | 14,32 | 15,23 | 15,98 |
| 306264.0200.15    | • 2,0 | 1,00      | 15  | 6     | 1,92 | 65 | 1,50 | 39,00 | 16,88 | 17,54 | 18,55 | 19,36 |
| 306264.0200.20    | • 2,0 | 1,00      | 20  | 6     | 1,92 | 65 | 1,50 | 40,00 | 22,11 | 22,87 | 24,02 | 24,92 |
| 306264.0200.25    | • 2,0 | 1,00      | 25  | 6     | 1,92 | 70 | 1,50 | 40,00 | 27,31 | 28,17 | 29,43 | 30,40 |
| 306264.0200.30    | • 2,0 | 1,00      | 30  | 6     | 1,92 | 75 | 1,50 | 40,50 | 32,49 | 33,43 | 34,79 | 35,82 |
| 306264.0250.04    | • 2,5 | 1,25      | 4   | 6     | 2,40 | 55 | 2,50 | 37,50 | –     | –     | –     | –     |
| 306264.0250.10    | • 2,5 | 1,25      | 10  | 6     | 2,40 | 65 | 2,50 | 37,50 | 11,67 | 12,18 | 13,00 | 13,68 |
| 306264.0250.15    | • 2,5 | 1,25      | 15  | 6     | 2,40 | 65 | 2,50 | 37,50 | 16,92 | 17,57 | 18,56 | 19,36 |
| 306264.0250.20    | • 2,5 | 1,25      | 20  | 6     | 2,40 | 65 | 2,50 | 37,50 | 22,14 | 22,89 | 24,02 | 24,91 |
| 306264.0250.25    | • 2,5 | 1,25      | 25  | 6     | 2,40 | 70 | 2,50 | 39,50 | 27,34 | 28,18 | 29,43 | 30,39 |
| 306264.0300.05    | • 3,0 | 1,50      | 5   | 6     | 2,90 | 55 | 2,50 | 37,50 | 6,36  | 6,67  | 7,22  | 7,72  |
| 306264.0300.10    | • 3,0 | 1,50      | 10  | 6     | 2,90 | 65 | 2,50 | 37,50 | 11,66 | 12,16 | 12,97 | 13,64 |
| 306264.0300.15    | • 3,0 | 1,50      | 15  | 6     | 2,90 | 65 | 2,50 | 37,50 | 16,91 | 17,55 | 18,53 | 19,33 |
| 306264.0300.20    | • 3,0 | 1,50      | 20  | 6     | 2,90 | 65 | 2,50 | 37,50 | 22,13 | 22,88 | 24,00 | 24,89 |
| 306264.0300.25    | • 3,0 | 1,50      | 25  | 6     | 2,90 | 70 | 2,50 | 39,50 | 27,33 | 28,17 | 29,41 | –     |
| 306264.0300.30    | • 3,0 | 1,50      | 30  | 6     | 2,90 | 75 | 2,50 | 40,50 | 32,51 | 33,43 | 34,77 | –     |
| 306264.0400.10    | • 4,0 | 2,00      | 10  | 6     | 3,90 | 65 | 3,20 | 37,50 | 11,63 | 12,12 | 12,90 | 13,56 |
| 306264.0400.15    | • 4,0 | 2,00      | 15  | 6     | 3,90 | 65 | 3,20 | 37,50 | 16,89 | 17,51 | 18,48 | 19,26 |
| 306264.0400.20    | • 4,0 | 2,00      | 20  | 6     | 3,90 | 65 | 3,20 | 37,50 | 22,11 | 22,85 | 23,96 | –     |
| 306264.0400.25    | • 4,0 | 2,00      | 25  | 6     | 3,90 | 70 | 3,20 | 39,50 | 27,31 | 28,14 | 29,37 | –     |
| 306264.0400.30    | • 4,0 | 2,00      | 30  | 6     | 3,90 | 75 | 3,20 | 40,50 | 32,49 | 33,41 | –     | –     |
| 306264.0500.10.55 | • 5,0 | 2,50      | 10  | 6     | 4,80 | 55 | 5,00 | 37,50 | –     | –     | –     | –     |
| 306264.0500.10    | • 5,0 | 2,50      | 10  | 6     | 4,90 | 65 | 4,00 | 37,50 | 11,60 | 12,07 | 12,84 | –     |
| 306264.0500.15    | • 5,0 | 2,50      | 15  | 6     | 4,90 | 65 | 4,00 | 37,50 | 16,86 | 17,48 | –     | –     |
| 306264.0500.20    | • 5,0 | 2,50      | 20  | 6     | 4,90 | 65 | 4,00 | 37,50 | 22,09 | 22,82 | –     | –     |
| 306264.0500.25    | • 5,0 | 2,50      | 25  | 6     | 4,90 | 70 | 4,00 | 40,50 | 32,48 | –     | –     | –     |
| 306264.0500.30    | • 5,0 | 2,50      | 30  | 6     | 4,90 | 75 | 4,00 | 40,50 | 42,81 | –     | –     | –     |
| 306264.0500.40    | • 5,0 | 2,50      | 40  | 6     | 4,90 | 90 | 4,00 | 40,50 | –     | –     | –     | –     |
| 306264.0600.10    | • 6,0 | 3,00      | 10  | 6     | 5,90 | 65 | 5,00 | 37,50 | –     | –     | –     | –     |
| 306264.0600.11    | • 6,0 | 3,00      | 11  | 6     | 5,80 | 55 | 6,00 | 37,50 | –     | –     | –     | –     |
| 306264.0600.15    | • 6,0 | 3,00      | 15  | 6     | 5,90 | 65 | 5,00 | 37,50 | –     | –     | –     | –     |
| 306264.0600.20    | • 6,0 | 3,00      | 20  | 6     | 5,90 | 65 | 5,00 | 37,50 | –     | –     | –     | –     |
| 306264.0600.25    | • 6,0 | 3,00      | 25  | 6     | 5,90 | 70 | 5,00 | 40,50 | –     | –     | –     | –     |
| 306264.0600.30    | • 6,0 | 3,00      | 30  | 6     | 5,90 | 75 | 5,00 | 40,50 | –     | –     | –     | –     |
| 306264.0600.40    | • 6,0 | 3,00      | 40  | 6     | 5,90 | 90 | 5,00 | 40,50 | –     | –     | –     | –     |
| 306264.0600.50    | • 6,0 | 3,00      | 50  | 6     | 5,90 | 90 | 5,00 | 41,50 | –     | –     | –     | –     |

30.6264 - Ø 1,0 x 15



Droplet-freie Beschichtung HXC-Nano<sup>3</sup>  
Droplet-free coating HXC-Nano<sup>3</sup>

306264-1,0x4,0



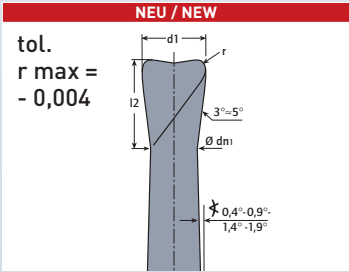
250-fache Vergrößerung  
250-times magnification

Art. **30.6265** **PROFESSIONAL** VHM-Micro-Schaftfräser mit Eckenradius, konischer Hals 0,4° - 0,9° - 1,4° - 1,9° < 35 x D

- HRC < 70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- NI-ALLOYS  
< 900 N/mm
- INCONEL  
HASTELLOY  
TITAN
- HARDOX
- GJL
- GJS



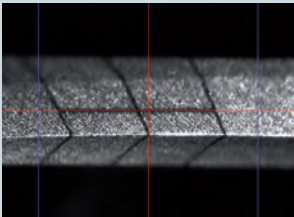
- Micro end mill with corner radius, conical neck –  
0,4° - 0,9° - 1,4° - 1,9° < 35xD
- Microfresa metal duro de mango con radio angular, cuello cónico -  
0,4° - 0,9° - 1,4° - 1,9° < 35xD
- Твердосплавная концевая микро-фреза с угловым радиусом,  
коническая шейка - 0,4° - 0,9° - 1,4° - 1,9° < 35xD



d1\* = Ø 0,2 - Ø 2,0 tol -0,004 / -0,018

d1\* = Ø 2,1 - Ø 6,0 tol -0,006 / -0,020

Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO GRAIN KARNASCH NORM

N/M DIN 6535 Form HA

30°

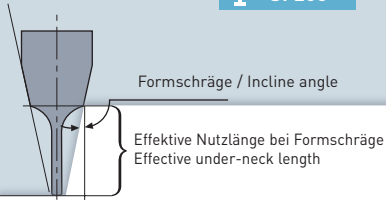
HHC HSC HPC

HXC-NANO<sup>3</sup>

Schnittdaten  
Cutting data



i S. 268

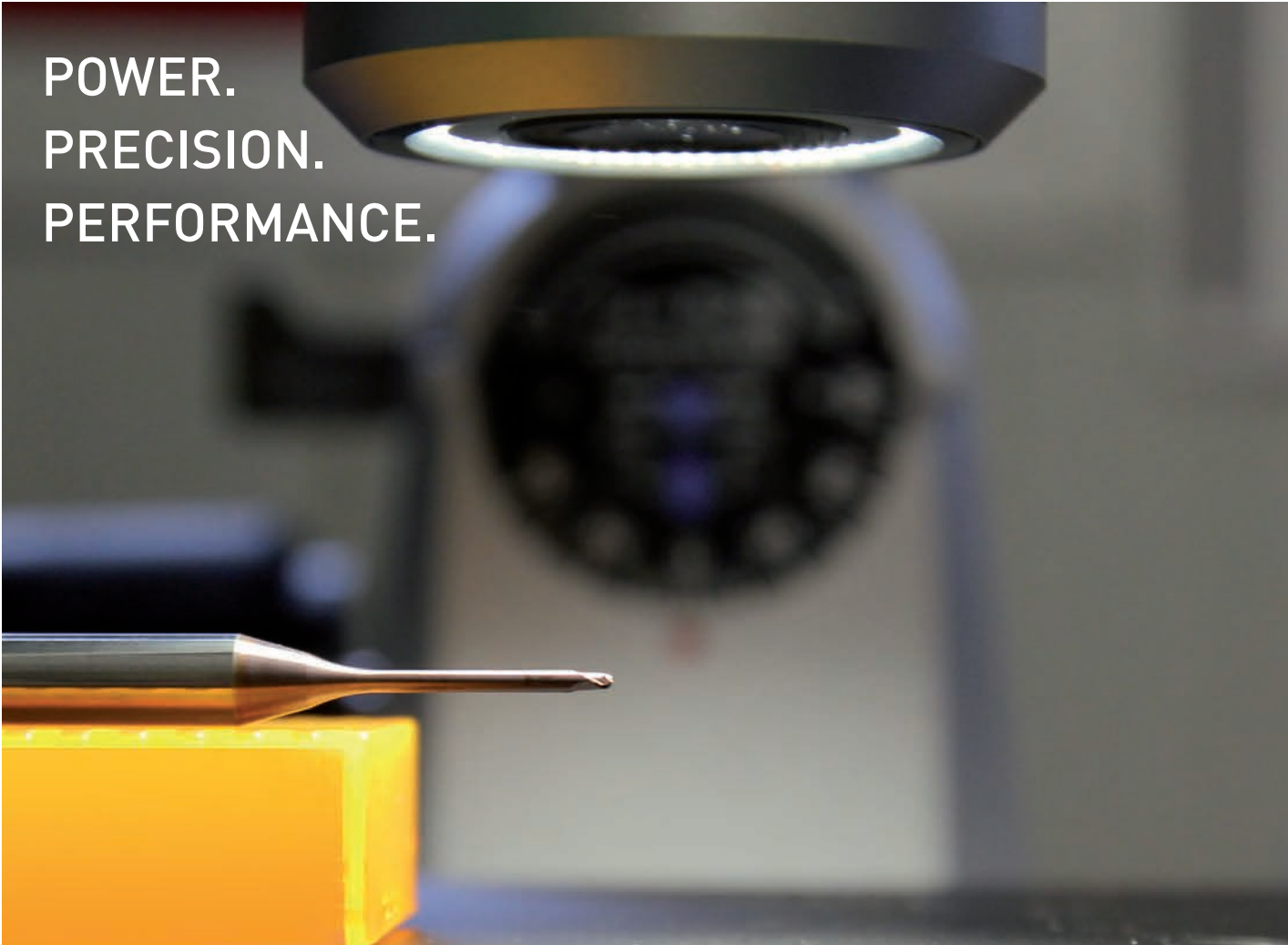


| Art.              | d1*   | r - 0,004 | ↗    | l3 | d2 h5 | l2   | dn 1 | dn 2  | l1 | €     | 0°   | 0,5° | 1°    | 2°    | 3°    |
|-------------------|-------|-----------|------|----|-------|------|------|-------|----|-------|------|------|-------|-------|-------|
| 306265.0020.14.02 | ▲ 0,2 | 0,05      | 1,4° | 2  | 6     | 0,15 | 0,17 | 0,260 | 55 | 67,00 | 0,75 | 1,15 | 2,50  | 3,28  | 3,82  |
| 306265.0020.14.03 | ▲ 0,2 | 0,05      | 1,4° | 3  | 6     | 0,15 | 0,17 | 0,309 | 55 | 67,00 | 0,75 | 1,15 | 2,52  | 4,39  | 5,02  |
| 306265.0020.19.02 | ▲ 0,2 | 0,05      | 1,9° | 2  | 6     | 0,15 | 0,17 | 0,293 | 55 | 67,00 | 0,60 | 0,80 | 1,22  | 3,09  | 3,69  |
| 306265.0020.19.03 | ▲ 0,2 | 0,05      | 1,9° | 3  | 6     | 0,15 | 0,17 | 0,359 | 55 | 67,00 | 0,60 | 0,80 | 1,22  | 4,12  | 4,85  |
| 306265.0040.09.04 | ● 0,4 | 0,05      | 0,9° | 4  | 6     | 0,30 | 0,37 | 0,486 | 55 | 54,50 | 1,25 | 2,73 | 4,91  | 5,76  | 6,39  |
| 306265.0040.09.05 | ● 0,4 | 0,05      | 0,9° | 5  | 6     | 0,30 | 0,37 | 0,518 | 55 | 54,50 | 1,25 | 2,73 | 5,94  | 6,89  | 7,57  |
| 306265.0040.14.04 | ▲ 0,4 | 0,05      | 1,4° | 4  | 6     | 0,30 | 0,37 | 0,551 | 55 | 54,50 | 0,91 | 1,39 | 3,07  | 5,51  | 6,21  |
| 306265.0040.14.06 | ▲ 0,4 | 0,05      | 1,4° | 6  | 6     | 0,30 | 0,37 | 0,649 | 55 | 54,50 | 0,91 | 1,39 | 3,07  | 7,68  | 8,50  |
| 306265.0040.19.04 | ▲ 0,4 | 0,05      | 1,9° | 4  | 6     | 0,30 | 0,37 | 0,615 | 55 | 54,50 | 0,74 | 1,00 | 1,53  | 5,19  | 6,01  |
| 306265.0040.19.06 | ▲ 0,4 | 0,05      | 1,9° | 6  | 6     | 0,30 | 0,37 | 0,748 | 55 | 54,50 | 0,74 | 1,00 | 1,53  | 7,23  | 8,25  |
| 306265.0050.09.05 | ● 0,5 | 0,05      | 0,9° | 5  | 6     | 0,40 | 0,47 | 0,615 | 55 | 48,00 | 1,72 | 3,85 | 6,03  | 6,94  | 7,60  |
| 306265.0050.09.08 | ● 0,5 | 0,05      | 0,9° | 8  | 6     | 0,40 | 0,47 | 0,709 | 55 | 48,00 | 1,72 | 3,85 | 9,09  | 10,26 | 11,06 |
| 306265.0050.09.10 | ● 0,5 | 0,05      | 0,9° | 10 | 6     | 0,40 | 0,47 | 0,772 | 55 | 48,00 | 1,72 | 3,85 | 11,13 | 12,44 | 13,31 |
| 306265.0060.09.12 | ● 0,6 | 0,06      | 0,9° | 12 | 6     | 0,40 | 0,57 | 0,934 | 55 | 48,00 | 1,35 | 2,93 | 13,09 | 14,58 | 15,53 |
| 306265.0060.09.15 | ● 0,6 | 0,06      | 0,9° | 15 | 6     | 0,40 | 0,57 | 1,029 | 55 | 48,00 | 1,35 | 2,93 | 16,15 | 17,82 | 18,85 |
| 306265.0060.14.06 | ▲ 0,6 | 0,06      | 1,4° | 6  | 6     | 0,40 | 0,57 | 0,844 | 55 | 48,00 | 1,01 | 1,54 | 3,40  | 7,69  | 8,51  |
| 306265.0060.14.08 | ▲ 0,6 | 0,06      | 1,4° | 8  | 6     | 0,40 | 0,57 | 0,941 | 55 | 48,00 | 1,01 | 1,54 | 3,40  | 9,84  | 10,77 |
| 306265.0060.14.10 | ▲ 0,6 | 0,06      | 1,4° | 10 | 6     | 0,40 | 0,57 | 1,039 | 55 | 48,00 | 1,01 | 1,54 | 3,40  | 11,97 | 12,99 |
| 306265.0060.14.12 | ▲ 0,6 | 0,06      | 1,4° | 12 | 6     | 0,40 | 0,57 | 1,137 | 55 | 48,00 | 1,01 | 1,54 | 3,40  | 14,09 | 15,20 |
| 306265.0060.14.15 | ▲ 0,6 | 0,06      | 1,4° | 15 | 6     | 0,40 | 0,57 | 1,284 | 55 | 48,00 | 1,01 | 1,54 | 3,40  | 17,26 | 18,48 |
| 306265.0060.19.08 | ▲ 0,6 | 0,06      | 1,9° | 8  | 6     | 0,40 | 0,57 | 1,074 | 55 | 48,00 | 0,85 | 1,12 | 1,73  | 9,31  | 10,46 |
| 306265.0060.19.12 | ▲ 0,6 | 0,06      | 1,9° | 12 | 6     | 0,40 | 0,57 | 1,340 | 55 | 48,00 | 0,85 | 1,12 | 1,73  | 13,38 | 14,81 |
| 306265.0060.19.15 | ▲ 0,6 | 0,06      | 1,9° | 15 | 6     | 0,40 | 0,57 | 1,539 | 55 | 48,00 | 0,85 | 1,12 | 1,73  | 16,42 | 18,04 |
| 306265.0080.04.06 | ● 0,8 | 0,08      | 0,4° | 6  | 6     | 0,50 | 0,77 | 0,847 | 55 | 48,00 | 2,65 | 6,84 | 7,45  | 8,28  | 8,93  |
| 306265.0080.09.12 | ● 0,8 | 0,08      | 0,9° | 12 | 6     | 0,50 | 0,77 | 1,131 | 55 | 48,00 | 1,63 | 3,17 | 13,11 | 14,59 | 15,53 |
| 306265.0080.14.12 | ▲ 0,8 | 0,08      | 1,4° | 12 | 6     | 0,50 | 0,77 | 1,332 | 55 | 48,00 | 1,11 | 1,69 | 13,35 | 14,40 | 15,40 |
| 306265.0080.14.16 | ▲ 0,8 | 0,08      | 1,4° | 16 | 6     | 0,50 | 0,77 | 1,528 | 55 | 48,00 | 1,11 | 1,69 | 17,57 | 18,70 | 19,81 |
| 306265.0080.19.08 | ▲ 0,8 | 0,08      | 1,9° | 8  | 6     | 0,50 | 0,77 | 1,268 | 55 | 48,00 | 0,95 | 1,91 | 1,26  | 9,33  | 10,47 |
| 306265.0080.19.12 | ▲ 0,8 | 0,08      | 1,9° | 12 | 6     | 0,50 | 0,77 | 1,533 | 55 | 48,00 | 0,95 | 1,91 | 1,26  | 13,40 | 14,82 |
| 306265.0080.19.16 | ▲ 0,8 | 0,08      | 1,9° | 16 | 6     | 0,50 | 0,77 | 1,798 | 55 | 48,00 | 0,95 | 1,91 | 1,26  | 17,47 | 19,12 |
| 306265.0100.04.08 | ● 1,0 | 0,10      | 0,4° | 8  | 6     | 0,80 | 0,94 | 1,041 | 55 | 48,00 | 5,10 | 9,08 | 9,71  | 10,61 | 11,32 |
| 306265.0100.09.10 | ● 1,0 | 0,10      | 0,9° | 10 | 6     | 0,80 | 0,94 | 1,229 | 55 | 48,00 | 2,71 | 5,97 | 11,27 | 12,50 | 13,36 |
| 306265.0100.09.15 | ● 1,0 | 0,10      | 0,9° | 15 | 6     | 0,80 | 0,94 | 1,386 | 60 | 48,00 | 2,71 | 5,97 | 16,34 | 17,90 | 18,90 |
| 306265.0100.09.20 | ● 1,0 | 0,10      | 0,9° | 20 | 6     | 0,80 | 0,94 | 1,543 | 65 | 49,00 | 2,71 | 5,97 | 21,41 | 23,23 | 24,36 |
| 306265.0100.09.25 | ● 1,0 | 0,10      | 0,9° | 25 | 6     | 0,80 | 0,94 | 1,700 | 70 | 50,00 | 2,71 | 5,97 | 26,48 | 28,53 | 29,76 |
| 306265.0100.09.30 | ● 1,0 | 0,10      | 0,9° | 30 | 6     | 0,80 | 0,94 | 1,857 | 75 | 50,00 | 2,71 | 5,97 | 31,55 | 33,79 | 35,11 |
| 306265.0100.09.35 | ● 1,0 | 0,10      | 0,9° | 35 | 6     | 0,80 | 0,94 | 2,015 | 80 | 50,00 | 2,71 | 5,97 | 36,61 | 39,04 | 40,44 |
| 306265.0100.14.10 | ▲ 1,0 | 0,10      | 1,4° | 10 | 6     | 0,80 | 0,95 | 1,390 | 55 | 48,00 | 2,03 | 3,10 | 6,84  | 12,11 | 13,08 |
| 306265.0100.14.15 | ▲ 1,0 | 0,10      | 1,4° | 15 | 6     | 0,80 | 0,95 | 1,634 | 60 | 48,00 | 2,03 | 3,10 | 6,84  | 17,38 | 18,55 |
| 306265.0100.14.20 | ▲ 1,0 | 0,10      | 1,4° | 20 | 6     | 0,80 | 0,95 | 1,878 | 65 | 49,00 | 2,03 | 3,10 | 6,84  | 22,61 | 23,94 |
| 306265.0100.14.25 | ▲ 1,0 | 0,10      | 1,4° | 25 | 6     | 0,80 | 0,95 | 2,123 | 70 | 50,00 | 2,03 | 3,10 | 6,84  | 27,82 | 29,29 |
| 306265.0100.14.30 | ▲ 1,0 | 0,10      | 1,4° | 30 | 6     | 0,80 | 0,95 | 2,367 | 75 | 50,00 | 2,03 | 3,10 | 6,84  | 33,02 | 34,61 |



| Art.              | d1*   | r - 0,004 | ↗    | l3 | d2 h5 | l2   | dn 1 | dn 2  | l1  | €     | 0°   | 0,5°  | 1°    | 2°    | 3°    |
|-------------------|-------|-----------|------|----|-------|------|------|-------|-----|-------|------|-------|-------|-------|-------|
| 306265.0100.19.10 | ▲ 1,0 | 0,10      | 1,9° | 10 | 6     | 0,80 | 0,95 | 1,550 | 55  | 48,00 | 1,70 | 2,28  | 3,49  | 11,58 | 12,76 |
| 306265.0100.19.15 | ▲ 1,0 | 0,10      | 1,9° | 15 | 6     | 0,80 | 0,95 | 1,882 | 60  | 48,00 | 1,70 | 2,28  | 3,49  | 16,65 | 18,14 |
| 306265.0100.19.20 | ▲ 1,0 | 0,10      | 1,9° | 20 | 6     | 0,80 | 0,95 | 2,214 | 65  | 49,00 | 1,70 | 2,28  | 3,49  | 21,71 | 23,46 |
| 306265.0100.19.25 | ▲ 1,0 | 0,10      | 1,9° | 25 | 6     | 0,80 | 0,95 | 2,546 | 70  | 50,00 | 1,70 | 2,28  | 3,49  | 26,77 | 28,75 |
| 306265.0100.19.30 | ▲ 1,0 | 0,10      | 1,9° | 30 | 6     | 0,80 | 0,95 | 2,877 | 75  | 50,00 | 1,70 | 2,28  | 3,49  | 31,83 | 34,01 |
| 306265.0150.09.15 | ● 1,5 | 0,15      | 0,9° | 15 | 6     | 1,35 | 1,42 | 1,849 | 60  | 48,00 | 3,90 | 8,58  | 16,48 | 17,96 | 18,94 |
| 306265.0150.09.25 | ● 1,5 | 0,15      | 0,9° | 25 | 6     | 1,35 | 1,42 | 2,163 | 70  | 50,00 | 3,90 | 8,58  | 22,61 | 28,57 | 29,79 |
| 306265.0150.09.30 | ● 1,5 | 0,15      | 0,9° | 30 | 6     | 1,35 | 1,42 | 2,320 | 75  | 50,00 | 3,90 | 8,58  | 31,67 | 33,84 | 35,14 |
| 306265.0150.14.15 | ▲ 1,5 | 0,15      | 1,4° | 15 | 6     | 1,35 | 1,42 | 2,087 | 60  | 48,00 | 2,99 | 4,56  | 10,08 | 17,48 | 18,61 |
| 306265.0150.14.20 | ▲ 1,5 | 0,15      | 1,4° | 20 | 6     | 1,35 | 1,42 | 2,332 | 65  | 49,00 | 2,99 | 4,56  | 10,08 | 22,70 | 24,00 |
| 306265.0150.14.30 | ▲ 1,5 | 0,15      | 1,4° | 30 | 6     | 1,35 | 1,42 | 2,820 | 75  | 50,00 | 2,99 | 4,56  | 10,08 | 33,09 | 34,65 |
| 306265.0150.19.15 | ▲ 1,5 | 0,15      | 1,9° | 15 | 6     | 1,35 | 1,42 | 2,326 | 60  | 48,00 | 2,56 | 3,41  | 5,23  | 16,84 | 18,22 |
| 306265.0150.19.20 | ▲ 1,5 | 0,15      | 1,9° | 20 | 6     | 1,35 | 1,42 | 2,657 | 65  | 49,00 | 2,56 | 3,41  | 5,23  | 21,89 | 23,54 |
| 306265.0150.19.30 | ▲ 1,5 | 0,15      | 1,9° | 30 | 6     | 1,35 | 1,42 | 3,321 | 75  | 50,00 | 2,56 | 3,41  | 5,23  | 32,00 | 34,07 |
| 306265.0200.09.30 | ● 2,0 | 0,20      | 0,9° | 30 | 6     | 1,70 | 1,92 | 2,809 | 70  | 50,00 | 4,25 | 9,30  | 31,70 | 33,85 | 34,15 |
| 306265.0200.09.40 | ● 2,0 | 0,20      | 0,9° | 40 | 6     | 1,70 | 1,92 | 3,123 | 80  | 50,00 | 4,25 | 9,30  | 41,81 | 44,32 | -     |
| 306265.0200.09.50 | ● 2,0 | 0,20      | 0,9° | 50 | 6     | 1,70 | 1,92 | 3,438 | 90  | 52,00 | 4,25 | 9,30  | 51,91 | 54,72 | -     |
| 306265.0200.14.20 | ▲ 2,0 | 0,20      | 1,4° | 20 | 6     | 1,70 | 1,92 | 2,814 | 65  | 49,00 | 3,34 | 5,08  | 11,18 | 22,73 | 24,01 |
| 306265.0200.14.25 | ▲ 2,0 | 0,20      | 1,4° | 25 | 6     | 1,70 | 1,92 | 3,059 | 65  | 49,00 | 3,34 | 5,08  | 11,18 | 27,93 | 29,35 |
| 306265.0200.14.30 | ▲ 2,0 | 0,20      | 1,4° | 30 | 6     | 1,70 | 1,92 | 3,303 | 70  | 50,00 | 3,34 | 5,08  | 11,18 | 33,12 | 34,66 |
| 306265.0200.14.35 | ▲ 2,0 | 0,20      | 1,4° | 35 | 6     | 1,70 | 1,92 | 3,548 | 75  | 50,00 | 3,34 | 5,08  | 11,18 | 38,29 | -     |
| 306265.0200.14.40 | ▲ 2,0 | 0,20      | 1,4° | 40 | 6     | 1,70 | 1,92 | 3,792 | 80  | 50,00 | 3,34 | 5,08  | 11,18 | 43,45 | -     |
| 306265.0200.19.20 | ▲ 2,0 | 0,20      | 1,9° | 20 | 6     | 1,70 | 1,92 | 3,134 | 65  | 49,00 | 2,91 | 3,87  | 5,91  | 21,95 | 23,57 |
| 306265.0200.19.25 | ▲ 2,0 | 0,20      | 1,9° | 25 | 6     | 1,70 | 1,92 | 3,466 | 65  | 49,00 | 2,91 | 3,87  | 5,91  | 25,00 | 28,84 |
| 306265.0200.19.30 | ▲ 2,0 | 0,20      | 1,9° | 30 | 6     | 1,70 | 1,92 | 3,798 | 70  | 50,00 | 2,91 | 3,87  | 5,91  | 32,06 | 34,10 |
| 306265.0200.19.35 | ▲ 2,0 | 0,20      | 1,9° | 35 | 6     | 1,70 | 1,92 | 4,129 | 75  | 50,00 | 2,91 | 3,87  | 5,91  | 37,11 | -     |
| 306265.0200.19.40 | ▲ 2,0 | 0,20      | 1,9° | 40 | 6     | 1,70 | 1,92 | 4,461 | 80  | 50,00 | 2,91 | 3,87  | 5,91  | 42,15 | -     |
| 306265.0300.09.40 | ● 3,0 | 0,30      | 0,9° | 40 | 6     | 2,50 | 2,86 | 4,038 | 80  | 50,00 | 6,85 | 15,08 | 42,03 | -     | -     |
| 306265.0300.09.50 | ● 3,0 | 0,30      | 0,9° | 50 | 6     | 2,50 | 2,86 | 4,352 | 90  | 52,00 | 6,85 | 15,08 | 52,12 | -     | -     |
| 306265.0300.09.60 | ● 3,0 | 0,30      | 0,9° | 60 | 6     | 2,50 | 2,86 | 4,667 | 100 | 52,00 | 6,85 | 15,08 | 62,21 | -     | -     |
| 306265.0300.14.40 | ▲ 3,0 | 0,30      | 1,4° | 40 | 6     | 2,50 | 2,86 | 4,693 | 80  | 50,00 | 5,36 | 8,16  | 18,00 | -     | -     |
| 306265.0300.14.50 | ▲ 3,0 | 0,30      | 1,4° | 50 | 6     | 2,50 | 2,86 | 5,182 | 90  | 52,00 | 5,36 | 8,16  | 18,00 | -     | -     |
| 306265.0300.19.30 | ▲ 3,0 | 0,30      | 1,9° | 30 | 6     | 2,50 | 2,86 | 4,685 | 70  | 50,00 | 4,60 | 6,13  | 9,39  | 32,33 | -     |
| 306265.0300.19.40 | ▲ 3,0 | 0,30      | 1,9° | 40 | 6     | 2,50 | 2,86 | 5,348 | 80  | 50,00 | 4,60 | 6,13  | 9,39  | 42,42 | -     |
| 306265.0300.19.50 | ▲ 3,0 | 0,30      | 1,9° | 50 | 6     | 2,50 | 2,86 | 6,000 | 90  | 52,00 | 4,60 | 6,13  | 9,39  | -     | -     |

POWER.  
PRECISION.  
PERFORMANCE.

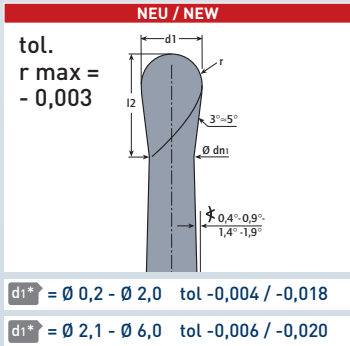


Art. 30.6266 PROFESSIONAL VHM-Micro-Radiusfräser konischer Hals 0,4° - 0,9° - 1,4° - 1,9° < 35 x D

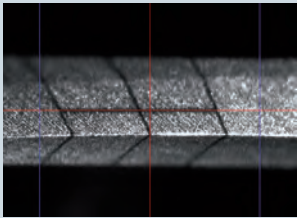
- HRC<70
- STAHL  
steel  
< 1400 N/mm
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- NI-ALLOYS  
< 900 N/mm
- INCONEL  
HASTELLOY  
TITAN
- HARDOX
- GJL
- GJS



- Micro end mill, radius cutter, conical neck –  
0,4° - 0,9° - 1,4° - 1,9° < 35xD
- Microfresa metal duro de radio, cuello cónico –  
0,4° - 0,9° - 1,4° - 1,9° < 35xD
- Твердосплавная радиусная фреза, коническая шейка –  
0,4° - 0,9° - 1,4° - 1,9° < 35xD



Mit definierter Kantenverrundung  
With a defined edge preparation

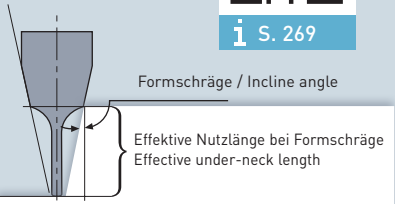


MICRO GRAIN KARNASCH NORM

N/M DIN 6535 Form HA

30°

Schnittdaten  
Cutting data

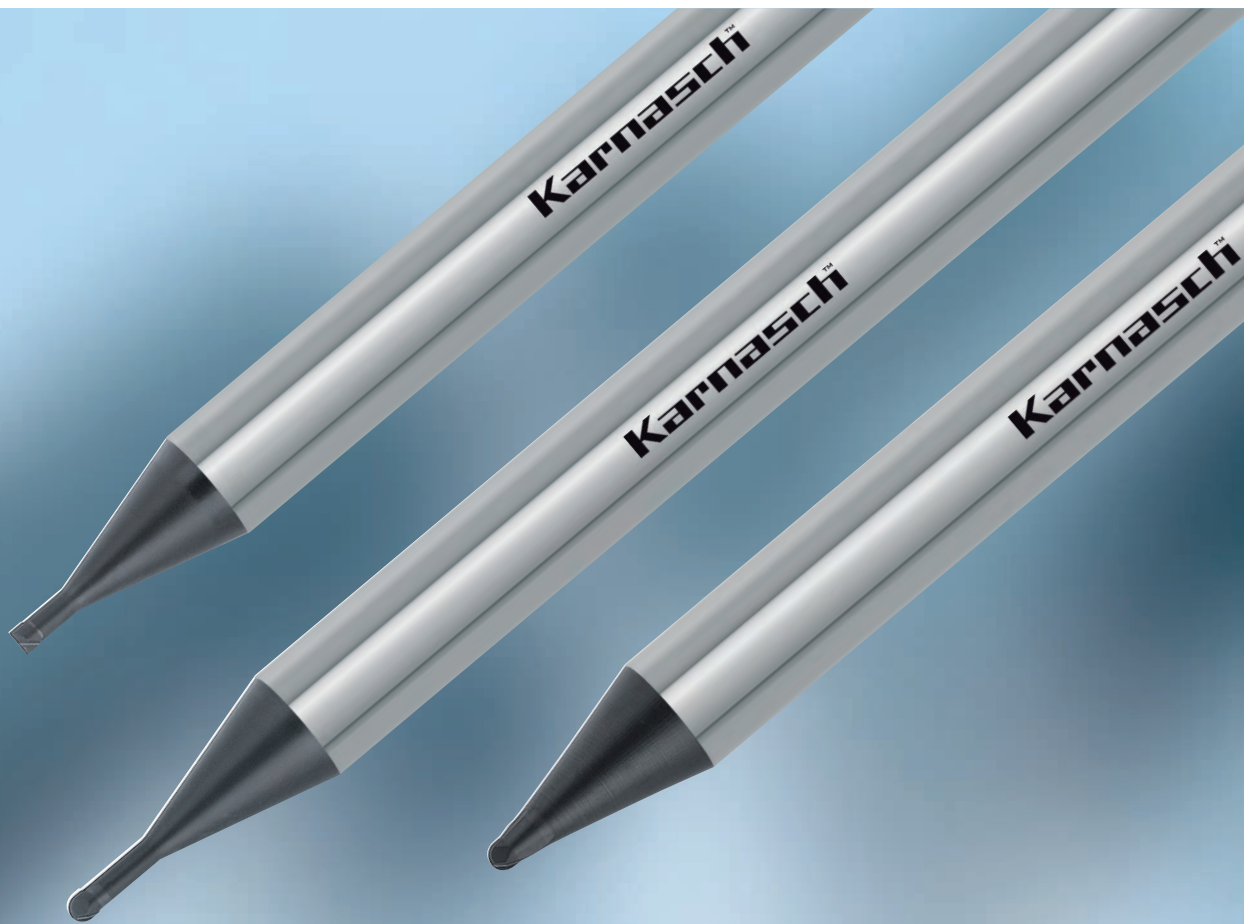


| Art.               | d1*   | r - 0,003 | ±    | l3   | d2 h5 | l2   | dn 1 | dn 2  | l1 | €     | 0,5° | 1°    | 2°    | 3°    |
|--------------------|-------|-----------|------|------|-------|------|------|-------|----|-------|------|-------|-------|-------|
| 306266.0020.04.010 | • 0,2 | 0,10      | 0,4° | 1,0  | 6     | 0,15 | 0,17 | 0,182 | 55 | 67,00 | 1,67 | 1,90  | 2,31  | 2,70  |
| 306266.0020.04.015 | • 0,2 | 0,10      | 0,4° | 1,5  | 6     | 0,15 | 0,17 | 0,189 | 55 | 67,00 | 1,83 | 2,47  | 2,94  | 3,37  |
| 306266.0020.09.020 | • 0,2 | 0,10      | 0,9° | 2,0  | 6     | 0,15 | 0,17 | 0,228 | 55 | 67,00 | 2,33 | 2,82  | 3,43  | 3,92  |
| 306266.0020.09.025 | • 0,2 | 0,10      | 0,9° | 2,5  | 6     | 0,15 | 0,17 | 0,244 | 55 | 67,00 | 2,32 | 3,33  | 4,01  | 4,54  |
| 306266.0020.14.020 | ▲ 0,2 | 0,10      | 1,4° | 2,0  | 6     | 0,15 | 0,17 | 0,260 | 55 | 67,00 | 1,10 | 2,46  | 3,26  | 3,80  |
| 306266.0020.14.030 | ▲ 0,2 | 0,10      | 1,4° | 3,0  | 6     | 0,15 | 0,17 | 0,309 | 55 | 67,00 | 1,13 | 2,42  | 4,37  | 5,00  |
| 306266.0020.19.020 | ▲ 0,2 | 0,10      | 1,9° | 2,0  | 6     | 0,15 | 0,17 | 0,293 | 55 | 67,00 | 0,76 | 1,14  | 3,07  | 3,67  |
| 306266.0020.19.030 | ▲ 0,2 | 0,10      | 1,9° | 3,0  | 6     | 0,15 | 0,17 | 0,359 | 55 | 67,00 | 0,76 | 1,14  | 4,09  | 4,83  |
| 306266.0040.04.020 | • 0,4 | 0,20      | 0,4° | 2,0  | 6     | 0,30 | 0,37 | 0,394 | 55 | 54,50 | 2,71 | 3,02  | 3,54  | 4,00  |
| 306266.0040.04.030 | • 0,4 | 0,20      | 0,4° | 3,0  | 6     | 0,30 | 0,37 | 0,408 | 55 | 54,50 | 3,41 | 3,96  | 4,64  | 5,19  |
| 306266.0040.09.040 | • 0,4 | 0,20      | 0,9° | 4,0  | 6     | 0,30 | 0,37 | 0,486 | 55 | 54,50 | 2,57 | 4,87  | 5,72  | 6,35  |
| 306266.0040.09.050 | • 0,4 | 0,20      | 0,9° | 5,0  | 6     | 0,30 | 0,37 | 0,518 | 55 | 54,50 | 2,56 | 5,90  | 6,86  | 7,53  |
| 306266.0040.14.040 | • 0,4 | 0,20      | 1,4° | 4,0  | 6     | 0,30 | 0,37 | 0,551 | 55 | 54,50 | 1,21 | 2,22  | 5,47  | 6,17  |
| 306266.0040.14.060 | ▲ 0,4 | 0,20      | 1,4° | 6,0  | 6     | 0,30 | 0,37 | 0,649 | 55 | 54,50 | 1,21 | 2,22  | 7,64  | 8,47  |
| 306266.0040.19.040 | ▲ 0,4 | 0,20      | 1,9° | 4,0  | 6     | 0,30 | 0,37 | 0,615 | 55 | 54,50 | 0,95 | 1,37  | 5,13  | 5,91  |
| 306266.0040.19.060 | ▲ 0,4 | 0,20      | 1,9° | 6,0  | 6     | 0,30 | 0,37 | 0,748 | 55 | 54,50 | 0,95 | 1,37  | 7,17  | 8,20  |
| 306266.0060.04.020 | • 0,6 | 0,30      | 0,4° | 2,0  | 6     | 0,40 | 0,57 | 0,592 | 55 | 48,00 | 2,70 | 3,01  | 3,52  | 3,97  |
| 306266.0060.04.040 | • 0,6 | 0,30      | 0,4° | 4,0  | 6     | 0,40 | 0,57 | 0,620 | 55 | 48,00 | 4,76 | 5,25  | 5,92  | 6,49  |
| 306266.0060.09.060 | • 0,6 | 0,30      | 0,9° | 6,0  | 6     | 0,40 | 0,57 | 0,746 | 55 | 48,00 | 2,67 | 6,91  | 7,96  | 8,68  |
| 306266.0060.09.080 | • 0,6 | 0,30      | 0,9° | 8,0  | 6     | 0,40 | 0,57 | 0,809 | 55 | 48,00 | 2,67 | 8,96  | 10,18 | 10,98 |
| 306266.0060.09.100 | • 0,6 | 0,30      | 0,9° | 10,0 | 6     | 0,40 | 0,57 | 0,872 | 55 | 48,00 | 2,67 | 11,01 | 12,37 | 13,25 |
| 306266.0060.09.120 | • 0,6 | 0,30      | 0,9° | 12,0 | 6     | 0,40 | 0,57 | 0,934 | 55 | 48,00 | 2,67 | 13,04 | 14,55 | 15,49 |
| 306266.0060.09.150 | • 0,6 | 0,30      | 0,9° | 15,0 | 6     | 0,40 | 0,57 | 1,029 | 55 | 48,00 | 2,67 | 16,10 | 17,79 | 18,81 |
| 306266.0060.14.060 | ▲ 0,6 | 0,30      | 1,4° | 6,0  | 6     | 0,40 | 0,57 | 0,844 | 55 | 48,00 | 1,41 | 2,80  | 7,63  | 8,45  |
| 306266.0060.14.080 | ▲ 0,6 | 0,30      | 1,4° | 8,0  | 6     | 0,40 | 0,57 | 0,941 | 55 | 48,00 | 1,41 | 2,80  | 9,78  | 10,71 |
| 306266.0060.14.100 | ▲ 0,6 | 0,30      | 1,4° | 10,0 | 6     | 0,40 | 0,57 | 1,039 | 55 | 48,00 | 1,41 | 2,80  | 11,92 | 12,94 |
| 306266.0060.14.120 | ▲ 0,6 | 0,30      | 1,4° | 12,0 | 6     | 0,40 | 0,57 | 1,137 | 55 | 48,00 | 1,41 | 2,80  | 14,04 | 15,15 |
| 306266.0060.14.150 | ▲ 0,6 | 0,30      | 1,4° | 15,0 | 6     | 0,40 | 0,57 | 1,284 | 55 | 48,00 | 1,41 | 2,80  | 17,21 | 18,44 |
| 306266.0060.19.080 | ▲ 0,6 | 0,30      | 1,9° | 8,0  | 6     | 0,40 | 0,57 | 1,074 | 55 | 48,00 | 1,05 | 1,47  | 9,21  | 10,40 |
| 306266.0060.19.150 | ▲ 0,6 | 0,30      | 1,9° | 15,0 | 6     | 0,40 | 0,57 | 1,539 | 55 | 48,00 | 1,05 | 1,47  | 13,34 | 17,99 |
| 306266.0080.04.040 | • 0,8 | 0,40      | 0,4° | 4,0  | 6     | 0,50 | 0,77 | 0,819 | 55 | 48,00 | 4,76 | 5,21  | 5,90  | 6,46  |
| 306266.0080.04.060 | • 0,8 | 0,40      | 0,4° | 6,0  | 6     | 0,50 | 0,77 | 0,847 | 55 | 48,00 | 6,80 | 7,40  | 8,22  | 8,87  |
| 306266.0080.09.080 | • 0,8 | 0,40      | 0,9° | 8,0  | 6     | 0,50 | 0,77 | 1,006 | 55 | 48,00 | 2,77 | 8,97  | 10,17 | 10,97 |
| 306266.0080.09.120 | • 0,8 | 0,40      | 0,9° | 12,0 | 6     | 0,50 | 0,77 | 1,131 | 55 | 48,00 | 2,77 | 13,03 | 14,54 | 15,48 |
| 306266.0080.09.160 | • 0,8 | 0,40      | 0,9° | 16,0 | 6     | 0,50 | 0,77 | 1,257 | 55 | 48,00 | 2,77 | 17,11 | 18,85 | 19,90 |
| 306266.0080.14.080 | ▲ 0,8 | 0,40      | 1,4° | 8,0  | 6     | 0,50 | 0,77 | 1,137 | 55 | 48,00 | 1,51 | 2,90  | 9,78  | 10,70 |
| 306266.0080.14.120 | ▲ 0,8 | 0,40      | 1,4° | 12,0 | 6     | 0,50 | 0,77 | 1,332 | 55 | 48,00 | 1,51 | 2,90  | 14,04 | 15,14 |
| 306266.0080.14.160 | ▲ 0,8 | 0,40      | 1,4° | 16,0 | 6     | 0,50 | 0,77 | 1,528 | 55 | 48,00 | 1,51 | 2,90  | 18,27 | 19,51 |
| 306266.0080.19.080 | ▲ 0,8 | 0,40      | 1,9° | 8,0  | 6     | 0,50 | 0,77 | 1,268 | 55 | 48,00 | 1,15 | 1,57  | 9,21  | 10,39 |
| 306266.0080.19.120 | ▲ 0,8 | 0,40      | 1,9° | 12,0 | 6     | 0,50 | 0,77 | 1,533 | 55 | 48,00 | 1,15 | 1,57  | 13,29 | 14,75 |
| 306266.0080.19.160 | ▲ 0,8 | 0,40      | 1,9° | 16,0 | 6     | 0,50 | 0,77 | 1,798 | 55 | 48,00 | 1,15 | 1,57  | 17,36 | 19,06 |

| Art.               | d1*   | r - 0,003 | ↘    | l3   | d2 h5 | l2   | dn 1 | dn 2  | l1  | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|-------|-----------|------|------|-------|------|------|-------|-----|-------|-------|-------|-------|-------|
| 306266.0100.04.060 | • 1,0 | 0,50      | 0,4° | 6,0  | 6     | 0,80 | 0,94 | 1,013 | 55  | 48,00 | 7,00  | 7,52  | 8,29  | 8,92  |
| 306266.0100.04.080 | • 1,0 | 0,50      | 0,4° | 8,0  | 6     | 0,80 | 0,94 | 1,041 | 55  | 48,00 | 9,04  | 9,67  | 10,55 | 11,25 |
| 306266.0100.09.100 | • 1,0 | 0,50      | 0,9° | 10,0 | 6     | 0,80 | 0,94 | 1,229 | 55  | 48,00 | 5,47  | 11,18 | 12,44 | 13,29 |
| 306266.0100.09.150 | • 1,0 | 0,50      | 0,9° | 15,0 | 6     | 0,80 | 0,94 | 1,386 | 60  | 49,00 | 5,47  | 16,26 | 17,84 | 18,84 |
| 306266.0100.09.200 | • 1,0 | 0,50      | 0,9° | 20,0 | 6     | 0,80 | 0,94 | 1,543 | 65  | 49,00 | 5,47  | 21,41 | 23,18 | 24,31 |
| 306266.0100.09.250 | • 1,0 | 0,50      | 0,9° | 25,0 | 6     | 0,80 | 0,94 | 1,700 | 70  | 50,00 | 5,47  | 21,34 | 28,48 | 29,71 |
| 306266.0100.09.300 | • 1,0 | 0,50      | 0,9° | 30,0 | 6     | 0,80 | 0,94 | 1,857 | 75  | 50,00 | 5,47  | 31,48 | 33,75 | 35,07 |
| 306266.0100.09.350 | • 1,0 | 0,50      | 0,9° | 35,0 | 6     | 0,80 | 0,94 | 2,015 | 80  | 50,00 | 5,47  | 36,56 | 39,01 | 40,40 |
| 306266.0100.14.100 | ▲ 1,0 | 0,50      | 1,4° | 10,0 | 6     | 0,80 | 0,94 | 1,390 | 55  | 48,00 | 2,88  | 5,85  | 12,02 | 13,00 |
| 306266.0100.14.300 | ▲ 1,0 | 0,50      | 1,4° | 30,0 | 6     | 0,80 | 0,94 | 2,367 | 75  | 50,00 | 2,88  | 5,85  | 32,96 | 34,56 |
| 306266.0100.19.100 | ▲ 1,0 | 0,50      | 1,9° | 10,0 | 6     | 0,80 | 0,94 | 1,550 | 55  | 48,00 | 2,13  | 5,85  | 11,46 | 12,67 |
| 306266.0150.04.080 | • 1,5 | 0,75      | 0,4° | 8,0  | 6     | 1,35 | 1,42 | 1,513 | 55  | 48,00 | 9,16  | 9,73  | 10,57 | 11,25 |
| 306266.0150.04.100 | • 1,5 | 0,75      | 0,4° | 10,0 | 6     | 1,35 | 1,42 | 1,541 | 55  | 48,00 | 11,16 | 11,85 | 12,80 | 13,55 |
| 306266.0150.04.120 | • 1,5 | 0,75      | 0,4° | 12,0 | 6     | 1,35 | 1,42 | 1,569 | 55  | 48,00 | 13,22 | 13,97 | 15,01 | 15,81 |
| 306266.0150.09.150 | • 1,5 | 0,75      | 0,9° | 15,0 | 6     | 1,35 | 1,42 | 1,849 | 60  | 49,00 | 7,83  | 16,40 | 17,88 | 18,86 |
| 306266.0150.09.200 | • 1,5 | 0,75      | 0,9° | 20,0 | 6     | 1,35 | 1,42 | 2,006 | 65  | 49,00 | 7,83  | 21,40 | 23,22 | 24,32 |
| 306266.0150.09.300 | • 1,5 | 0,75      | 0,9° | 30,0 | 6     | 1,35 | 1,42 | 2,320 | 75  | 50,00 | 7,83  | 31,58 | 33,78 | 35,08 |
| 306266.0150.14.200 | ▲ 1,5 | 0,75      | 1,4° | 20,0 | 6     | 1,35 | 1,42 | 2,332 | 65  | 49,00 | 4,23  | 8,58  | 22,61 | 23,92 |
| 306266.0150.14.300 | ▲ 1,5 | 0,75      | 1,4° | 30,0 | 6     | 1,35 | 1,42 | 2,820 | 75  | 50,00 | 4,23  | 8,58  | 33,02 | 34,58 |
| 306266.0150.19.200 | ▲ 1,5 | 0,75      | 1,9° | 20,0 | 6     | 1,35 | 1,42 | 2,657 | 65  | 49,00 | 3,20  | 4,56  | 21,74 | 23,44 |
| 306266.0150.19.300 | ▲ 1,5 | 0,75      | 1,9° | 30,0 | 6     | 1,35 | 1,42 | 3,321 | 75  | 50,00 | 3,20  | 4,56  | 31,86 | 33,99 |
| 306266.0200.04.080 | • 2,0 | 1,00      | 0,4° | 8,0  | 6     | 1,70 | 1,92 | 2,008 | 55  | 48,00 | 8,31  | 9,31  | 10,29 | 11,02 |
| 306266.0200.04.120 | • 2,0 | 1,00      | 0,4° | 12,0 | 6     | 1,70 | 1,92 | 2,064 | 55  | 48,00 | 8,30  | 13,37 | 14,64 | 15,52 |
| 306266.0200.04.160 | • 2,0 | 1,00      | 0,4° | 16,0 | 6     | 1,70 | 1,92 | 2,120 | 60  | 49,00 | 8,30  | 17,43 | 18,94 | 19,94 |
| 306266.0200.09.200 | • 2,0 | 1,00      | 0,9° | 20,0 | 6     | 1,70 | 1,92 | 2,495 | 65  | 49,00 | 8,30  | 21,48 | 23,21 | 24,30 |
| 306266.0200.09.250 | • 2,0 | 1,00      | 0,9° | 25,0 | 6     | 1,70 | 1,92 | 2,652 | 65  | 49,00 | 8,30  | 26,54 | 28,51 | 29,71 |
| 306266.0200.09.300 | • 2,0 | 1,00      | 0,9° | 30,0 | 6     | 1,70 | 1,92 | 2,809 | 70  | 50,00 | 8,30  | 31,61 | 33,78 | 35,07 |
| 306266.0200.09.350 | • 2,0 | 1,00      | 0,9° | 35,0 | 6     | 1,70 | 1,92 | 2,966 | 75  | 50,00 | 8,30  | 36,64 | 39,02 | -     |
| 306266.0200.09.400 | • 2,0 | 1,00      | 0,9° | 40,0 | 6     | 1,70 | 1,92 | 3,123 | 80  | 50,00 | 8,30  | 41,70 | 44,25 | -     |
| 306266.0200.09.500 | • 2,0 | 1,00      | 0,9° | 50,0 | 6     | 1,70 | 1,92 | 3,438 | 90  | 52,00 | 8,30  | 51,81 | 54,66 | -     |
| 306266.0200.14.200 | ▲ 2,0 | 1,00      | 1,4° | 20,0 | 6     | 1,70 | 1,92 | 2,814 | 65  | 49,00 | 4,63  | 9,20  | 22,61 | 23,90 |
| 306266.0200.14.250 | ▲ 2,0 | 1,00      | 1,4° | 25,0 | 6     | 1,70 | 1,92 | 3,059 | 65  | 49,00 | 4,63  | 9,20  | 27,82 | 29,26 |
| 306266.0200.14.350 | ▲ 2,0 | 1,00      | 1,4° | 35,0 | 6     | 1,70 | 1,92 | 3,548 | 75  | 50,00 | 4,63  | 9,20  | 38,19 | -     |
| 306266.0200.14.400 | ▲ 2,0 | 1,00      | 1,4° | 40,0 | 6     | 1,70 | 1,92 | 3,792 | 80  | 50,00 | 4,63  | 9,20  | 43,38 | -     |
| 306266.0200.19.200 | ▲ 2,0 | 1,00      | 1,9° | 20,0 | 6     | 1,70 | 1,92 | 3,134 | 65  | 49,00 | 3,59  | 5,02  | 21,76 | 23,44 |
| 306266.0200.19.250 | ▲ 2,0 | 1,00      | 1,9° | 25,0 | 6     | 1,70 | 1,92 | 3,466 | 65  | 49,00 | 3,59  | 5,02  | 26,82 | 28,73 |
| 306266.0200.19.400 | ▲ 2,0 | 1,00      | 1,9° | 40,0 | 6     | 1,70 | 1,92 | 4,461 | 80  | 50,00 | 3,59  | 5,02  | 41,98 | -     |
| 306266.0300.04.080 | • 3,0 | 1,50      | 0,4° | 8,0  | 6     | 2,50 | 2,86 | 2,937 | 55  | 48,00 | 9,36  | 9,88  | 10,61 | 11,25 |
| 306266.0300.04.160 | • 3,0 | 1,50      | 0,4° | 16,0 | 6     | 2,50 | 2,86 | 3,048 | 55  | 48,00 | 17,52 | 18,19 | 19,42 | 20,27 |
| 306266.0300.04.200 | • 3,0 | 1,50      | 0,4° | 20,0 | 6     | 2,50 | 2,86 | 3,104 | 60  | 49,00 | 21,52 | 22,49 | 23,73 | 24,68 |
| 306266.0300.09.300 | • 3,0 | 1,50      | 0,9° | 30,0 | 6     | 2,50 | 2,86 | 3,724 | 70  | 50,00 | 13,78 | 31,82 | 33,84 | -     |
| 306266.0300.09.400 | • 3,0 | 1,50      | 0,9° | 40,0 | 6     | 2,50 | 2,86 | 4,038 | 80  | 50,00 | 13,78 | 41,92 | -     | -     |
| 306266.0300.09.500 | • 3,0 | 1,50      | 0,9° | 50,0 | 6     | 2,50 | 2,86 | 4,352 | 90  | 52,00 | 13,78 | 52,14 | -     | -     |
| 306266.0300.09.600 | • 3,0 | 1,50      | 0,9° | 60,0 | 6     | 2,50 | 2,86 | 4,667 | 100 | 55,50 | 13,78 | 62,11 | -     | -     |
| 306266.0300.14.400 | ▲ 3,0 | 1,50      | 1,4° | 40,0 | 6     | 2,50 | 2,86 | 4,693 | 80  | 50,00 | 7,38  | 15,02 | 43,46 | -     |
| 306266.0300.14.500 | ▲ 3,0 | 1,50      | 1,4° | 50,0 | 6     | 2,50 | 2,86 | 5,182 | 90  | 52,00 | 7,38  | 15,02 | -     | -     |
| 306266.0300.19.400 | ▲ 3,0 | 1,50      | 1,9° | 40,0 | 6     | 2,50 | 2,86 | 5,348 | 80  | 50,00 | 5,72  | 8,06  | 42,21 | -     |
| 306266.0300.19.500 | ▲ 3,0 | 1,50      | 1,9° | 50,0 | 6     | 2,50 | 2,86 | 6,000 | 90  | 52,00 | 5,72  | 8,06  | -     | -     |

Art. 30.6266 – Ø 0,6 x 8 ↘ 1,9°





**Wenn Hartmetall  
Hartmetall bearbeitet**

Bei schwer zerspanbaren Werkstoffen, wie z.B. Hartmetall, geraten Werkzeuge oftmals an Ihre Grenzen und treiben die Fertigungskosten – aufgrund langer Bearbeitungszeiten – stark in die Höhe.

Durch den Einsatz der neuesten Karnasch-Fräser für die Hartmetallbearbeitung (Zerspanung mit geometrisch bestimmter Schneide) haben wir die Wirtschaftlichkeit enorm gesteigert.

**Vorteile:**

- Diamantbeschichtete Karnasch-Hartmetallfräser senken die Fertigungskosten und Bearbeitungszeiten
- Die Herstellung von komplexen 3D-Formen und Konturen wird möglich
- Erreichen einer besseren Oberflächengüte
- Hartmetallbearbeitung über 2.000HV
- Sehr hohe Schneidkantenstabilität bis zu 10.000HV
- Weiße Erodierzonen werden vermieden

**When carbide is  
machining carbide**

During the machining of difficult materials, such as cemented carbide, tools will reach their limits and pushes up the production costs – due to long processing times.

We have enhance the productivity and efficiency by using the latest Karnasch end mills ( tools with geometrically defined cutting edges ).

**Advantages:**

- Diamond coated Karnasch carbide end mills reduce manufacturing costs and machining time
- The production of complex 3-D moulds and contours is possible
- You achieve a better surface
- Machining of carbide over 2.000HV is possible
- Excellent cutting edge stability up to 10.000HV
- No white erode zones



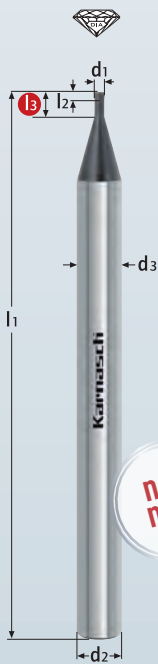
Diamantbeschichteter Micro Schaftfräser mit Eckenradius für die **Hartmetallbearbeitung**

PROFESSIONAL  
★ ★ ★ Art. **30.6271**

Cemented Carbide

GRAPHIT graphite

Zirkonoxid Zr O<sub>2</sub> gepresst

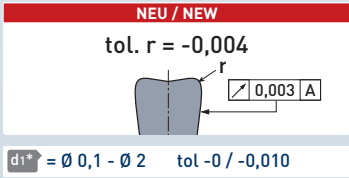


Diamond coated solid carbide end mills with corner radius for machining in **cemented carbide**

Fresa frontal metal duro recubierta de diamante para el **procesamiento de metal duro**

концевая микро-фреза с угловым радиусом и с алмазным покрытием **для обработки твердого металла**

Erhöhte Diamant-Schichtdicke!  
Increased Diamond coating thickness!



**MICRO GRAIN**

KARNASCH NORM

**ITX**

DIN 6535 Form HA



**HSC HHC**

**HSC HHC**



**D-CC**

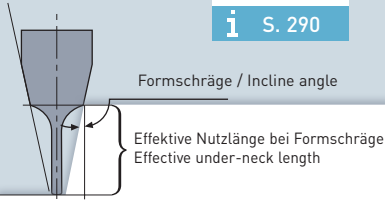


Schnittdaten  
Cutting data



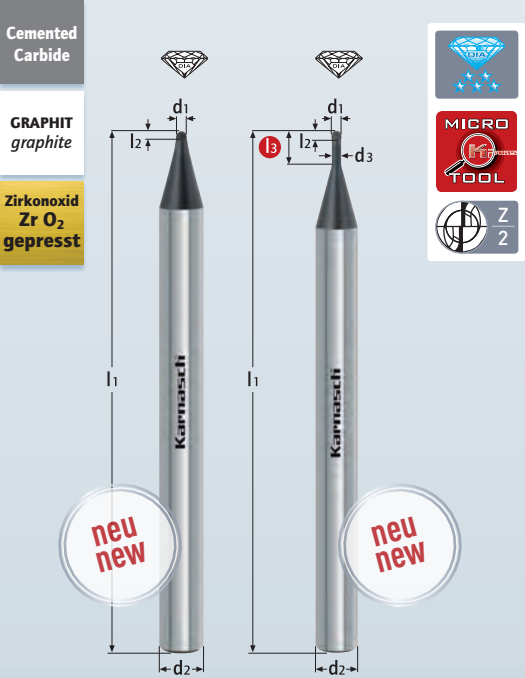
**i** S. 290

**d2**  
Ø4



| Art.                | d1*   | r -0,004 | l3  | d2/h5 | d3   | l1 | l2   | €      | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|-------|----------|-----|-------|------|----|------|--------|-------|-------|-------|-------|
| 306271.0030.003.006 | • 0,3 | 0,03     | 0,6 | 4     | 0,28 | 50 | 0,15 | 122,00 | 0,864 | 0,922 | 1,020 | 1,120 |
| 306271.0030.005.006 | • 0,3 | 0,05     | 0,6 | 4     | 0,28 | 50 | 0,15 | 122,00 | 0,864 | 0,922 | 1,020 | 1,120 |
| 306271.0050.003.005 | • 0,5 | 0,03     | 0,5 | 4     | 0,46 | 50 | 0,25 | 120,00 | 0,829 | 0,874 | 0,960 | 1,040 |
| 306271.0050.003.010 | • 0,5 | 0,03     | 1,0 | 4     | 0,46 | 50 | 0,25 | 120,00 | 1,350 | 1,420 | 1,540 | 1,640 |
| 306271.0050.005.005 | • 0,5 | 0,05     | 0,5 | 4     | 0,46 | 50 | 0,25 | 120,00 | 0,829 | 0,874 | 0,960 | 1,040 |
| 306271.0050.005.010 | • 0,5 | 0,05     | 1,0 | 4     | 0,46 | 50 | 0,25 | 120,00 | 1,350 | 1,420 | 1,540 | 1,640 |
| 306271.0080.003.008 | • 0,8 | 0,03     | 0,8 | 4     | 0,76 | 50 | 0,4  | 120,00 | 1,300 | 1,390 | 1,570 | 1,730 |
| 306271.0080.003.016 | • 0,8 | 0,03     | 1,6 | 4     | 0,76 | 50 | 0,4  | 120,00 | 2,150 | 2,290 | 2,520 | 2,730 |
| 306271.0080.005.008 | • 0,8 | 0,05     | 0,8 | 4     | 0,76 | 50 | 0,4  | 120,00 | 1,300 | 1,390 | 1,570 | 1,730 |
| 306271.0080.005.016 | • 0,8 | 0,05     | 1,6 | 4     | 0,76 | 50 | 0,4  | 120,00 | 2,150 | 2,290 | 2,520 | 2,730 |
| 306271.0080.010.008 | • 0,8 | 0,10     | 0,8 | 4     | 0,76 | 50 | 0,4  | 120,00 | 1,300 | 1,390 | 1,570 | 1,730 |
| 306271.0080.010.016 | • 0,8 | 0,10     | 1,6 | 4     | 0,76 | 50 | 0,4  | 120,00 | 2,150 | 2,290 | 2,520 | 2,730 |
| 306271.0100.003.010 | • 1,0 | 0,03     | 1,0 | 4     | 0,96 | 50 | 0,5  | 120,00 | 1,510 | 1,620 | 1,810 | 1,990 |
| 306271.0100.003.020 | • 1,0 | 0,03     | 2,0 | 4     | 0,96 | 50 | 0,5  | 120,00 | 2,580 | 2,730 | 2,990 | 3,210 |
| 306271.0100.005.010 | • 1,0 | 0,05     | 1,0 | 4     | 0,96 | 50 | 0,5  | 120,00 | 1,510 | 1,620 | 1,810 | 1,990 |
| 306271.0100.005.020 | • 1,0 | 0,05     | 2,0 | 4     | 0,96 | 50 | 0,5  | 120,00 | 2,580 | 2,730 | 2,990 | 3,210 |
| 306271.0100.010.010 | • 1,0 | 0,10     | 1,0 | 4     | 0,96 | 50 | 0,5  | 120,00 | 1,510 | 1,620 | 1,810 | 1,990 |
| 306271.0100.010.020 | • 1,0 | 0,10     | 2,0 | 4     | 0,96 | 50 | 0,5  | 120,00 | 2,580 | 2,730 | 2,990 | 3,210 |
| 306271.0150.003.015 | • 1,5 | 0,03     | 1,5 | 4     | 1,44 | 50 | 0,75 | 121,00 | 2,210 | 2,240 | 2,450 | 2,650 |
| 306271.0150.003.030 | • 1,5 | 0,03     | 3,0 | 4     | 1,44 | 50 | 0,75 | 121,00 | 3,700 | 3,880 | 4,170 | 4,480 |
| 306271.0150.005.015 | • 1,5 | 0,05     | 1,5 | 4     | 1,44 | 50 | 0,75 | 121,00 | 2,210 | 2,240 | 2,450 | 2,650 |
| 306271.0150.005.030 | • 1,5 | 0,05     | 3,0 | 4     | 1,44 | 50 | 0,75 | 121,00 | 3,700 | 3,880 | 4,170 | 4,480 |
| 306271.0150.010.015 | • 1,5 | 0,10     | 1,5 | 4     | 1,44 | 50 | 0,75 | 121,00 | 2,210 | 2,240 | 2,450 | 2,650 |
| 306271.0150.010.030 | • 1,5 | 0,10     | 3,0 | 4     | 1,44 | 50 | 0,75 | 121,00 | 3,700 | 3,880 | 4,170 | 4,480 |
| 306271.0200.003.020 | • 2,0 | 0,03     | 2,0 | 4     | 1,90 | 50 | 1,0  | 121,00 | 2,760 | 2,890 | 3,110 | 3,350 |
| 306271.0200.003.040 | • 2,0 | 0,03     | 4,0 | 4     | 1,90 | 50 | 1,0  | 121,00 | 4,850 | 5,040 | 5,390 | 5,790 |
| 306271.0200.005.020 | • 2,0 | 0,05     | 2,0 | 4     | 1,90 | 50 | 1,0  | 121,00 | 2,760 | 2,890 | 3,110 | 3,350 |
| 306271.0200.005.040 | • 2,0 | 0,05     | 4,0 | 4     | 1,90 | 50 | 1,0  | 121,00 | 4,850 | 5,040 | 5,390 | 5,790 |
| 306271.0200.010.020 | • 2,0 | 0,10     | 2,0 | 4     | 1,90 | 50 | 1,0  | 121,00 | 2,760 | 2,890 | 3,110 | 3,350 |
| 306271.0200.010.040 | • 2,0 | 0,10     | 4,0 | 4     | 1,90 | 50 | 1,0  | 121,00 | 4,850 | 5,040 | 5,390 | 5,790 |

Art. **30.6274** **PROFESSIONAL** ★ ★ ★ Diamantbeschichteter Micro 3D-Radiusfräser für die **Hartmetallbearbeitung**



- Diamond coated solid carbide 3D ball nose end mills for machining in **cemented carbide**
- Fresa radial metal duro 3D recubierta de diamante para el **procesamiento de metal duro**
- концевая фреза 3D с шаровым торцом и с алмазным покрытием **для обработки твердого металла**

Erhöhte Diamant-Schichtdicke!  
Increased Diamond coating thickness!

**NEU / NEW**

tol. r = ±0,003

d1\* = Ø 0,1 - Ø 2    tol -0 / -0,010

**MICRO GRAIN**

**KARNASCH NORM**

**ITX**

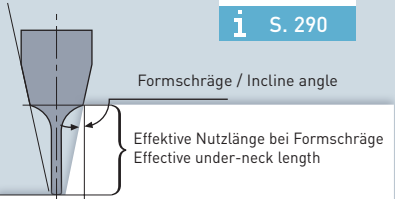
**DIN 6535 Form HA**

**HSC HHC**

**D-CC**

Schnittdaten  
Cutting data

**i** S. 290



| Art.            | d1*   | r -0,004 | l3  | d2/h5 | d3   | l1 | l2   | €      | 0,5°  | 1°    | 2°     | 3°     |
|-----------------|-------|----------|-----|-------|------|----|------|--------|-------|-------|--------|--------|
| 306274.0020     | • 0,2 | 0,10     | -   | 4     | -    | 50 | 0,14 | 122,00 |       |       |        |        |
| 306274.0020.003 | • 0,2 | 0,10     | 0,3 | 4     | 0,18 | 50 | 0,14 | 122,00 | 0,467 | 0,492 | 0,538  | 0,582  |
| 306274.0020.005 | • 0,2 | 0,10     | 0,5 | 4     | 0,18 | 50 | 0,14 | 122,00 | 0,678 | 0,710 | 0,769  | 0,821  |
| 306274.0020.008 | • 0,2 | 0,10     | 0,8 | 4     | 0,18 | 50 | 0,14 | 122,00 | 0,992 | 1,070 | 1,110  | 1,190  |
| 306274.0020.010 | • 0,2 | 0,10     | 1,0 | 4     | 0,18 | 50 | 0,14 | 122,00 | 1,200 | 1,270 | 1,330  | 1,430  |
| 306274.0030     | • 0,3 | 0,15     | -   | 4     | -    | 50 | 0,21 | 122,00 |       |       |        |        |
| 306274.0030.003 | • 0,3 | 0,15     | 0,3 | 4     | 0,28 | 50 | 0,21 | 122,00 | 0,542 | 0,623 | 0,754  | 0,851  |
| 306274.0030.005 | • 0,3 | 0,15     | 0,5 | 4     | 0,28 | 50 | 0,21 | 122,00 | 0,757 | 0,859 | 0,998  | 1,050  |
| 306274.0030.008 | • 0,3 | 0,15     | 0,8 | 4     | 0,28 | 50 | 0,21 | 122,00 | 1,070 | 1,200 | 1,350  | 1,360  |
| 306274.0030.010 | • 0,3 | 0,15     | 1,0 | 4     | 0,28 | 50 | 0,21 | 122,00 | 1,290 | 1,430 | 1,550  | 1,610  |
| 306274.0040     | • 0,4 | 0,20     | -   | 4     | -    | 50 | 0,28 | 122,00 |       |       |        |        |
| 306274.0040.005 | • 0,4 | 0,20     | 0,5 | 4     | 0,36 | 50 | 0,28 | 122,00 | 0,829 | 0,917 | 1,040  | 1,050  |
| 306274.0040.010 | • 0,4 | 0,20     | 1,0 | 4     | 0,36 | 50 | 0,28 | 122,00 | 1,350 | 1,480 | 1,550  | 1,650  |
| 306274.0040.015 | • 0,4 | 0,20     | 1,5 | 4     | 0,36 | 50 | 0,28 | 122,00 | 1,880 | 2,030 | 2,100  | 2,260  |
| 306274.0040.020 | • 0,4 | 0,20     | 2,0 | 4     | 0,36 | 50 | 0,28 | 122,00 | 2,400 | 2,550 | 2,670  | 2,870  |
| 306274.0050     | • 0,5 | 0,25     | -   | 4     | -    | 50 | 0,35 | 120,00 |       |       |        |        |
| 306274.0050.005 | • 0,5 | 0,25     | 0,5 | 4     | 0,46 | 50 | 0,35 | 120,00 | 0,829 | 0,917 | 1,040  | 1,050  |
| 306274.0050.010 | • 0,5 | 0,25     | 1,0 | 4     | 0,46 | 50 | 0,35 | 120,00 | 1,350 | 1,480 | 1,550  | 1,650  |
| 306274.0050.015 | • 0,5 | 0,25     | 1,5 | 4     | 0,46 | 50 | 0,35 | 120,00 | 1,880 | 2,030 | 2,100  | 2,260  |
| 306274.0050.020 | • 0,5 | 0,25     | 2,0 | 4     | 0,46 | 50 | 0,35 | 120,00 | 2,400 | 2,550 | 2,670  | 2,870  |
| 306274.0060     | • 0,6 | 0,30     | -   | 4     | -    | 50 | 0,42 | 120,00 |       |       |        |        |
| 306274.0060.010 | • 0,6 | 0,30     | 1,0 | 4     | 0,56 | 50 | 0,42 | 120,00 | 1,510 | 1,710 | 1,990  | 2,100  |
| 306274.0060.015 | • 0,6 | 0,30     | 1,5 | 4     | 0,56 | 50 | 0,42 | 120,00 | 2,040 | 2,290 | 2,600  | 2,610  |
| 306274.0060.020 | • 0,6 | 0,30     | 2,0 | 4     | 0,56 | 50 | 0,42 | 120,00 | 2,580 | 2,860 | 3,100  | 3,200  |
| 306274.0060.030 | • 0,6 | 0,30     | 3,0 | 4     | 0,56 | 50 | 0,42 | 120,00 | 3,640 | 3,990 | 4,130  | 4,440  |
| 306274.0080     | • 0,8 | 0,40     | -   | 4     | -    | 50 | 0,56 | 120,00 |       |       |        |        |
| 306274.0080.020 | • 0,8 | 0,40     | 2,0 | 4     | 0,76 | 50 | 0,56 | 120,00 | 2,580 | 2,860 | 3,100  | 3,220  |
| 306274.0080.030 | • 0,8 | 0,40     | 3,0 | 4     | 0,76 | 50 | 0,56 | 120,00 | 3,640 | 3,990 | 4,130  | 4,440  |
| 306274.0080.040 | • 0,8 | 0,40     | 4,0 | 4     | 0,76 | 50 | 0,56 | 120,00 | 4,690 | 5,090 | 5,270  | 5,660  |
| 306274.0100     | • 1,0 | 0,50     | -   | 4     | -    | 50 | 0,70 | 120,00 |       |       |        |        |
| 306274.0100.020 | • 1,0 | 0,50     | 2,0 | 4     | 0,96 | 50 | 0,70 | 120,00 | 2,580 | 2,890 | 4,250  | 4,570  |
| 306274.0100.025 | • 1,0 | 0,50     | 2,5 | 4     | 0,96 | 50 | 0,70 | 120,00 | 3,110 | 3,440 | 5,390  | 5,790  |
| 306274.0100.030 | • 1,0 | 0,50     | 3,0 | 4     | 0,96 | 50 | 0,70 | 120,00 | 3,640 | 3,990 | 7,670  | 8,240  |
| 306274.0100.040 | • 1,0 | 0,50     | 4,0 | 4     | 0,96 | 50 | 0,70 | 120,00 | 4,690 | 5,090 | 9,940  | 10,700 |
| 306274.0100.050 | • 1,0 | 0,50     | 5,0 | 4     | 0,96 | 50 | 0,70 | 120,00 | 5,740 | 6,100 | 12,250 | 13,130 |

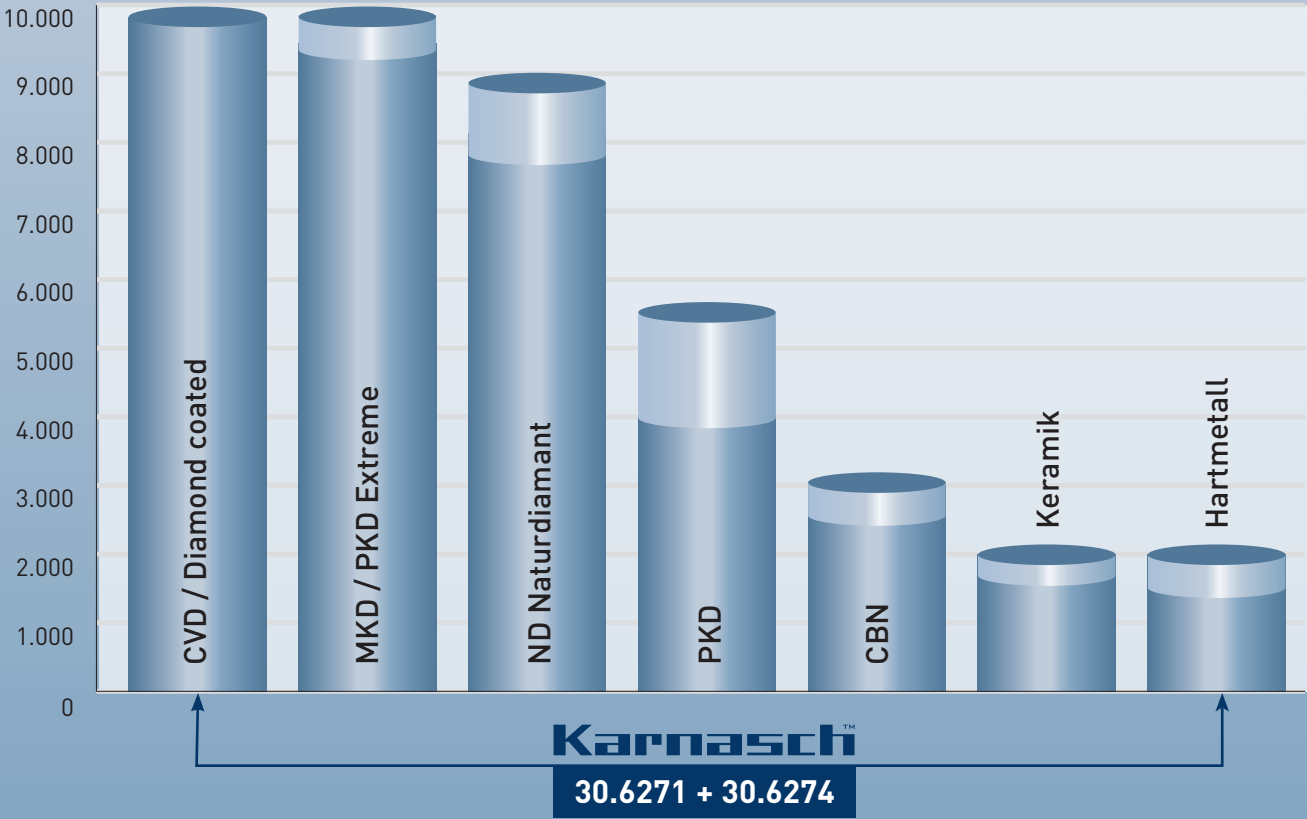


| Art.            | d1*   | r -0,004 | l3   | d2/h5 | d3   | l1 | l2   | €      | 0,5°   | 1°     | 2°     | 3°     |
|-----------------|-------|----------|------|-------|------|----|------|--------|--------|--------|--------|--------|
| 306274.0200     | • 2,0 | 1,0      | -    | 4     | -    | 50 | 1,40 | 121,00 |        |        |        |        |
| 306274.0200.030 | • 2,0 | 1,0      | 3,0  | 4     | 1,90 | 50 | 1,40 | 121,00 | 3,810  | 4,100  | 4,250  | 4,570  |
| 306274.0200.040 | • 2,0 | 1,0      | 4,0  | 4     | 1,90 | 50 | 1,40 | 121,00 | 4,850  | 5,100  | 5,390  | 5,790  |
| 306274.0200.060 | • 2,0 | 1,0      | 6,0  | 4     | 1,90 | 50 | 1,40 | 121,00 | 6,930  | 7,100  | 7,670  | 8,240  |
| 306274.0200.080 | • 2,0 | 1,0      | 8,0  | 4     | 1,90 | 50 | 1,40 | 121,00 | 9,000  | 9,100  | 9,940  | 10,700 |
| 306274.0200.100 | • 2,0 | 1,0      | 10,0 | 4     | 1,90 | 50 | 1,40 | 121,00 | 11,070 | 11,100 | 12,250 | 13,130 |
| 306274.0300     | • 3,0 | 1,5      | -    | 6     | -    | 60 | 2,10 | 174,00 |        |        |        |        |
| 306274.0300.060 | • 3,0 | 1,5      | 6,0  | 6     | 2,90 | 60 | 2,10 | 174,00 | 6,930  | 7,100  | 7,670  | 8,240  |
| 306274.0300.080 | • 3,0 | 1,5      | 8,0  | 6     | 2,90 | 60 | 2,10 | 174,00 | 9,000  | 9,100  | 9,940  | 10,690 |
| 306274.0300.100 | • 3,0 | 1,5      | 10,0 | 6     | 2,90 | 60 | 2,10 | 174,00 | 11,070 | 11,100 | 12,220 | 13,130 |
| 306274.0300.120 | • 3,0 | 1,5      | 12,0 | 6     | 2,90 | 60 | 2,10 | 174,00 | 13,100 | 13,130 | 14,500 | 15,580 |
| 306274.0300.140 | • 3,0 | 1,5      | 14,0 | 6     | 2,90 | 60 | 2,10 | 174,00 | 15,100 | 15,190 | 16,780 | 18,030 |
| 306274.0400     | • 4,0 | 2,0      | -    | 6     | -    | 60 | 2,80 | 174,00 |        |        |        |        |
| 306274.0400.080 | • 4,0 | 2,0      | 8,0  | 6     | 3,90 | 60 | 2,80 | 174,00 | 9,010  | 9,100  | 9,940  | 10,690 |
| 306274.0400.100 | • 4,0 | 2,0      | 10,0 | 6     | 3,90 | 60 | 2,80 | 174,00 | 11,070 | 11,100 | 12,250 | 13,130 |
| 306274.0400.150 | • 4,0 | 2,0      | 15,0 | 6     | 3,90 | 60 | 2,80 | 174,00 | 16,100 | 16,230 | 17,910 |        |
| 306274.0500     | • 5,0 | 2,5      | -    | 6     | -    | 60 | 3,50 | 214,00 |        |        |        |        |
| 306274.0500.100 | • 5,0 | 2,5      | 10,0 | 6     | 4,80 | 60 | 3,50 | 214,00 | 11,100 | 11,250 | 12,420 |        |
| 306274.0500.150 | • 5,0 | 2,5      | 15,0 | 6     | 4,80 | 60 | 3,50 | 214,00 | 16,100 | 16,410 |        |        |
| 306274.0600     | • 6,0 | 3,0      | -    | 6     | -    | 60 | 4,20 | 214,00 |        |        |        |        |
| 306274.0600.100 | • 6,0 | 3,0      | 10,0 | 6     | 5,70 | 60 | 4,20 | 214,00 |        |        |        |        |
| 306274.0600.150 | • 6,0 | 3,0      | 15,0 | 6     | 5,70 | 60 | 4,20 | 214,00 |        |        |        |        |

Karnasch D-CC Diamantbeschichtete Fräser, fräsen HARTMETALL.  
Karnasch D-CC diamond-coated end mills, for machining CEMENTED CARBIDE.

Härtevergleich  
Hardness Comparison

Härte [Knoop kg/mm<sup>2</sup>]



Art. 30.6267 **PROFESSIONAL** ★ ★ ★

VHM-Gesenkfräser mit Eckenradius, kurz, Rockwell Cutter

- HRC < 70
- STAHL  
steel  
< 1670 N/mm
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- NI-ALLOYS  
< 900 N/mm
- GJL
- GJS
- TITAN



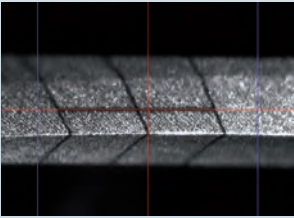
- Solid carbide end mills with corner radius, short, Rockwell Cutter
- Fresadora metal duro de matrices con radio angular, corta, Rockwell Cutter
- Твердосплавная штамповочная фреза с угловым радиусом, короткая, Rockwell Cutter

NEU / NEW

tol. r = -0,005

d1\* = Ø 1,0 - Ø 4,0 tol 0,000 / -0,008

Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

20°

rp = radius position

HSC HHC

HXC-NANO<sup>3</sup>

Schnittdaten  
Cutting data



i S. 264

| Art.               | Ø d1* | r -0,005 | l3 | d2 h5 | d3   | l1 | l2   | Z | €     |
|--------------------|-------|----------|----|-------|------|----|------|---|-------|
| 306267.0100.005.04 | • 1,0 | 0,05     | 4  | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.005.06 | • 1,0 | 0,05     | 6  | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.005.08 | • 1,0 | 0,05     | 8  | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.005.10 | • 1,0 | 0,05     | 10 | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.005.12 | • 1,0 | 0,05     | 12 | 4     | 0,94 | 60 | 0,8  | 4 | 48,00 |
| 306267.0100.005.16 | • 1,0 | 0,05     | 16 | 4     | 0,94 | 60 | 0,8  | 4 | 48,00 |
| 306267.0100.005.20 | • 1,0 | 0,05     | 20 | 4     | 0,94 | 60 | 0,8  | 4 | 48,00 |
| 306267.0100.010.04 | • 1,0 | 0,10     | 4  | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.010.06 | • 1,0 | 0,10     | 6  | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.010.08 | • 1,0 | 0,10     | 8  | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.010.10 | • 1,0 | 0,10     | 10 | 4     | 0,94 | 50 | 0,8  | 4 | 46,00 |
| 306267.0100.010.12 | • 1,0 | 0,10     | 12 | 4     | 0,94 | 60 | 0,8  | 4 | 48,00 |
| 306267.0100.010.16 | • 1,0 | 0,10     | 16 | 4     | 0,94 | 60 | 0,8  | 4 | 48,00 |
| 306267.0100.010.20 | • 1,0 | 0,10     | 20 | 4     | 0,94 | 60 | 0,8  | 4 | 48,00 |
| 306267.0150.010.04 | • 1,5 | 0,10     | 4  | 4     | 1,42 | 50 | 1,35 | 4 | 46,00 |
| 306267.0150.010.08 | • 1,5 | 0,10     | 8  | 4     | 1,42 | 50 | 1,35 | 4 | 46,00 |
| 306267.0150.010.12 | • 1,5 | 0,10     | 12 | 4     | 1,42 | 60 | 1,35 | 4 | 48,00 |
| 306267.0150.010.15 | • 1,5 | 0,10     | 15 | 4     | 1,42 | 60 | 1,35 | 4 | 48,00 |
| 306267.0150.010.20 | • 1,5 | 0,10     | 20 | 4     | 1,42 | 60 | 1,35 | 4 | 48,00 |
| 306267.0200.005.04 | • 2,0 | 0,05     | 4  | 4     | 1,92 | 50 | 1,70 | 4 | 46,00 |
| 306267.0200.005.08 | • 2,0 | 0,05     | 8  | 4     | 1,92 | 50 | 1,70 | 4 | 46,00 |
| 306267.0200.005.12 | • 2,0 | 0,05     | 12 | 4     | 1,92 | 60 | 1,70 | 4 | 48,00 |
| 306267.0200.005.16 | • 2,0 | 0,05     | 16 | 4     | 1,92 | 60 | 1,70 | 4 | 48,00 |
| 306267.0200.005.20 | • 2,0 | 0,05     | 20 | 4     | 1,92 | 60 | 1,70 | 4 | 48,00 |
| 306267.0200.010.04 | • 2,0 | 0,10     | 4  | 4     | 1,92 | 50 | 1,70 | 4 | 46,00 |
| 306267.0200.010.08 | • 2,0 | 0,10     | 8  | 4     | 1,92 | 50 | 1,70 | 4 | 46,00 |
| 306267.0200.010.12 | • 2,0 | 0,10     | 12 | 4     | 1,92 | 60 | 1,70 | 4 | 48,00 |
| 306267.0200.010.16 | • 2,0 | 0,10     | 16 | 4     | 1,92 | 60 | 1,70 | 4 | 48,00 |
| 306267.0200.010.20 | • 2,0 | 0,10     | 20 | 4     | 1,92 | 60 | 1,70 | 4 | 48,00 |
| 306267.0250.010.08 | • 2,5 | 0,10     | 8  | 4     | 2,40 | 50 | 2,00 | 4 | 46,00 |
| 306267.0250.010.16 | • 2,5 | 0,10     | 16 | 4     | 2,40 | 60 | 2,00 | 4 | 48,00 |
| 306267.0250.010.20 | • 2,5 | 0,10     | 20 | 4     | 2,40 | 60 | 2,00 | 4 | 48,00 |
| 306267.0250.020.08 | • 2,5 | 0,20     | 8  | 4     | 2,40 | 50 | 2,00 | 4 | 46,00 |
| 306267.0250.020.16 | • 2,5 | 0,20     | 16 | 4     | 2,40 | 60 | 2,00 | 4 | 48,00 |
| 306267.0250.020.20 | • 2,5 | 0,20     | 20 | 4     | 2,40 | 60 | 2,00 | 4 | 48,00 |
| 306267.0300.020.08 | • 3,0 | 0,20     | 8  | 6     | 2,86 | 60 | 2,50 | 4 | 55,00 |
| 306267.0300.020.12 | • 3,0 | 0,20     | 12 | 6     | 2,86 | 60 | 2,50 | 4 | 55,00 |
| 306267.0300.020.16 | • 3,0 | 0,20     | 16 | 6     | 2,86 | 60 | 2,50 | 4 | 55,00 |
| 306267.0300.020.20 | • 3,0 | 0,20     | 20 | 6     | 2,86 | 70 | 2,50 | 4 | 58,00 |
| 306267.0300.020.25 | • 3,0 | 0,20     | 25 | 6     | 2,86 | 70 | 2,50 | 4 | 58,00 |
| 306267.0300.020.30 | • 3,0 | 0,20     | 30 | 6     | 2,86 | 80 | 2,50 | 4 | 61,00 |
| 306267.0400.020.12 | • 4,0 | 0,20     | 12 | 6     | 3,90 | 60 | 4,00 | 4 | 56,00 |
| 306267.0400.020.20 | • 4,0 | 0,20     | 20 | 6     | 3,90 | 60 | 4,00 | 4 | 56,00 |
| 306267.0400.020.30 | • 4,0 | 0,20     | 30 | 6     | 3,90 | 80 | 4,00 | 4 | 62,00 |
| 306267.0400.020.40 | • 4,0 | 0,20     | 40 | 6     | 3,90 | 80 | 4,00 | 4 | 62,00 |



# CVD TOOLS

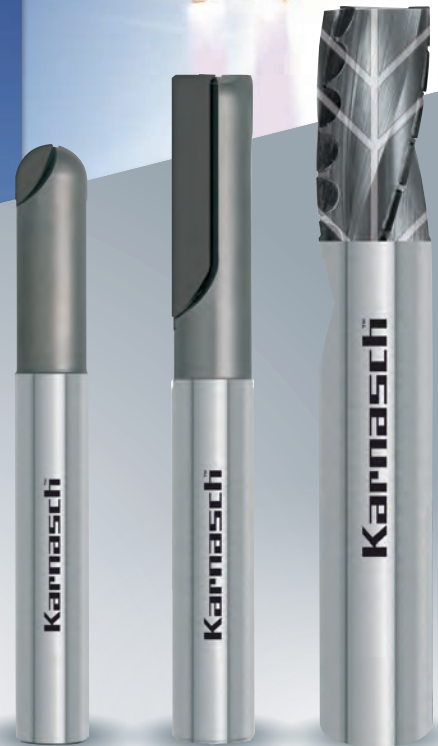
KARNASCH gelaserte  
**CVD -Schneiden**  
vermeiden Delamination!

Die Zukunft in der Zerspaltung von  
GFK und CFK / Al > 30% Si / Magnesium

→ Automobilindustrie

→ Luftfahrtindustrie

→ Raumfahrtindustrie



- Für abrasive Werkstoffe
- Auch über 80% Faseranteil einsetzbar
- Der weltweit erste Anbieter mit einem CVD-Komplettprogramm
- Zukunftsweisende Technologie für Leichtbaukomponenten

🇩🇪 **IMMER AKTUELL** – Der COMPOSITES-KATALOG  
jederzeit für Sie online erreichbar.

🇬🇧 **ALWAYS UP TO DATE** – the COMPOSITES CATALOGUE  
are available to you online at all times.



Art. 30.6284 VHM-Micro-Präzisionsfräser, 3 Schneiden, lang · HSC-fräsen

- HRC < 45
- STAHL steel < 1400 N/mm
- UNI
- INOX stainless steel < 900 N/mm ferritic
- GG/G cast iron
- TITAN < 1100 N/mm



- Solid Carbide miniature end mills, 3 cutting, long, HSC
- Microfresa metal duro de precisión, 3 cuchillas, larga · fresado HSC
- Твердосплавная прецизионная микро-фреза, 3 резца, длинная, фрезеровка HSC

MICRO GRAIN

DIN 6527 L

N

DIN 6535 Form HA

45°

HSC High-Speed-Cutting

UFX-1 NANO

Schnittdaten  
Cutting data

i S. 270-271

| Art.        | Ø d1 e8 | l2 | d2 h6 | l1 | Z | €     |
|-------------|---------|----|-------|----|---|-------|
| 306284.0040 | • 0,4   | 2  | 3     | 38 | 3 | 17,00 |
| 306284.0060 | • 0,6   | 2  | 3     | 38 | 3 | 17,00 |
| 306284.0080 | • 0,8   | 3  | 3     | 38 | 3 | 17,00 |
| 306284.0100 | • 1,0   | 3  | 3     | 38 | 3 | 17,00 |
| 306284.0150 | • 1,5   | 5  | 3     | 38 | 3 | 17,00 |

10 Stück  
Verpackungseinheit  
10 items per unit

Art. 30.6286 VHM-Micro-Radiusfräser, 2 Schneiden, lang · HSC-fräsen

- HRC < 45
- STAHL steel < 1400 N/mm
- UNI
- INOX stainless steel < 900 N/mm ferritic
- GG/G cast iron
- TITAN < 1100 N/mm



- Solid Carbide Miniature ball nose end mill, 2 cutting, long, HSC
- Microfresa metal duro de radio, 2 cuchillas, larga · fresado HSC
- Твердосплавная радиусная микро-фреза, 2 резца, длинная, фрезеровка HSC

MICRO GRAIN

DIN 6527 L

N

DIN 6535 Form HA

30°

HSC High-Speed-Cutting

UFX-1 NANO

Schnittdaten  
Cutting data

i S. 272-273

| Art.        | Ød1 f8 | r    | l2 | d2 h6 | l1 | Z | €     |
|-------------|--------|------|----|-------|----|---|-------|
| 306286.0040 | • 0,4  | 0,2  | 3  | 3     | 38 | 2 | 27,00 |
| 306286.0060 | • 0,6  | 0,3  | 3  | 3     | 38 | 2 | 27,00 |
| 306286.0080 | • 0,8  | 0,4  | 3  | 3     | 38 | 2 | 26,00 |
| 306286.0100 | • 1,0  | 0,5  | 5  | 3     | 38 | 2 | 26,00 |
| 306286.0150 | • 1,5  | 0,75 | 5  | 3     | 38 | 2 | 26,00 |

10 Stück  
Verpackungseinheit  
10 items per unit

VHM-Miniplus- 3 Schneidenfräser, lang, HSC < 50 HRC = 1800 N/mm²

Art. **30.6296**

HRC  
< 50

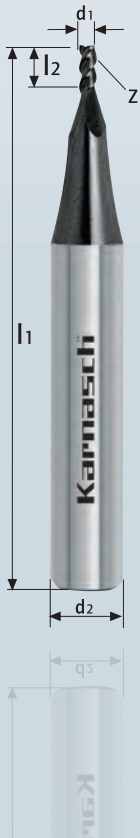
UNI

INOX  
stainless steel  
< 900 N/mm  
ferritic

NI-ALLOYS  
< 900 N/mm

TITAN  
< 1100  
N/mm

TOOLOX  
44



Solid carbide end mills, long, 3 cutting  
HSC < 50 HRC = 1800 N/mm²

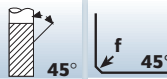
Fresa metal duro miniplus con 3 cuchillas, larga,  
HSC < 50 HRC = 1800 N/mm²

Твердосплавная радиусная микро-фреза, 3 реза,  
длинная, фрезеровка HSC  
HSC < 50 HRC = 1800 N/mm²

|     | Art.        | Ø d1 e8 | l2   | d2 h6 | l1 | Z | €     |
|-----|-------------|---------|------|-------|----|---|-------|
| NEU | 306296.0050 | • 0,5   | 1,5  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0060 | • 0,6   | 1,8  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0080 | • 0,8   | 2,5  | 6     | 45 | 3 | 22,00 |
|     | 306296.0100 | • 1,0   | 3,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0120 | • 1,2   | 3,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0140 | • 1,4   | 3,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0150 | • 1,5   | 3,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0180 | • 1,8   | 4,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0200 | • 2,0   | 4,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0250 | • 2,5   | 4,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0280 | • 2,8   | 6,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0300 | • 3,0   | 6,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0350 | • 3,5   | 6,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0380 | • 3,8   | 6,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0400 | • 4,0   | 7,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0450 | • 4,5   | 7,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0480 | • 4,8   | 7,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0500 | • 5,0   | 8,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0550 | • 5,5   | 8,0  | 6     | 45 | 3 | 22,00 |
| NEU | 306296.0580 | • 5,8   | 8,0  | 6     | 45 | 3 | 22,00 |
|     | 306296.0600 | • 6,0   | 10,0 | 6     | 45 | 3 | 22,00 |

MICRO GRAIN KARNASCH NORM

N DIN 6535 Form HA



HSC High-Speed-Cutting

UFX-1 NANO



Schnittdaten  
Cutting data



i S. 274

10 Stück  
Verpackungseinheit  
10 items per unit

VHM-Schaftfräser, lang

Art. **30.6331**

HRC  
< 45

STAHL  
steel  
< 1500 N/mm

UNI

TOOLOX  
44



Solid carbide end mills, long

Fresa metal duro de mango, larga

Твердосплавная концевая фреза, длинная



|  | Art.        | Ø d1 e8 | l3 | l2 | d2 h6 | d3   | l1  | Z | €      |
|--|-------------|---------|----|----|-------|------|-----|---|--------|
|  | 306331.0300 | • 3     | -  | 7  | 6     | -    | 57  | 3 | 28,00  |
|  | 306331.0400 | • 4     | -  | 8  | 6     | -    | 57  | 3 | 28,00  |
|  | 306331.0500 | • 5     | -  | 10 | 6     | -    | 57  | 3 | 28,00  |
|  | 306331.0600 | • 6     | 21 | 10 | 6     | 5,8  | 57  | 3 | 31,00  |
|  | 306331.0800 | • 8     | 25 | 16 | 8     | 7,8  | 63  | 3 | 37,00  |
|  | 306331.1000 | • 10    | 30 | 19 | 10    | 9,8  | 72  | 3 | 54,00  |
|  | 306331.1200 | • 12    | 38 | 22 | 12    | 11,8 | 83  | 3 | 75,00  |
|  | 306331.2000 | ▲ 20    | 50 | 32 | 20    | 19,8 | 104 | 3 | 160,00 |

MICRO GRAIN DIN 6527 L

N DIN 6535 Form HB



HSC HPC

UFX-1 NANO



Schnittdaten  
Cutting data



i S. 274

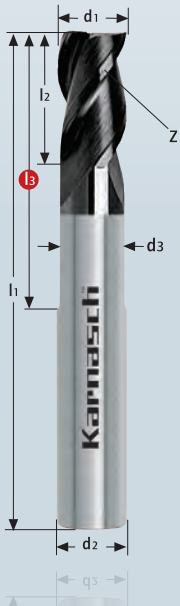
Art. 30.6332 VHM-Schaftfräser, lang

HRC<45

STAHL  
steel  
<1500 N/mm

UNI

TOOLOX  
44



 Z 3

 <Ø12 0,1  
45°

 <Ø20 0,2  
45°

-  Solid carbide end mills, long
-  Fresa metal duro de mango, larga
-  Твердосплавная концевая фреза, длинная

MICRO GRAIN

DIN 6527 L

N

DIN 6535 Form HA

 45°

 f 45°

 HSC HPC

 UFX-1 NANO





Schnittdaten  
Cutting data



i S. 274

| Art.        | Ø d1 e8 | l3 | l2 | d2 h6 | d3   | l1 | Z | €     |
|-------------|---------|----|----|-------|------|----|---|-------|
| 306332.0300 | • 3     | -  | 7  | 6     | -    | 57 | 3 | 28,00 |
| 306332.0400 | • 4     | -  | 8  | 6     | -    | 57 | 3 | 28,00 |
| 306332.0500 | • 5     | -  | 10 | 6     | -    | 57 | 3 | 28,00 |
| 306332.0600 | • 6     | 21 | 10 | 6     | 5,8  | 57 | 3 | 31,00 |
| 306332.0800 | • 8     | 25 | 16 | 8     | 7,8  | 63 | 3 | 37,00 |
| 306332.1000 | • 10    | 30 | 19 | 10    | 9,8  | 72 | 3 | 54,00 |
| 306332.1200 | • 12    | 38 | 22 | 12    | 11,8 | 83 | 3 | 75,00 |

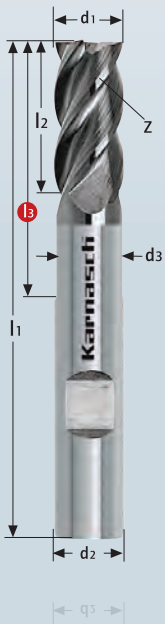
Art. 30.6341 VHM-Schaftfräser, lang

HRC<45

STAHL  
steel  
<1500 N/mm

UNI

TOOLOX  
44



 Z 4

 <Ø12 0,1  
45°

 <Ø20 0,2  
45°

-  Solid carbide end mills, long
-  Fresa metal duro de mango, larga
-  Твердосплавная концевая фреза, длинная

MICRO GRAIN

DIN 6527 L

N

DIN 6535 Form HB

 45°

 f 45°

 HSC HPC

 UFX-1 NANO





Schnittdaten  
Cutting data



i S. 274

| Art.        | Ø d1 e8 | l3 | l2 | d2 h6 | d3   | l1  | Z | €      |
|-------------|---------|----|----|-------|------|-----|---|--------|
| 306341.0300 | • 3     | -  | 10 | 6     | -    | 57  | 4 | 28,00  |
| 306341.0400 | • 4     | -  | 13 | 6     | -    | 57  | 4 | 28,00  |
| 306341.0500 | • 5     | -  | 15 | 6     | -    | 57  | 4 | 28,00  |
| 306341.0600 | • 6     | 21 | 16 | 6     | 5,8  | 57  | 4 | 31,00  |
| 306341.0800 | • 8     | 25 | 19 | 8     | 7,8  | 63  | 4 | 37,00  |
| 306341.1000 | • 10    | 30 | 25 | 10    | 9,8  | 72  | 4 | 54,00  |
| 306341.1200 | • 12    | 38 | 28 | 12    | 11,8 | 83  | 4 | 75,00  |
| 306341.1400 | • 14    | 35 | 30 | 14    | 13,8 | 83  | 4 | 82,00  |
| 306341.1600 | • 16    | 45 | 35 | 16    | 15,8 | 92  | 4 | 126,00 |
| 306341.1800 | • 18    | 45 | 35 | 18    | 17,8 | 92  | 4 | 147,00 |
| 306341.2000 | • 20    | 50 | 40 | 20    | 19,8 | 104 | 4 | 197,00 |



VHM-Schaftfräser, lang

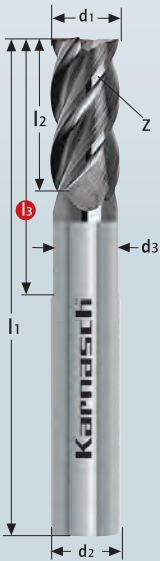
Art. **30.6342**

HRC  
< 45

STAHL  
steel  
< 1500 N/mm

UNI

TOOLOX  
44



- Solid carbide end mills, long
- Fresa metal duro de mango, larga
- Твердосплавная концевая фреза, длинная

MICRO GRAIN

DIN 6527 L

N

DIN 6535 Form HA

HSC HPC

UFX-1 NANO

| Art.        | Ø d1 e8 | l3 | l2 | d2 h6 | d3   | l1 | Z | €     |
|-------------|---------|----|----|-------|------|----|---|-------|
| 306342.0300 | • 3     | -  | 10 | 6     | -    | 57 | 4 | 28,00 |
| 306342.0400 | • 4     | -  | 13 | 6     | -    | 57 | 4 | 28,00 |
| 306342.0500 | • 5     | -  | 15 | 6     | -    | 57 | 4 | 28,00 |
| 306342.0600 | • 6     | 21 | 16 | 6     | 5,8  | 57 | 4 | 31,00 |
| 306342.0800 | • 8     | 25 | 19 | 8     | 7,8  | 63 | 4 | 37,00 |
| 306342.1000 | • 10    | 30 | 25 | 10    | 9,8  | 72 | 4 | 54,00 |
| 306342.1200 | • 12    | 38 | 28 | 12    | 11,8 | 83 | 4 | 75,00 |
| 306342.1400 | Δ 14    | 35 | 30 | 14    | 13,8 | 83 | 4 | 68,00 |

Nachfolgewerkzeug / Replacement article 30.6432

Schnittdaten  
Cutting data



i S. 274

VHM Feinschruppfräser MTC\*, Progressiv, 1xD, Innen- und Aussenschrupp

Art. **30.6349**

UNI

lang-spanend  
long chip

STAHL  
steel  
< 1400 N/mm

Schruppen  
roughing

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

GJL

GJS

GTW  
GTS

TITAN



- Solid carbide fine roughing end mills with HR profile, right hand spiral fluted, right-handed. MTC-Multi-Task-Cutting, progressive, 1xD
- Fresa metal duro de desbastar. MTC-Multi-Task-Cutting, progresiva, 1xD
- Твердосплавная тонко-обдирочная фреза, MTC-Multi-Task-Cutting, 1xD

\* MTC – Multi-Task-Cutting geeignet für die neueste MTM-Generation von Dreh- und Fräszentren (MTC für MTM)

\* MTC – Multi-Task-Cutting suitable for the newest MTM-Generation for turning and milling centres (MTC for MTM)

MICRO GRAIN

KARNASCH NORM

HR

DIN 6535 Form HA

MTC

HVS

| Art.           | Ø d1 * | l2 | d2 h6 | l1 | Z | €      |
|----------------|--------|----|-------|----|---|--------|
| 306349.1400.16 | • 14   | 16 | 14    | 75 | 4 | 111,00 |
| 306349.1600.18 | • 16   | 18 | 16    | 85 | 5 | 148,00 |
| 306349.2000.18 | • 20   | 18 | 20    | 92 | 5 | 228,00 |

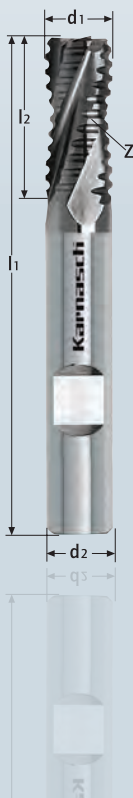
Schnittdaten  
Cutting data



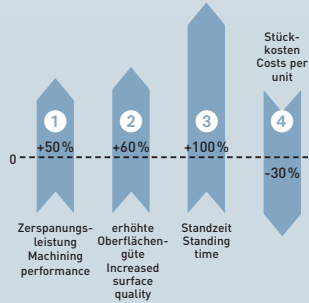
i S. 278

Art. 30.6353 VHM-HXF-Profil-Schrupfräser, lang

- HRC < 50
- UNI
- STAHL steel < 1670 N/mm
- GG/G cast iron
- INOX stainless steel < 900 N/mm ferritic
- INOX stainless steel > 900 N/mm martensitic
- INOX stainless steel < 900 N/mm austenitic
- TITAN < 1100 N/mm
- INCONEL HASTELLOY TITAN



- Solid carbide roughing end mills with HXF profile, long
- Fresa metal duro de desbastar HXF, larga
- Твердосплавная обдирочная фреза HXF, длинная



| Art.        | Ø d1 * | l2 | d2 h6 | l1  | Z | €      |
|-------------|--------|----|-------|-----|---|--------|
| 306353.0400 | • 4    | 8  | 6     | 57  | 3 | 58,00  |
| 306353.0600 | • 6    | 13 | 6     | 57  | 3 | 61,00  |
| 306353.0800 | • 8    | 19 | 8     | 63  | 3 | 76,00  |
| 306353.1000 | • 10   | 22 | 10    | 72  | 4 | 83,00  |
| 306353.1200 | • 12   | 26 | 12    | 83  | 4 | 104,00 |
| 306353.1600 | • 16   | 32 | 16    | 92  | 4 | 157,00 |
| 306353.2000 | • 20   | 38 | 20    | 104 | 4 | 234,00 |

MICRO GRAIN

DIN 6527 L

HXF

DIN 6535 Form HB

30°

45°

HSC HPC

DVC-X3

Cutting data

Schnittdaten  
Cutting data

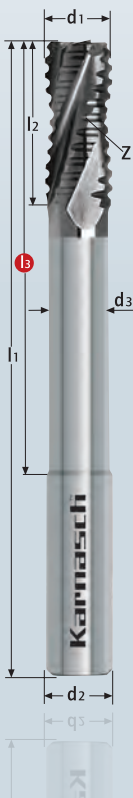


i S. 275

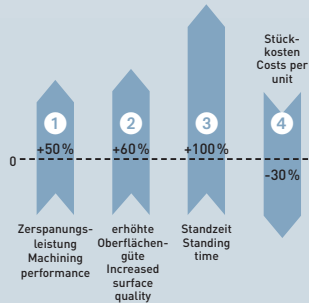
| * tol. d1 |              |
|-----------|--------------|
| Ø4 - Ø 6  | -0,01/-0,048 |
| Ø8 - Ø10  | -0,01/-0,058 |
| Ø12 - Ø18 | -0,01/-0,070 |
| Ø20       | -0,01/-0,084 |

Art. 30.6355 VHM-HXF-Profil-Schrupfräser, < 7xD, extra lang

- HRC < 50
- UNI
- STAHL steel < 1670 N/mm
- GG/G cast iron
- INOX stainless steel < 900 N/mm ferritic
- INOX stainless steel > 900 N/mm martensitic
- INOX stainless steel < 900 N/mm austenitic
- TITAN < 1100 N/mm
- INCONEL HASTELLOY TITAN



- Solid carbide roughing end mills with HXF profile, extra long
- Fresa metal duro de desbastar HXF, < 7xD, extra larga
- Твердосплавная обдирочная фреза HXF, < 7xD, особенно длинная



| Art.        | Ø d1 * | d2 h6 | d3-0,1 | l1  | l2 | l3 | Z | €      |
|-------------|--------|-------|--------|-----|----|----|---|--------|
| 306355.0600 | • 6    | 6     | 5,5    | 80  | 15 | 44 | 3 | 81,00  |
| 306355.0800 | • 8    | 8     | 7,5    | 85  | 21 | 49 | 3 | 102,00 |
| 306355.1000 | • 10   | 10    | 9,5    | 100 | 24 | 60 | 4 | 121,00 |
| 306355.1200 | • 12   | 12    | 11,5   | 120 | 28 | 65 | 4 | 160,00 |
| 306355.1600 | • 16   | 16    | 15,5   | 125 | 34 | 77 | 4 | 233,00 |
| 306355.2000 | • 20   | 20    | 19,5   | 150 | 42 | 90 | 4 | 346,00 |

MICRO GRAIN

KARNASCH NORM

HXF

DIN 6535 Form HA

30°

45°

HSC HPC

DVC-X3

Cutting data

Schnittdaten  
Cutting data



i S. 275

| * tol. d1 |              |
|-----------|--------------|
| Ø4 - Ø 6  | -0,01/-0,048 |
| Ø8 - Ø10  | -0,01/-0,058 |
| Ø12 - Ø18 | -0,01/-0,070 |
| Ø20       | -0,01/-0,084 |

VHM-Feinschruppfräser, MTC\*, Progressiv, Innen- und Aussenschrupp

Art. **30.6356**

UNI

lang-spanend  
long chip

STAHL  
steel  
< 1400 N/mm

Schruppen  
roughing

GJL

GJS

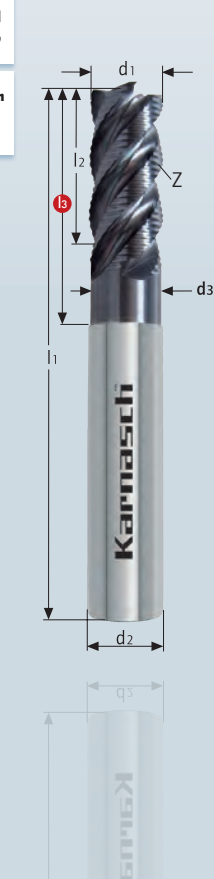
GTW  
GTS

TITAN

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic



- Solid carbide fine roughing end mills with HR profile, right hand spiral fluted, right-handed. MTC-Multi-Task-Cutting, progressive
- Fresa metal duro de desbistar. MTC-Multi-Task-Cutting, progresiva
- Твердосплавная тонко-обдирочная фреза HPC, MTC-Multi-Task-Cutting

\* MTC – Multi-Task-Cutting geeignet für die neueste MTM-Generation von Dreh- und Fräszentren (MTC für MTM)  
\* MTC – Multi-Task-Cutting suitable for the newest MTM-Generation for turning and milling centres (MTC for MTM)

| Art.           | Ø d1 h10 | l3 | l2 | d2 h6 | d3   | l1  | Z | €      |
|----------------|----------|----|----|-------|------|-----|---|--------|
| 306356.0600.21 | • 6      | 21 | 16 | 6     | 5,5  | 57  | 4 | 76,00  |
| 306356.0800.27 | • 8      | 27 | 22 | 8     | 7,5  | 72  | 4 | 86,00  |
| 306356.1000.30 | • 10     | 30 | 25 | 10    | 9,5  | 72  | 4 | 95,00  |
| 306356.1200.38 | • 12     | 38 | 28 | 12    | 11,2 | 83  | 4 | 116,00 |
| 306356.1400.40 | • 14     | 40 | 30 | 14    | 13,0 | 83  | 4 | 165,00 |
| 306356.1600.45 | • 16     | 45 | 35 | 16    | 15,0 | 92  | 5 | 218,00 |
| 306356.1800.45 | • 18     | 45 | 35 | 18    | 17,0 | 92  | 5 | 276,00 |
| 306356.2000.55 | • 20     | 55 | 40 | 20    | 19,0 | 104 | 5 | 331,00 |

MICRO GRAIN

KARNASCH NORM

HR

DIN 6535 Form HA

PROGRESSIV

MTC

HVS

Schnittdaten  
Cutting data



i S. 276

VHM-Schruppfräser, MTC\*, mit Innenkühlung, Progressiv, Innen- und Aussenschrupp

Art. **30.6358**

HRC < 55

UNI

TITAN

GJL

GJS

lang-spanend  
long chip

kurz-spanend  
short chip

Schruppen  
roughing



- Solid carbide fine roughing end mills with HR profile, right hand spiral fluted, right-handed. MTC-Multi-Task-Cutting, progressive, with interior cooling
- Fresa metal duro de desbistar HPC-progresiva, con refrigeracion interna. MTC-Multi-Task-Cutting
- Твердосплавная тонко-обдирочная фреза, MTC-Multi-Task-Cutting

\* MTC – Multi-Task-Cutting geeignet für die neueste MTM-Generation von Dreh- und Fräszentren (MTC für MTM)  
\* MTC – Multi-Task-Cutting suitable for the newest MTM-Generation for turning and milling centres (MTC for MTM)

Mit kontrolliertem Kühlmittelaustritt  
With controlled interior cooling leaving

| Art.           | Ø d1 d10 | l3 | l2 | d2 h5 | d3   | l1  | Z | €      |
|----------------|----------|----|----|-------|------|-----|---|--------|
| 306358.0600.21 | • 6      | 21 | 16 | 6     | 5,5  | 58  | 4 | 108,00 |
| 306358.0800.27 | • 8      | 27 | 22 | 8     | 7,5  | 70  | 4 | 122,00 |
| 306358.1000.30 | • 10     | 30 | 25 | 10    | 9,5  | 72  | 4 | 142,00 |
| 306358.1200.38 | • 12     | 38 | 28 | 12    | 11,2 | 82  | 4 | 178,00 |
| 306358.1400.40 | • 14     | 40 | 30 | 14    | 13,0 | 82  | 4 | 235,00 |
| 306358.1600.45 | • 16     | 45 | 35 | 16    | 15,0 | 92  | 5 | 305,00 |
| 306358.1800.45 | • 18     | 45 | 35 | 18    | 17,0 | 92  | 5 | 355,00 |
| 306358.2000.55 | • 20     | 55 | 40 | 20    | 19,0 | 104 | 5 | 426,00 |

Ø 6 ohne Kühlmittel Stirnaustritt / Without cooling face discharge

MICRO GRAIN

KARNASCH NORM

HR

DIN 6535 Form HAK

PROGRESSIV

MTC

HVS

Schnittdaten  
Cutting data



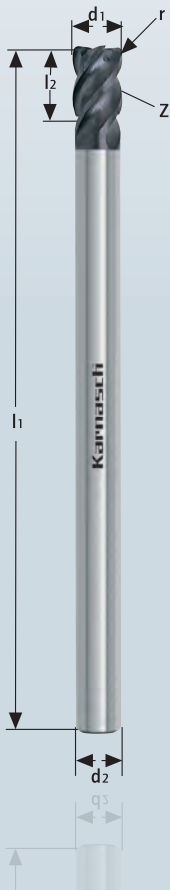
i S. 277

Art. 30.6425 VHM-Schaftfräser mit Eckenradius, überlang

HRC<60

UNI

GG/G  
cast iron



- Solid carbide end mills with corner radius, extra long
- Fresa metal duro de mango con radio angular, extra larga
- Твердосплавная концевая фреза с угловым радиусом, особенно длинная



- Wichtig/Important:
- I Generell HSC Gleichlaufräsen mit Emulsion!  
General HSC Synchronized milling with emulsion!
- II Guss- und NE-Metall naß bearbeiten oder mit Luftkühlung!  
Caste and NE-Metal wet processed or with air cooling!
- III Stabile, schwingungsfreie Verhältnisse sind Voraussetzung.  
Stabile, oscillation free relationships are the prerequisite.

MICRO GRAIN

KARNASCH NORM

N/M

DIN 6535 Form HA

45°

HSC HHC

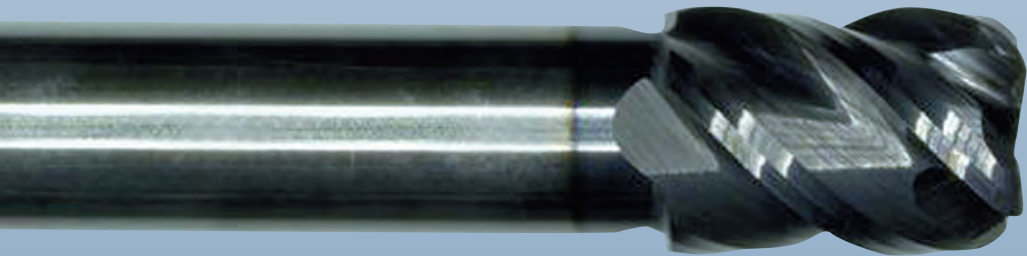
UFX-3

Schnittdaten  
Cutting data



i S. 275

| Art.           | Ø d1 e8 | r ± 0,01 | d2 h6 | l1  | l2 | Z | €      |
|----------------|---------|----------|-------|-----|----|---|--------|
| 306425.0700.05 | • 7     | 0,5      | 6     | 120 | 9  | 4 | 94,00  |
| 306425.0700.10 | • 7     | 1,0      | 6     | 120 | 9  | 4 | 94,00  |
| 306425.0900.05 | • 9     | 0,5      | 8     | 135 | 12 | 4 | 125,00 |
| 306425.0900.10 | • 9     | 1,0      | 8     | 135 | 12 | 4 | 125,00 |
| 306425.1100.05 | • 11    | 0,5      | 10    | 150 | 15 | 4 | 159,00 |
| 306425.1100.10 | • 11    | 1,0      | 10    | 150 | 15 | 4 | 159,00 |
| 306425.1300.05 | • 13    | 0,5      | 12    | 160 | 18 | 4 | 221,00 |
| 306425.1300.10 | • 13    | 1,0      | 12    | 160 | 18 | 4 | 221,00 |



Stirnseitig  
On the front side



30.6425 - 7,0 r0,5

Objektiv: Z30 x 30



Extrem Rapid Cutter Nut- und Schruppfräser < 700 N/mm<sup>2</sup>

Art. **30.6432**

UNI

STAHL  
steel  
<1100 N/mm

HRC  
< 45

GJL

GJS

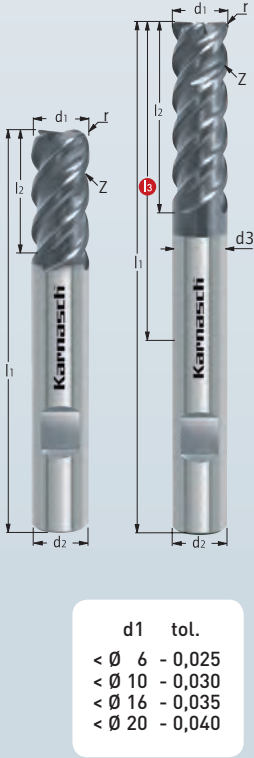
GTW  
GTS

Schruppen  
roughing  
▼

Schrupp-  
schlicht  
semifinishing  
▼▼

kurz-  
spanend  
short chip

lang-  
spanend  
long chip



- Extreme rapid cutter steel < 700 N/mm<sup>2</sup>
- Fresado extremadamente rápido en acero < 700 N/mm<sup>2</sup>
- Чрезвычайно быстрое фрезерование в стали < 700 N/mm<sup>2</sup>

| Art.               | d1 *   | r   | l2 | l3 | d2 h5 | d3    | l1  | Z | €      |
|--------------------|--------|-----|----|----|-------|-------|-----|---|--------|
| 306432.0300.030.06 | • 3,0  | 0,3 | 6  | -  | 6     | -     | 57  | 4 | 41,50  |
| 306432.0400.030.08 | • 4,0  | 0,3 | 8  | -  | 6     | -     | 57  | 4 | 41,00  |
| 306432.0500.030.10 | • 5,0  | 0,3 | 10 | -  | 6     | -     | 57  | 4 | 41,00  |
| 306432.0600.030.12 | • 6,0  | 0,3 | 12 | -  | 6     | -     | 57  | 4 | 39,50  |
| 306432.0600.030.18 | • 6,0  | 0,3 | 18 | 36 | 6     | 5,80  | 75  | 4 | 58,50  |
| 306432.0800.050.16 | • 8,0  | 0,5 | 16 | -  | 8     | -     | 63  | 4 | 44,00  |
| 306432.0800.050.24 | • 8,0  | 0,5 | 24 | 48 | 8     | 7,80  | 90  | 4 | 68,00  |
| 306432.1000.050.20 | • 10,0 | 0,5 | 20 | -  | 10    | -     | 72  | 4 | 58,00  |
| 306432.1000.050.30 | • 10,0 | 0,5 | 30 | 55 | 10    | 9,80  | 100 | 4 | 91,00  |
| 306432.1200.100.24 | • 12,0 | 1,0 | 24 | -  | 12    | -     | 83  | 4 | 75,50  |
| 306432.1200.100.36 | • 12,0 | 1,0 | 36 | 60 | 12    | 11,80 | 110 | 4 | 115,50 |
| 306432.1600.100.32 | • 16,0 | 1,0 | 32 | -  | 16    | -     | 92  | 4 | 142,50 |
| 306432.1600.100.48 | • 16,0 | 1,0 | 48 | 80 | 16    | 15,80 | 140 | 4 | 223,00 |
| 306432.2000.100.40 | • 20,0 | 1,0 | 40 | -  | 20    | -     | 104 | 4 | 190,00 |
| 306432.2000.100.60 | • 20,0 | 1,0 | 60 | 90 | 20    | 19,80 | 150 | 4 | 314,50 |

d3 < Ø10 HA / d3 > Ø12 HB

MICRO GRAIN

KARNASCH NORM

N DUO

DIN 6535/Form HA  
DIN 6535/Form HB

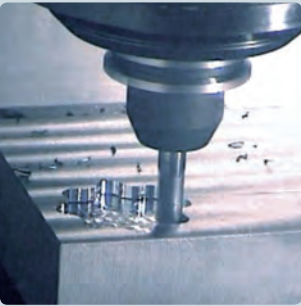
50°

Extrem Rapid Cutting

XP-772

OIL

Schnittdaten  
Cutting data



|                              |                                                                                                                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Test                      | Reale Schnittdaten<br>Real cutting data                                                                                                                        |
| Werkstoff /<br>Work material | 1.7225<br>Tool 12,0 x 24 r 1,0<br>Vc = 265 m/min.<br>n = 7.000 U/min.<br>Vf = 6.000 mm/min.<br>fz = 0,21 mm<br>ae = 1,25 mm<br>ap = 20,0 mm<br>Q = 138 cm/min. |



|                                                    |        |        |        |
|----------------------------------------------------|--------|--------|--------|
| Länge ausserhalb<br>Spannfutter<br>Overhang length | Vc - % | ap - % | Vf - % |
| l7 ≤ 4 x d1                                        | 100    | 100    | 100    |
| l7 ≤ 5 x d1                                        | 70     | 70     | 80     |
| l7 ≤ 4 x d1                                        | 50     | 50     | 70     |

|                              |                                                                                                                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. Test                      | Reale Schnittdaten<br>Real cutting data                                                                                                                                                                            |
| Werkstoff /<br>Work material | St 52-3U<br>Tool 12,0 x 24 r 1,0<br>Vc = 150 m/min.<br>n = 4.780 U/min.<br>Vf = 2.200 mm/min.<br>fz = 0,12 mm<br>ae = 8,0 mm<br>ap = 6,0 mm<br>Q = 105 cm/min.<br>Eintauchvorschub = 700 mm/min.<br>Plunging speed |

- Bearbeitungshinweise:**
- Vorausgesetzt, es werden stabile Maschinenverhältnisse und einwandfreie Werkzeugaufnahmen verwendet (Schrumpffutter)
  - Die genannten Richtwerte basieren auf interpolationsfräsen auch in den Ecken. Ohne Interpolationsfräsen reduzieren Sie die Schnittgeschwindigkeit (Vc) um 50%-70% sowie die Schnitttiefe (ap) um 50%-80%.
  - Kühlen Sie mit MMKS (Minimalkühlschmierung) oder Luft.
  - Beim Eintauchen in Z-Achse mit einer Schräge von ≈ 2° ist der Vorschub auf 40-60% zu reduzieren.
  - Die Richtwerte beziehen sich auf eine Ausraglänge l3 von 3xD. Für tiefere Anwendungen sind Vc / ap / Vf den Gegebenheiten anzupassen.
  - Um optimale Schnittbedingungen zu erreichen sind die Einsatzbedingungen vor Ort zu berücksichtigen.

|                              |                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------|
| 3. Test                      | Reale Schnittdaten<br>Real cutting data                                                   |
| Werkstoff /<br>Work material | 1.2085<br>Tool 16 x 32 r = 1,0<br>Vc = 120 m/min.<br>n = 2.355 U/min.<br>Vf = 800 mm/min. |

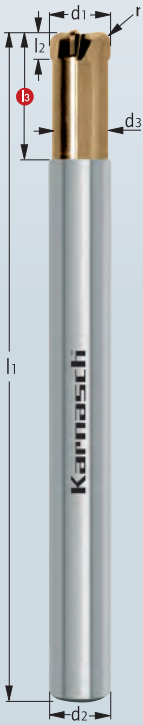
- Machining details:**
- Conditions must be: rigid machine circumstances and excellent holders. (shrinking holder)
  - The mentioned standard values based on interpolation milling also in corners.
  - Coolant with MMKS [MQL (mist)] or air blow.
  - When dipping in Z-axis, you have to reduce the feed speed 40% - 60%.
  - The standard values refer to the length l3 of 3xD. For deeper applications please adjust Vc/ap/Vf for the conditions.
  - In order to achieve ideal cutting results you have to consider your local operating conditions.

Art. 30.6433 Vollhartmetall High Performance -Fräser bis 60 HRC

HRC<60

HRC<55

UNI



- Solid carbide – High Performance end mill up to 60 HRC
- Fresadora metal duro de alto rendimiento hasta 60 HRC
- VHM - высокопрочная фреза до 60 HRC (твёрдость по шкале Роквелла)

MICRO GRAIN

KARNASCH NORM

H

DIN 6535 Form HA

HPC

HXC-NANO<sup>3</sup>

| Art.            | d1 e8  | r    | l3   | d2 h6 | d3   | l1  | l2  | Z | €      |
|-----------------|--------|------|------|-------|------|-----|-----|---|--------|
| 306433.0200.05  | • 2,0  | 0,5  | 5,0  | 6     | 1,8  | 60  | 0,8 | 3 | 66,00  |
| 306433.0300.075 | • 3,0  | 0,75 | 7,5  | 6     | 2,7  | 60  | 1,2 | 4 | 66,00  |
| 306433.0400.10  | • 4,0  | 1,0  | 10,0 | 6     | 3,5  | 70  | 1,6 | 4 | 70,00  |
| 306433.0500.12  | • 5,0  | 1,2  | 12,5 | 6     | 4,5  | 80  | 2,0 | 4 | 70,00  |
| 306433.0600.15  | • 6,0  | 1,5  | 12,0 | 6     | 5,5  | 90  | 2,5 | 4 | 96,00  |
| 306433.0700.15  | • 7,0  | 1,5  | -    | 6     | -    | 90  | 3,0 | 4 | 104,00 |
| 306433.0800.20  | • 8,0  | 2,0  | 16,0 | 8     | 7,2  | 105 | 3,5 | 4 | 112,00 |
| 306433.0900.20  | • 9,0  | 2,0  | -    | 8     | -    | 105 | 4,0 | 4 | 126,00 |
| 306433.1000.20  | • 10,0 | 2,0  | 20,0 | 10    | 9,0  | 105 | 4,0 | 4 | 139,00 |
| 306433.1100.20  | • 11,0 | 2,0  | -    | 10    | -    | 105 | 4,5 | 4 | 154,00 |
| 306433.1200.30  | • 12,0 | 3,0  | 24,0 | 12    | 11,0 | 105 | 5,0 | 4 | 165,00 |
| 306433.1300.30  | • 13,0 | 3,0  | -    | 12    | -    | 105 | 5,5 | 4 | 182,00 |
| 306433.1600.40  | • 16,0 | 4,0  | 28,0 | 16    | 14,0 | 105 | 6,5 | 4 | 224,00 |

Schnittdaten  
Cutting data

i S. 278

IHR PARTNER FÜR: Metallindustrie | Automobilindustrie | Flugzeugindustrie | Schiffbau | Schienenbau | Formenbau | Forschung und Entwicklung

Eine große Vision braucht einen zuverlässigen Partner.  
KARNASCH – Made for Professionals

VHM-Gesenkfräser mit Eckenradius, kurz, Rockwell Cutter

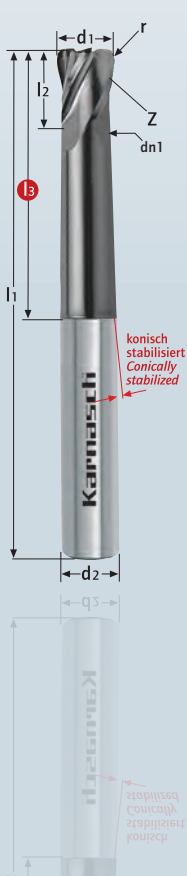
Art. **30.6434**

HRC < 68

UNI

GG/G  
cast iron

TITAN < 1100 N/mm



- Solid carbide end mills with corner radius, short, Rockwell Cutter
- Fresadora metal duro de matrices con radio angular, corta, Rockwell Cutter
- Твердосплавная штамповочная фреза с угловым радиусом, короткая, Rockwell Cutter

| Art.           | Ø d1 - 0,03 | r ± 0,01 | l3 | d2 h6 | dn1     | l1 | l2 | Z | €     |
|----------------|-------------|----------|----|-------|---------|----|----|---|-------|
| 306434.0500.05 | • 5         | 0,5      | 18 | 5     | konisch | 54 | 6  | 4 | 26,50 |
| 306434.0500.10 | • 5         | 1,0      | 18 | 5     | konisch | 54 | 6  | 4 | 26,50 |
| 306434.0600.10 | • 6         | 1,0      | 21 | 6     | konisch | 57 | 7  | 4 | 32,00 |
| 306434.0600.15 | • 6         | 1,5      | 21 | 6     | konisch | 57 | 7  | 4 | 32,00 |
| 306434.0800.15 | • 8         | 1,5      | 27 | 8     | konisch | 63 | 9  | 4 | 42,50 |
| 306434.1000.15 | • 10        | 1,5      | 32 | 10    | konisch | 72 | 11 | 4 | 56,50 |
| 306434.1000.20 | • 10        | 2,0      | 32 | 10    | konisch | 72 | 11 | 4 | 56,50 |

Alternative 30.6436

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

30°

rp = radius position

HSC HHC

UFX-3

Schnittdaten  
Cutting data



i S. 284

VHM-Gesenkfräser mit Eckenradius, extra lang, Rockwell Cutter

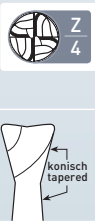
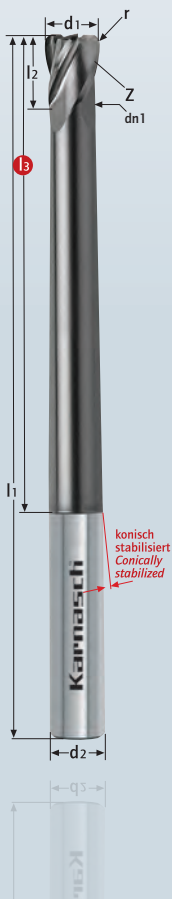
Art. **30.6435**

HRC < 68

UNI

GG/G  
cast iron

TITAN < 1100 N/mm



- Solid carbide end mills with corner radius, extra long, Rockwell Cutter
- Fresadora metal duro de matrices con radio angular, extra larga, Rockwell Cutter
- Твердосплавная штамповочная фреза с угловым радиусом, особенно длинная, Rockwell Cutter

| Art.           | Ø d1 - 0,03 | r ± 0,01 | l3 | d2 h6 | dn1     | l1  | l2 | Z | €     |
|----------------|-------------|----------|----|-------|---------|-----|----|---|-------|
| 306435.0200.02 | ▲ 2         | 0,2      | 27 | 3     | konisch | 75  | 3  | 4 | 28,00 |
| 306435.0600.15 | ▲ 6         | 1,5      | 45 | 6     | konisch | 100 | 7  | 4 | 42,50 |
| 306435.1000.05 | ▲ 10        | 0,5      | 60 | 10    | konisch | 100 | 11 | 4 | 75,50 |
| 306435.1000.15 | ▲ 10        | 1,5      | 60 | 10    | konisch | 100 | 11 | 4 | 75,50 |

Alternative 30.6437

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

30°

rp = radius position

HSC HHC

UFX-3

Schnittdaten  
Cutting data



i S. 284

Art. 30.6436 VHM-Gesenkfräser mit Eckenradius, kurz, Rockwell Cutter

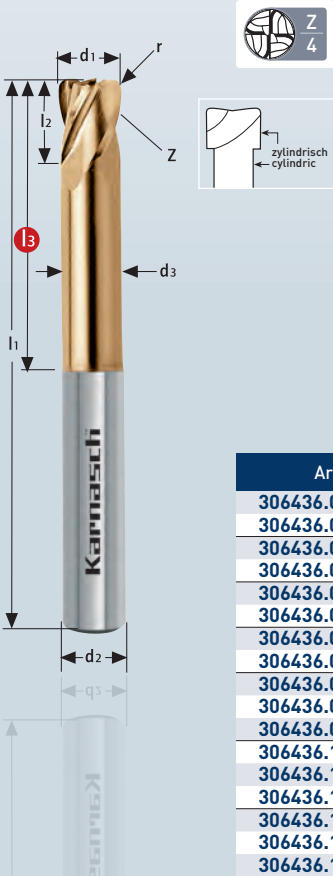
HRC<68

UNI

TOOLOX44

GG/Gcast iron

TITAN<1100N/mm



- Solid carbide end mills with corner radius, short, Rockwell Cutter
- Fresadora metal duro de matrices con radio angular, corta, Rockwell Cutter
- Твердосплавная штамповочная фреза с угловым радиусом, короткая, Rockwell Cutter

| Art.           | Ø d1 e8 | r ± 0,01 | l3 | d2 h6 | d3   | l1 | l2 | Z | €      |
|----------------|---------|----------|----|-------|------|----|----|---|--------|
| 306436.0100.01 | • 1     | 0,1      | 10 | 6     | 0,9  | 57 | 2  | 4 | 78,00  |
| 306436.0100.02 | • 1     | 0,2      | 10 | 6     | 0,9  | 57 | 2  | 4 | 78,00  |
| 306436.0200.02 | • 2     | 0,2      | 13 | 6     | 1,9  | 57 | 3  | 4 | 48,00  |
| 306436.0300.03 | • 3     | 0,3      | 14 | 6     | 2,7  | 57 | 4  | 4 | 45,00  |
| 306436.0400.04 | • 4     | 0,4      | 16 | 6     | 3,7  | 57 | 5  | 4 | 58,00  |
| 306436.0500.05 | • 5     | 0,5      | 18 | 6     | 4,6  | 57 | 6  | 4 | 58,00  |
| 306436.0600.05 | • 6     | 0,5      | 21 | 6     | 5,5  | 57 | 7  | 4 | 57,00  |
| 306436.0600.10 | • 6     | 1,0      | 21 | 6     | 5,5  | 57 | 7  | 4 | 57,00  |
| 306436.0800.05 | • 8     | 0,5      | 27 | 8     | 7,4  | 63 | 10 | 4 | 79,00  |
| 306436.0800.08 | ▲ 8     | 0,8      | 27 | 8     | 7,4  | 63 | 10 | 4 | 76,00  |
| 306436.0800.10 | • 8     | 1,0      | 27 | 8     | 7,4  | 63 | 10 | 4 | 79,00  |
| 306436.1000.05 | • 10    | 0,5      | 32 | 10    | 9,2  | 72 | 12 | 4 | 105,00 |
| 306436.1000.10 | • 10    | 1,0      | 32 | 10    | 9,2  | 72 | 12 | 4 | 105,00 |
| 306436.1000.15 | • 10    | 1,5      | 32 | 10    | 9,2  | 72 | 12 | 4 | 105,00 |
| 306436.1200.05 | • 12    | 0,5      | 36 | 12    | 11,0 | 83 | 15 | 4 | 139,00 |
| 306436.1200.10 | • 12    | 1,0      | 36 | 12    | 11,0 | 83 | 15 | 4 | 139,00 |
| 306436.1200.15 | • 12    | 1,5      | 36 | 12    | 11,0 | 83 | 15 | 4 | 139,00 |

MICROGRAIN

DIN 6527 K

N

DIN 6535 Form HA

Schnittdaten  
Cutting data



Art. 30.6437 VHM-Gesenkfräser mit Eckenradius, extra lang, Rockwell Cutter

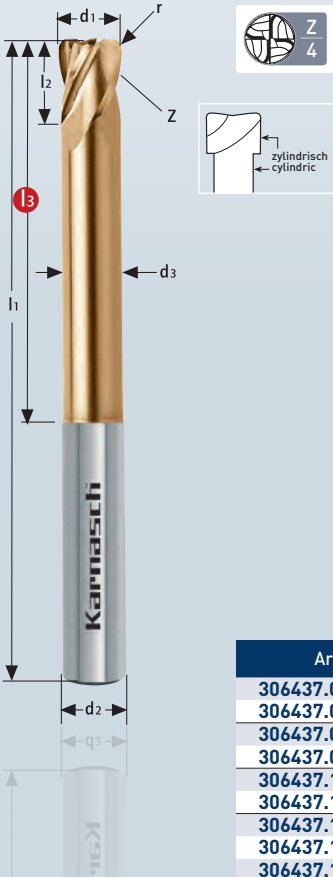
HRC<68

UNI

TOOLOX44

GG/Gcast iron

TITAN<1100N/mm



- Solid carbide end mills with corner radius, extra long, Rockwell Cutter
- Fresadora metal duro de matrices con radio angular, extra larga, Rockwell Cutter
- Твердосплавная штамповочная фреза с угловым радиусом, особенно длинная, Rockwell Cutter

| Art.           | Ø d1 e8 | r ± 0,01 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|----------------|---------|----------|----|-------|------|-----|----|---|--------|
| 306437.0600.05 | • 6     | 0,5      | 45 | 6     | 5,5  | 100 | 7  | 4 | 81,00  |
| 306437.0600.10 | • 6     | 1,0      | 45 | 6     | 5,5  | 100 | 7  | 4 | 81,00  |
| 306437.0800.05 | • 8     | 0,5      | 55 | 8     | 7,4  | 100 | 10 | 4 | 115,00 |
| 306437.0800.10 | • 8     | 1,0      | 55 | 8     | 7,4  | 100 | 10 | 4 | 115,00 |
| 306437.1000.05 | • 10    | 0,5      | 60 | 10    | 9,2  | 100 | 12 | 4 | 151,00 |
| 306437.1000.10 | • 10    | 1,0      | 60 | 10    | 9,2  | 100 | 12 | 4 | 151,00 |
| 306437.1200.05 | • 12    | 0,5      | 75 | 12    | 11,0 | 120 | 15 | 4 | 199,00 |
| 306437.1200.10 | • 12    | 1,0      | 75 | 12    | 11,0 | 120 | 15 | 4 | 199,00 |
| 306437.1200.15 | • 12    | 1,5      | 75 | 12    | 11,0 | 120 | 15 | 4 | 199,00 |

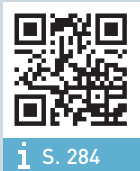
MICROGRAIN

KARNASCH NORM

N

DIN 6535 Form HA

Schnittdaten  
Cutting data





VHM-Gesenkfräser mit Eckenradius, kurz, Superfinish, Rockwell Cutter

Art. **30.6439**

HRC  
< 68

UNI

INOX  
stainless steel  
< 900 N/mm  
ferritic

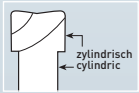
INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

GG/G  
cast iron

TITAN  
< 1100  
N/mm

TOOLOX  
44



- Solid carbide end mills with corner radius, short, Superfinish, Rockwell Cutter
- Fresadora metal duro de matrices con radio angular, corta, Superfinish, Rockwell Cutter
- Твердосплавная штамповочная фреза с угловым радиусом, короткая, супер-финиш, Rockwell Cutter

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

45°

HSC HHC

UFX-3

| Art.           | Ø d1 e8 | r ± 0,01 | l3 | d2 h6 | d3   | l1 | l2  | Z | €      |
|----------------|---------|----------|----|-------|------|----|-----|---|--------|
| 306439.0300.03 | • 3     | 0,3      | 14 | 3     | 2,7  | 50 | 4   | 4 | 41,00  |
| 306439.0300.05 | • 3     | 0,5      | 12 | 6     | 2,8  | 55 | 3,5 | 4 | 55,00  |
| 306439.0400.04 | • 4     | 0,4      | 16 | 4     | 3,7  | 54 | 5   | 4 | 47,00  |
| 306439.0400.05 | • 4     | 0,5      | 12 | 6     | 3,8  | 55 | 4   | 4 | 56,00  |
| 306439.0500.05 | • 5     | 0,5      | 18 | 6*    | 4,6  | 54 | 6   | 4 | 48,00  |
| 306439.0600.05 | • 6     | 0,5      | 21 | 6     | 5,5  | 65 | 7   | 6 | 58,00  |
| 306439.0800.05 | • 8     | 0,5      | 27 | 8     | 7,4  | 70 | 9   | 6 | 73,00  |
| 306439.1000.05 | • 10    | 0,5      | 32 | 10    | 9,2  | 80 | 11  | 6 | 98,00  |
| 306439.1200.05 | • 12    | 0,5      | 38 | 12    | 11,0 | 93 | 12  | 6 | 137,00 |
| 306439.1200.10 | • 12    | 1,0      | 38 | 12    | 11,0 | 93 | 12  | 6 | 137,00 |

\* Laufende Produktion wird geändert auf Schaft d2 = 6,0mm  
\* Running production changed the shank to d2 = 6mm

Schnittdaten  
Cutting data



i S. 284

**Karnasch**™  
PROFESSIONAL TOOLS

IHR PARTNER FÜR: Metallindustrie Automobilindustrie Flugzeugindustrie Schiffbau Schienenbau Formenbau Forschung und Entwicklung

Eine große Vision braucht einen zuverlässigen Partner.  
KARNASCH – Made for Professionals



Art. 30.6446 VHM-Schaftfräser positiv, lang, Superfinish

STAHL  
steel  
< 1400 N/mm

UNI

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

NI-ALLOYS  
< 900 N/mm

NI-CO  
ALLOYS  
> 900 N/mm

TITAN  
< 1100  
N/mm





-  Solid carbide end mills high speed cutting Superfinish
-  Fresa metal duro de mango positiva, larga, Superfinish
-  Твердосплавная концевая фреза, позитивная, длинная, супер-финиш

MICRO GRAIN

DIN 6527 L

N

DIN 6535 Form HA



45°



HSC  
High-Speed-Cutting



UFX-2



Schnittdaten  
Cutting data



| Art.        | Ø d1 e8 | l2 | d2 h6 | l1  | Z  | €      |
|-------------|---------|----|-------|-----|----|--------|
| 306446.0300 | • 3     | 8  | 6     | 57  | 6  | 29,00  |
| 306446.0400 | • 4     | 11 | 6     | 57  | 6  | 29,00  |
| 306446.0500 | • 5     | 13 | 6     | 57  | 6  | 29,00  |
| 306446.0600 | • 6     | 13 | 6     | 57  | 6  | 29,00  |
| 306446.0800 | • 8     | 19 | 8     | 63  | 6  | 33,00  |
| 306446.1000 | • 10    | 22 | 10    | 72  | 6  | 52,00  |
| 306446.1200 | • 12    | 26 | 12    | 83  | 6  | 72,00  |
| 306446.1600 | • 16    | 32 | 16    | 92  | 8  | 131,00 |
| 306446.2000 | • 20    | 38 | 20    | 104 | 10 | 185,00 |

Art. 30.6447 VHM-Schaftfräser positiv, extra lang, Superfinish

STAHL  
steel  
< 1400 N/mm

UNI

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

NI-ALLOYS  
< 900 N/mm

NI-CO  
ALLOYS  
> 900 N/mm

TITAN  
< 1100  
N/mm





-  Solid carbide end mills high speed cutting, extra long, Superfinish
-  Fresa metal duro de mango positiva, extra larga, Superfinish
-  Твердосплавная концевая фреза, позитивная, особенно длинная, супер-финиш

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA



45°



HSC  
High-Speed-Cutting



UFX-2



Schnittdaten  
Cutting data



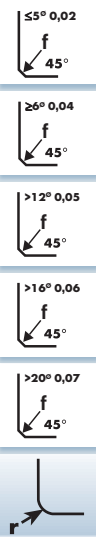
| Art.        | Ø d1 e8 | l2 | d2 h6 | l1  | Z  | €      |
|-------------|---------|----|-------|-----|----|--------|
| 306447.0600 | • 6     | 18 | 6     | 60  | 6  | 39,00  |
| 306447.0800 | • 8     | 24 | 8     | 70  | 6  | 43,00  |
| 306447.1000 | • 10    | 30 | 10    | 80  | 6  | 72,00  |
| 306447.1200 | • 12    | 36 | 12    | 93  | 6  | 105,00 |
| 306447.1600 | • 16    | 48 | 16    | 110 | 8  | 191,00 |
| 306447.2000 | • 20    | 60 | 20    | 125 | 10 | 286,00 |

VHM-Schaftfräser, > 4 x D, Rockwell Cutter, Progressiv

Art. **30.6456**

**HRC  
< 68**

**GG/G**  
cast iron



- High hard cutting solid carbide end mills, > 4 x D, Rockwell Cutter, progressive
- Fresa metal duro de mango, > 4xD, Rockwell Cutter, progresiva
- Твердосплавная концевая фреза, > 4xD, Rockwell Cutter, прогрессивная резка

| Art.               | Ø d1 e8 | r ± 0,01 / f | l2 | l1  | d2 h6 | Z  | €      |
|--------------------|---------|--------------|----|-----|-------|----|--------|
| 306456.0200.06     | • 2,0   | f 0,02       | 6  | 57  | 6     | 4  | 35,00  |
| 306456.0200.020.06 | • 2,0   | r 0,2        | 6  | 57  | 6     | 4  | 42,00  |
| 306456.0200.08     | • 2,0   | f 0,02       | 8  | 64  | 6     | 4  | 42,00  |
| 306456.0300.08     | • 3,0   | f 0,02       | 8  | 57  | 6     | 4  | 35,00  |
| 306456.0300.030.08 | • 3,0   | r 0,3        | 8  | 57  | 6     | 4  | 42,00  |
| 306456.0300.11     | • 3,0   | f 0,02       | 11 | 64  | 6     | 4  | 42,00  |
| 306456.0400.08     | • 4,0   | f 0,02       | 8  | 57  | 6     | 6  | 43,00  |
| 306456.0400.030.08 | • 4,0   | r 0,3        | 8  | 57  | 6     | 6  | 50,00  |
| 306456.0400.15     | • 4,0   | f 0,02       | 15 | 64  | 6     | 6  | 52,00  |
| 306456.0500.10     | • 5,0   | f 0,02       | 10 | 57  | 6     | 6  | 43,00  |
| 306456.0500.030.10 | • 5,0   | r 0,3        | 10 | 57  | 6     | 6  | 50,00  |
| 306456.0500.18     | • 5,0   | f 0,02       | 18 | 64  | 6     | 6  | 48,00  |
| 306456.0600.16     | • 6,0   | f 0,04       | 16 | 57  | 6     | 6  | 43,00  |
| 306456.0600.030.16 | • 6,0   | r 0,3        | 16 | 57  | 6     | 6  | 50,00  |
| 306456.0600.21     | • 6,0   | f 0,04       | 21 | 64  | 6     | 6  | 51,00  |
| 306456.0800.22     | • 8,0   | f 0,04       | 22 | 70  | 8     | 6  | 46,00  |
| 306456.0800.030.22 | • 8,0   | r 0,3        | 22 | 70  | 8     | 6  | 56,00  |
| 306456.0800.050.22 | • 8,0   | r 0,5        | 22 | 70  | 8     | 6  | 56,00  |
| 306456.0800.28     | • 8,0   | f 0,04       | 28 | 75  | 8     | 6  | 60,00  |
| 306456.1000.25     | • 10,0  | f 0,04       | 25 | 73  | 10    | 6  | 79,00  |
| 306456.1000.030.25 | • 10,0  | r 0,3        | 25 | 73  | 10    | 6  | 94,00  |
| 306456.1000.050.25 | • 10,0  | r 0,5        | 25 | 73  | 10    | 6  | 93,00  |
| 306456.1000.30     | • 10,0  | f 0,04       | 30 | 80  | 10    | 6  | 90,00  |
| 306456.1200.28     | • 12,0  | f 0,05       | 28 | 83  | 12    | 6  | 105,00 |
| 306456.1200.030.28 | • 12,0  | r 0,3        | 28 | 83  | 12    | 6  | 125,00 |
| 306456.1200.050.28 | • 12,0  | r 0,5        | 28 | 83  | 12    | 6  | 124,00 |
| 306456.1200.45     | • 12,0  | f 0,05       | 45 | 100 | 12    | 6  | 133,00 |
| 306456.1400.30     | • 14,0  | f 0,05       | 30 | 83  | 14    | 6  | 135,00 |
| 306456.1400.42     | • 14,0  | f 0,05       | 42 | 100 | 14    | 6  | 176,00 |
| 306456.1600.35     | • 16,0  | f 0,06       | 35 | 92  | 16    | 8  | 183,00 |
| 306456.1600.50     | • 16,0  | f 0,06       | 50 | 110 | 16    | 8  | 235,00 |
| 306456.1600.100.50 | ▲ 16,0  | r 1,0        | 50 | 110 | 16    | 8  | 235,00 |
| 306456.1600.65     | • 16,0  | f 0,06       | 65 | 125 | 16    | 8  | 267,00 |
| 306456.1800.35     | ▲ 18,0  | f 0,06       | 35 | 92  | 18    | 8  | 186,00 |
| 306456.2000.40     | • 20,0  | f 0,07       | 40 | 104 | 20    | 10 | 257,00 |
| 306456.2000.55     | • 20,0  | f 0,07       | 55 | 115 | 20    | 10 | 333,00 |
| 306456.2000.100.55 | ▲ 20,0  | r 1,0        | 55 | 115 | 20    | 10 | 333,00 |
| 306456.2000.70     | • 20,0  | f 0,07       | 70 | 135 | 20    | 10 | 410,00 |

**MICRO GRAIN**  
KARNASCH NORM

**SPEZIAL**  
DIN 6535 Form HA

**PROGRESSIV**  
f 45°

**HSC HHC**

**UFX-24**

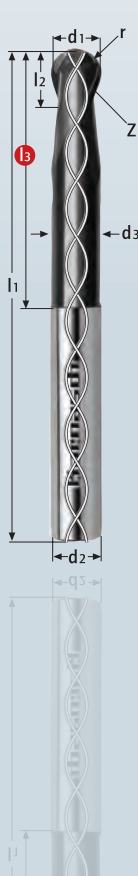
Schnittdaten  
Cutting data



i S. 280

Art. 30.5955 VHM-3D-Radiusfräser, mit Innenkühlung, lang, Rockwell Cutter

- HRC < 65
- STAHL  
steel  
< 1400 N/mm
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm ferritic
- INOX  
stainless steel  
> 900 N/mm martensitic
- INOX  
stainless steel  
< 900 N/mm austenitic
- NI-ALLOYS  
< 900 N/mm



- Solid carbide ball nose end mills, with interior cooling, long
- Fresadora metal duro de radio de 3D, con refrigeración interna, larga, Rockwell Cutter
- Твердосплавная радиусная фреза 3D, с внутренним охлаждением, длинная, Rockwell Cutter

MICRO GRAIN

DIN 6527 K

MF

DIN 6535 Form HAK

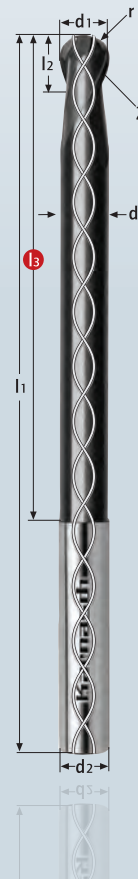
Schnittdaten  
Cutting data



| Art.        | d1/f8  | r ± 0,005 | l3 | d2 h5 | d3   | l1 | l2 | Z | €     |
|-------------|--------|-----------|----|-------|------|----|----|---|-------|
| 305955.0500 | • 5,0  | 2,5       | 21 | 6     | 4,8  | 57 | 5  | 2 | 28,00 |
| 305955.0600 | • 6,0  | 3,0       | 21 | 6     | 5,8  | 57 | 6  | 2 | 28,00 |
| 305955.0800 | • 8,0  | 4,0       | 27 | 8     | 7,8  | 63 | 8  | 2 | 37,00 |
| 305955.1000 | • 10,0 | 5,0       | 32 | 10    | 9,8  | 72 | 10 | 2 | 55,00 |
| 305955.1200 | • 12,0 | 6,0       | 38 | 12    | 11,8 | 83 | 12 | 2 | 90,00 |

Art. 30.5958 VHM-3D-Radiusfräser, mit Innenkühlung, extra lang, Rockwell Cutter

- HRC < 65
- STAHL  
steel  
< 1400 N/mm
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm ferritic
- INOX  
stainless steel  
> 900 N/mm martensitic
- INOX  
stainless steel  
< 900 N/mm austenitic
- NI-ALLOYS  
< 900 N/mm



- Solid carbide ball nose end mills, with interior cooling, extra long
- Fresadora metal duro de radio de 3D, con refrigeración interna, extra larga, Rockwell Cutter
- Твердосплавная радиусная фреза 3D, с внутренним охлаждением, особенно длинная, Rockwell Cutter

MICRO GRAIN

KARNASCH NORM

MF

DIN 6535 Form HAK

Schnittdaten  
Cutting data



| Art.        | d1/f8  | r ± 0,005 | l3  | d2 h5 | d3   | l1  | l2 | Z | €      |
|-------------|--------|-----------|-----|-------|------|-----|----|---|--------|
| 305958.0400 | • 4,0  | 2,0       | 44  | 6     | 3,9  | 80  | 4  | 2 | 39,00  |
| 305958.0500 | • 5,0  | 2,5       | 54  | 6     | 4,8  | 90  | 5  | 2 | 39,00  |
| 305958.0600 | • 6,0  | 3,0       | 64  | 6     | 5,8  | 100 | 6  | 2 | 39,00  |
| 305958.0800 | • 8,0  | 4,0       | 84  | 8     | 7,8  | 120 | 8  | 2 | 54,00  |
| 305958.1000 | • 10,0 | 5,0       | 100 | 10    | 9,8  | 140 | 10 | 2 | 70,00  |
| 305958.1200 | • 12,0 | 6,0       | 105 | 12    | 11,8 | 150 | 12 | 2 | 104,00 |



VHM-3D-Radiusfräser, lang, Rockwell Cutter

Art. **30.6474**

HRC<68

UNI

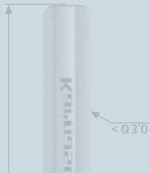
GG/G  
cast iron



- Solid carbide 3D ball nose end mills, long, Rockwell Cutter
- Fresadora metal duro de radio de 3D, larga, Rockwell Cutter
- Твердосплавная радиусная фреза 3D, особенно длинная, Rockwell Cutter



Ø 0,2 - Ø 2,5



| Art.        | Ø d1 f8 | r    | l3  | d2 h5 | d3 | l1 | l2   | Z | €     |
|-------------|---------|------|-----|-------|----|----|------|---|-------|
| 306474.0060 | • 0,6   | 0,30 | 1,3 | 3     | –  | 50 | 0,90 | 2 | 26,50 |
| 306474.0070 | • 0,7   | 0,35 | 2,0 | 3     | –  | 50 | 1,20 | 2 | 26,50 |
| 306474.0080 | • 0,8   | 0,40 | 2,0 | 3     | –  | 50 | 1,20 | 2 | 26,50 |
| 306474.0090 | • 0,9   | 0,45 | 2,5 | 3     | –  | 50 | 1,50 | 2 | 26,50 |
| 306474.0110 | • 1,1   | 0,55 | 2,8 | 3     | –  | 50 | 1,60 | 2 | 22,50 |
| 306474.0120 | • 1,2   | 0,60 | 2,8 | 3     | –  | 50 | 1,60 | 2 | 22,50 |
| 306474.0250 | • 2,5   | 1,25 | 5,0 | 3     | –  | 50 | 2,50 | 2 | 20,50 |

Nachfolgewerkzeug / Replacement article 30.6264 / 30.6476

MICRO GRAIN

DIN 6527 K

MF

DIN 6535  
Form HA

Schnittdaten  
Cutting data



i S. 281

VHM-3D-Radiusfräser, extra lang, Rockwell Cutter

Art. **30.6475**

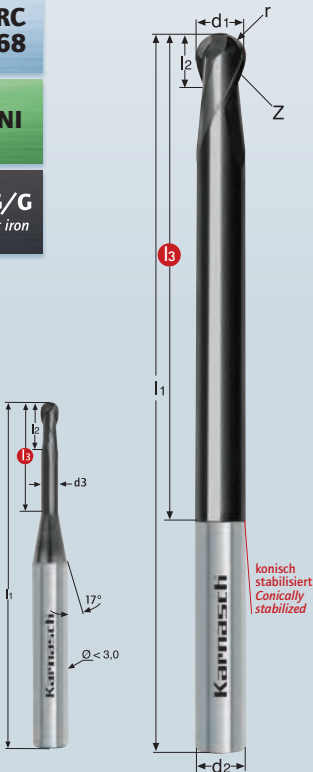
HRC<68

UNI

GG/G  
cast iron



- Solid carbide 3D ball nose end mills, extra long, Rockwell Cutter
- Fresadora metal duro de radio de 3D, extra larga, Rockwell Cutter
- Твердосплавная радиусная фреза 3D, особенно длинная, Rockwell Cutter



Ø 0,6 - Ø 2,0

Ø 3,0 - Ø 12,0

| Art.        | Ø d1 f8 | r    | l3  | d2 h5 | d3   | l1  | l2   | Z | €     |
|-------------|---------|------|-----|-------|------|-----|------|---|-------|
| 306475.0070 | • 0,7   | 0,35 | 8   | 3     | 0,77 | 65  | 1,2  | 2 | 25,50 |
| 306475.0080 | • 0,8   | 0,40 | 8   | 3     | 0,77 | 65  | 1,2  | 2 | 25,50 |
| 306475.0090 | • 0,9   | 0,45 | 12  | 3     | 0,85 | 65  | 1,5  | 2 | 25,50 |
| 306475.0100 | • 1,0   | 0,50 | 12  | 3     | 0,95 | 65  | 1,5  | 2 | 24,50 |
| 306475.0110 | • 1,1   | 0,55 | 12  | 3     | 1,05 | 65  | 1,6  | 2 | 24,50 |
| 306475.0120 | • 1,2   | 0,60 | 12  | 3     | 1,15 | 65  | 1,6  | 2 | 24,50 |
| 306475.0140 | • 1,4   | 0,70 | 15  | 3     | 1,34 | 65  | 1,8  | 2 | 24,50 |
| 306475.0150 | • 1,5   | 0,75 | 15  | 3     | 1,44 | 65  | 1,8  | 2 | 24,50 |
| 306475.0160 | • 1,6   | 0,80 | 15  | 3     | 1,54 | 65  | 1,8  | 2 | 24,50 |
| 306475.0180 | • 1,8   | 0,90 | 20  | 3     | 1,72 | 65  | 2,0  | 2 | 24,50 |
| 306475.0200 | • 2,0   | 1,00 | 20  | 3     | 1,92 | 65  | 2,0  | 2 | 24,50 |
| 306475.0300 | • 3,0   | 1,50 | 30  | 4     | 2,92 | 80  | 3,0  | 2 | 28,00 |
| 306475.0500 | • 5,0   | 2,50 | 54  | 6     | 4,80 | 90  | 5,0  | 2 | 31,00 |
| 306475.0600 | • 6,0   | 3,00 | 64  | 6     | –    | 100 | 6,0  | 2 | 31,00 |
| 306475.1000 | • 10,0  | 5,00 | 100 | 10    | –    | 140 | 10,0 | 2 | 55,50 |

Nachfolgewerkzeug / Replacement article 30.6264 / 30.6477

MICRO GRAIN

KARNASCH NORM

MF

DIN 6535  
Form HA

Schnittdaten  
Cutting data



i S. 281

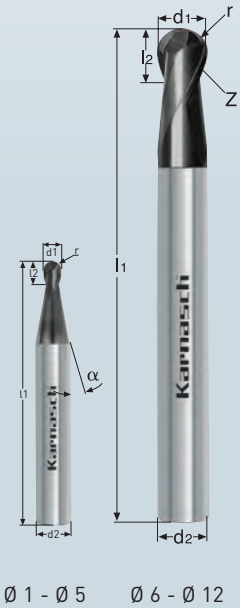
Art. 30.6476 EXPERT VHM-3D- Radiusfräser, kurz, Rockwell Cutter

HRC<70

GJL

TOOLOX 44

kurz-spanend  
short chip



- Solid carbide 3D ball nose end mills, short, Rockwell Cutter
- Fresadora metal duro de radio de 3D, corta, Rockwell Cutter
- Твердосплавная радиусная фреза 3D, короткая, Rockwell Cutter

| Art.           | d1 f8  | r ± 0,005 | d2 h6 | l1 | l2   | α  | Z | €     |
|----------------|--------|-----------|-------|----|------|----|---|-------|
| 306476.0010.03 | • 0,1  | 0,05      | 3     | 38 | 0,2  | 8  | 2 | 73,00 |
| 306476.0020.03 | • 0,2  | 0,10      | 3     | 38 | 0,4  | 8  | 2 | 63,00 |
| 306476.0030.03 | • 0,3  | 0,15      | 3     | 38 | 0,5  | 8  | 2 | 59,00 |
| 306476.0040.03 | • 0,4  | 0,20      | 3     | 38 | 0,5  | 8  | 2 | 40,00 |
| 306476.0050.03 | • 0,5  | 0,25      | 3     | 38 | 0,5  | 8  | 2 | 35,00 |
| 306476.0050.06 | • 0,5  | 0,25      | 6     | 54 | 0,8  | 12 | 2 | 36,00 |
| 306476.0060.03 | • 0,6  | 0,30      | 3     | 38 | 0,8  | 8  | 2 | 37,00 |
| 306476.0080.03 | • 0,8  | 0,40      | 3     | 38 | 0,8  | 8  | 2 | 35,00 |
| 306476.0100.03 | • 1,0  | 0,50      | 3     | 50 | 1,0  | 8  | 2 | 35,00 |
| 306476.0100.06 | • 1,0  | 0,50      | 6     | 54 | 1,5  | 12 | 2 | 36,00 |
| 306476.0120.03 | • 1,2  | 0,60      | 3     | 50 | 1,5  | 8  | 2 | 35,00 |
| 306476.0150.03 | • 1,5  | 0,75      | 3     | 50 | 1,8  | 8  | 2 | 35,00 |
| 306476.0150.06 | • 1,5  | 0,75      | 6     | 54 | 1,8  | 12 | 2 | 36,00 |
| 306476.0160.03 | ▲ 1,6  | 0,80      | 3     | 50 | 2,0  | 8  | 2 | 31,00 |
| 306476.0200.03 | • 2,0  | 1,00      | 3     | 50 | 2,0  | 8  | 2 | 35,00 |
| 306476.0200.06 | • 2,0  | 1,00      | 6     | 54 | 2,0  | 12 | 2 | 36,00 |
| 306476.0300.03 | • 3,0  | 1,50      | 3     | 50 | 3,0  | –  | 2 | 35,00 |
| 306476.0300.06 | • 3,0  | 1,50      | 6     | 54 | 3,0  | 12 | 2 | 36,00 |
| 306476.0400.04 | • 4,0  | 2,00      | 4     | 54 | 4,0  | –  | 2 | 35,00 |
| 306476.0400.06 | • 4,0  | 2,00      | 6     | 54 | 4,0  | 12 | 2 | 36,00 |
| 306476.0500.05 | • 5,0  | 2,50      | 5     | 54 | 5,0  | –  | 2 | 36,00 |
| 306476.0500.06 | • 5,0  | 2,50      | 6     | 54 | 5,0  | 12 | 2 | 36,00 |
| 306476.0600.06 | • 6,0  | 3,00      | 6     | 54 | 6,0  | –  | 2 | 36,00 |
| 306476.0800.08 | • 8,0  | 4,00      | 8     | 60 | 8,0  | –  | 2 | 41,00 |
| 306476.1000.10 | • 10,0 | 5,00      | 10    | 68 | 10,0 | –  | 2 | 50,00 |
| 306476.1200.12 | • 12,0 | 6,00      | 12    | 75 | 12,0 | –  | 2 | 76,00 |

MICRO GRAIN KARNASCH NORM

N/M DIN 6535 Form HA

30°

HHC HSC HPC

UFX-24

Schnittdaten  
Cutting data



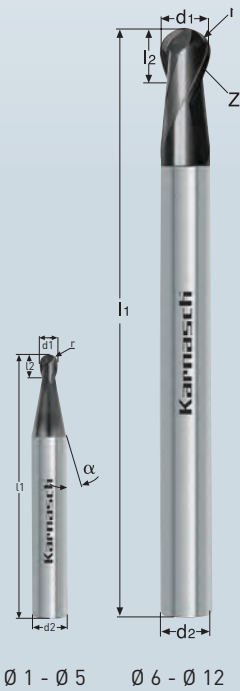
Art. 30.6477 EXPERT VHM-3D- Radiusfräser, lang, Rockwell Cutter

HRC<70

GJL

TOOLOX 44

kurz-spanend  
short chip



- Solid carbide 3D ball nose end mills, long, Rockwell Cutter
- Fresadora metal duro de radio de 3D, larga, Rockwell Cutter
- Твердосплавная радиусная фреза 3D, длинная, Rockwell Cutter

| Art.        | d1 f8  | r ± 0,005 | d2 h6 | l1  | l2   | Z | €      |
|-------------|--------|-----------|-------|-----|------|---|--------|
| 306477.0100 | • 1,0  | 0,50      | 6     | 80  | 1,5  | 2 | 49,00  |
| 306477.0150 | • 1,5  | 0,75      | 6     | 80  | 1,8  | 2 | 49,00  |
| 306477.0200 | • 2,0  | 1,00      | 6     | 80  | 2,0  | 2 | 49,00  |
| 306477.0250 | • 2,5  | 1,25      | 6     | 80  | 2,5  | 2 | 49,00  |
| 306477.0300 | • 3,0  | 1,50      | 6     | 80  | 3,0  | 2 | 49,00  |
| 306477.0400 | • 4,0  | 2,00      | 6     | 80  | 4,0  | 2 | 49,00  |
| 306477.0500 | • 5,0  | 2,50      | 6     | 100 | 5,0  | 2 | 49,00  |
| 306477.0600 | • 6,0  | 3,00      | 6     | 100 | 6,0  | 2 | 49,00  |
| 306477.0800 | • 8,0  | 4,00      | 8     | 100 | 8,0  | 2 | 58,00  |
| 306477.1000 | • 10,0 | 5,00      | 10    | 100 | 10,0 | 2 | 77,00  |
| 306477.1200 | • 12,0 | 6,00      | 12    | 100 | 12,0 | 2 | 102,00 |

MICRO GRAIN KARNASCH NORM

N/M DIN 6535 Form HA

30°

HHC HSC HPC

UFX-24

Schnittdaten  
Cutting data



VHM-3D-Radiusfräser, kurz

EXPERT  
★ ★ ★

Art. **30.6478**

HRC  
< 55

UNI

GG/G  
cast iron



- Solid carbide 3D ball nose end mills, short
- Fresadora metal duro de radio de 3D, corta
- Твердосплавная радиусная фреза 3D, короткая

MICRO  
GRAIN

DIN  
6527 K

N

DIN 6535  
Form HA



HSC  
HHC



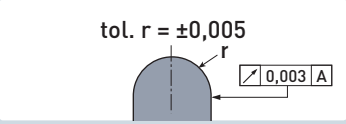
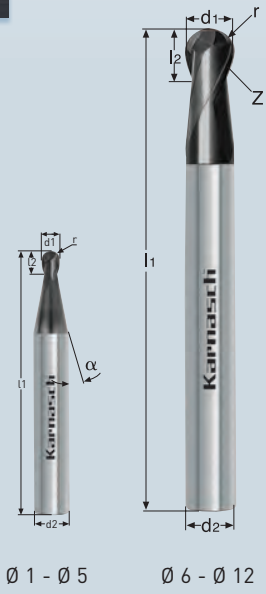
UFX-3



Schnittdaten  
Cutting data



i S. 281



|                      |                     |
|----------------------|---------------------|
| d1* = Ø 0,1 - Ø 2,0  | tol -0,002 / -0,010 |
| d1* = Ø 1,0 - Ø 3,0  | tol -0,006 / -0,020 |
| d1* = Ø 4,0 - Ø 6,0  | tol -0,010 / -0,028 |
| d1* = Ø 8,0 - Ø 10,0 | tol -0,013 / -0,035 |
| d1* = Ø 12           | tol -0,016 / -0,043 |

| Art.        | Ø d1 f8 | r ± 0,005 | d2 h6 | l1 | l2   | Z | €     |
|-------------|---------|-----------|-------|----|------|---|-------|
| 306478.0100 | • 1,0   | 0,5       | 6     | 54 | 1,5  | 2 | 32,00 |
| 306478.0150 | • 1,5   | 0,75      | 6     | 54 | 1,8  | 2 | 32,00 |
| 306478.0200 | • 2,0   | 1,0       | 6     | 54 | 2,0  | 2 | 32,00 |
| 306478.0250 | • 2,5   | 1,25      | 6     | 54 | 2,5  | 2 | 32,00 |
| 306478.0300 | • 3,0   | 1,5       | 6     | 54 | 3,0  | 2 | 32,00 |
| 306478.0400 | • 4,0   | 2,0       | 6     | 54 | 4,0  | 2 | 33,00 |
| 306478.0500 | • 5,0   | 2,5       | 6     | 54 | 5,0  | 2 | 33,00 |
| 306478.0600 | • 6,0   | 3,0       | 6     | 54 | 6,0  | 2 | 33,00 |
| 306478.0800 | • 8,0   | 4,0       | 8     | 58 | 8,0  | 2 | 39,00 |
| 306478.1000 | • 10,0  | 5,0       | 10    | 66 | 10,0 | 2 | 48,00 |
| 306478.1200 | • 12,0  | 6,0       | 12    | 73 | 12,0 | 2 | 73,00 |

VHM-3D-Radiusfräser, extra lang

EXPERT  
★ ★ ★

Art. **30.6479**

HRC  
< 55

UNI

GG/G  
cast iron



- Solid carbide 3D ball nose end mills, extra long
- Fresadora metal duro de radio de 3D, extra larga
- Твердосплавная радиусная фреза 3D, особенно длинная

MICRO  
GRAIN

KARNASCH  
NORM

N

DIN 6535  
Form HA



HSC  
HHC



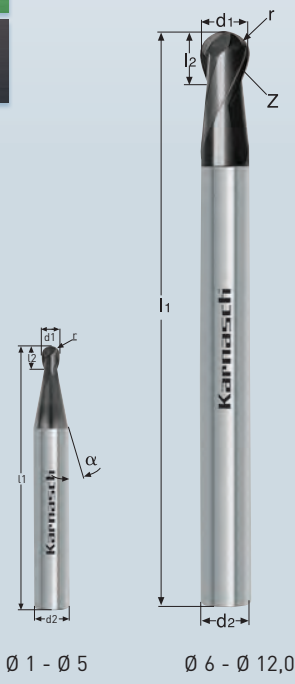
UFX-3



Schnittdaten  
Cutting data



i S. 281



| Art.        | d1 f8  | r ± 0,005 | d2 h6 | l1  | l2   | Z | €     |
|-------------|--------|-----------|-------|-----|------|---|-------|
| 306479.0100 | ▲ 1,0  | 0,5       | 6     | 80  | 1,5  | 2 | 36,50 |
| 306479.0150 | ▲ 1,5  | 0,75      | 6     | 80  | 1,8  | 2 | 36,50 |
| 306479.0200 | ▲ 2,0  | 1,0       | 6     | 80  | 2,0  | 2 | 36,50 |
| 306479.0250 | ▲ 2,5  | 1,25      | 6     | 80  | 2,5  | 2 | 36,50 |
| 306479.0500 | ▲ 5,0  | 2,5       | 6     | 100 | 5,0  | 2 | 36,50 |
| 306479.0600 | • 6,0  | 3,0       | 6     | 100 | 6,0  | 2 | 46,00 |
| 306479.0800 | • 8,0  | 4,0       | 8     | 100 | 8,0  | 2 | 55,00 |
| 306479.1000 | • 10,0 | 5,0       | 10    | 100 | 10,0 | 2 | 74,00 |
| 306479.1200 | • 12,0 | 6,0       | 12    | 100 | 12,0 | 2 | 99,00 |

Nachfolgewerkzeug / Replacement article 30.6264 S. ... / 30.6477 S. ...

Art. **30.6485** Vollhartmetall-3D-Radiusfräser mit Kugelstirn 250°, extra lang

HRC<65

UNI



- Solid carbide ball nose slot drill 250°, extra long
- Fresa metal duro de radio con frente esférico, 250°, extra larga
- Твердосплавная концевая фреза 3D с шаровым торцом 250°, особенно длинная

MICRO GRAIN

KARNASCH NORM

N

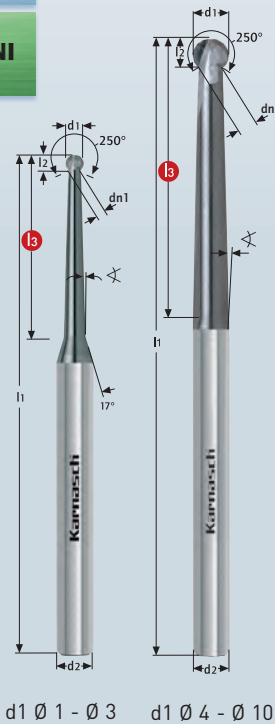
DIN 6535 Form HA

15°

r=250°

HSC HHC

UFX-3



| Art.        | Ø d1 f8 | r   | d2 h5 | dn1  | ∠    | l1  | l2   | l3 | Z | €      |
|-------------|---------|-----|-------|------|------|-----|------|----|---|--------|
| 306485.0100 | • 1     | 0,5 | 6     | 0,77 | 1,5° | 80  | 0,70 | 20 | 2 | 85,00  |
| 306485.0200 | • 2     | 1,0 | 6     | 1,53 | 1,5° | 80  | 1,35 | 20 | 2 | 85,00  |
| 306485.0300 | • 3     | 1,5 | 6     | 2,30 | 1,5° | 80  | 2,00 | 30 | 2 | 83,00  |
| 306485.0400 | • 4     | 2,0 | 6     | 3,06 | 3,0° | 80  | 2,70 | 30 | 2 | 84,00  |
| 306485.0500 | • 5     | 2,5 | 6     | 3,83 | 1,0° | 90  | 3,40 | 40 | 2 | 84,00  |
| 306485.0600 | • 6     | 3,0 | 6     | 4,60 | 1,0° | 100 | 4,05 | 45 | 2 | 84,00  |
| 306485.0800 | • 8     | 4,0 | 8     | 6,13 | 1,0° | 100 | 5,40 | 45 | 2 | 114,00 |
| 306485.1000 | • 10    | 5,0 | 10    | 7,66 | 1,0° | 110 | 6,75 | 55 | 2 | 147,00 |

Schnittdaten  
Cutting data

i S. 284

Karnasch™

PROFESSIONAL TOOLS

NÄHER AN DER PERFEKTION

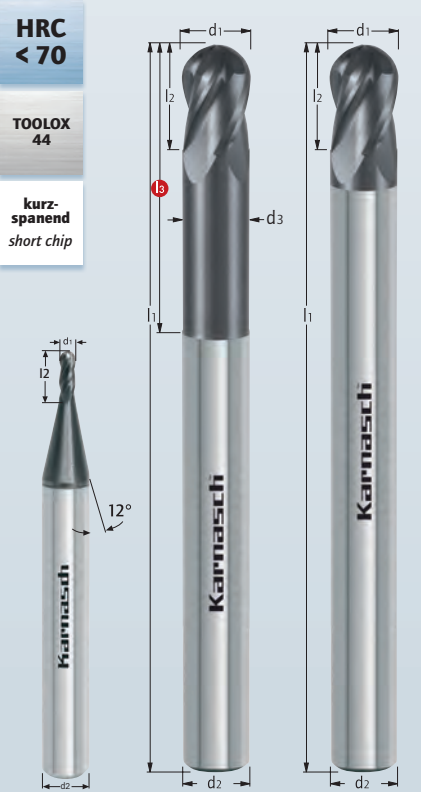
CLOSER TO PERFECTION



Vollhartmetall-3D- Radiusfräser, Rockwell Cutter –  
Der erste wahre Vierschneider mit 4 Stirnschneiden bis zum Zentrum

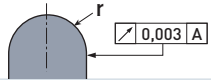
EXPERT  
★ ★ ★

Art. **30.6486**



- Solid carbide 3D ball nose end mills, Rockwell Cutter
- Fresadora metal duro de radio de 3D, Rockwell Cutter
- Твердосплавная радиусная фреза 3D

tol. r = ±0,004



|                      |                     |
|----------------------|---------------------|
| d1* = Ø 0,1 - Ø 2,0  | tol -0,002 / -0,010 |
| d1* = Ø 2,0 - Ø 3,0  | tol -0,006 / -0,020 |
| d1* = Ø 4,0 - Ø 6,0  | tol -0,010 / -0,028 |
| d1* = Ø 8,0 - Ø 10,0 | tol -0,013 / -0,035 |
| d1* = Ø 12           | tol -0,016 / -0,043 |

MICRO  
GRAIN

KARNASCH  
NORM

N/M

DIN 6535  
Form HA



HSC  
HPC

HSC  
HPC



UFX-24



Schnittdaten  
Cutting data



i S. 282-283

d1 Ø 2 - Ø 5    d1 Ø 6 - Ø 12    d1 Ø 6 - Ø 12

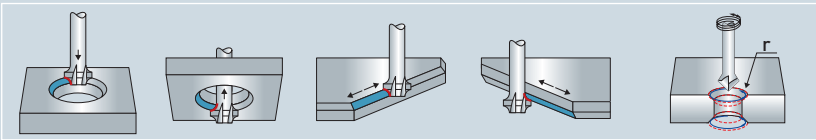
| Art.               | d1 f8  | r ± 0,004 | l3 | d2 h5 | d3   | l1  | l2 | α  | Z | €      |
|--------------------|--------|-----------|----|-------|------|-----|----|----|---|--------|
| 306486.0200.055    | • 2,0  | 1,0       | -  | 6     | -    | 55  | 4  | 12 | 4 | 60,00  |
| 306486.0200.12.055 | • 2,0  | 1,0       | 12 | 6     | 1,8  | 55  | 4  | 12 | 4 | 60,00  |
| 306486.0200.080    | • 2,0  | 1,0       | -  | 6     | -    | 80  | 4  | 12 | 4 | 78,00  |
| 306486.0200.20.080 | • 2,0  | 1,0       | 20 | 6     | 1,8  | 80  | 4  | 12 | 4 | 78,00  |
| 306486.0300.055    | • 3,0  | 1,5       | -  | 6     | -    | 55  | 5  | 12 | 4 | 57,00  |
| 306486.0300.14.055 | • 3,0  | 1,5       | 14 | 6     | 2,8  | 55  | 5  | 12 | 4 | 59,00  |
| 306486.0300.080    | • 3,0  | 1,5       | -  | 6     | -    | 80  | 5  | 12 | 4 | 77,00  |
| 306486.0300.30.080 | • 3,0  | 1,5       | 30 | 6     | 2,8  | 80  | 5  | 12 | 4 | 74,00  |
| 306486.0400.055    | • 4,0  | 2,0       | -  | 6     | -    | 55  | 8  | 12 | 4 | 56,00  |
| 306486.0400.16.055 | • 4,0  | 2,0       | 16 | 6     | 3,8  | 55  | 8  | 12 | 4 | 59,00  |
| 306486.0400.080    | • 4,0  | 2,0       | -  | 6     | -    | 80  | 8  | 12 | 4 | 78,00  |
| 306486.0400.30.080 | • 4,0  | 2,0       | 30 | 6     | 3,8  | 80  | 8  | 12 | 4 | 76,00  |
| 306486.0500.055    | • 5,0  | 2,5       | -  | 6     | -    | 55  | 9  | 12 | 4 | 57,00  |
| 306486.0500.18.055 | • 5,0  | 2,5       | 18 | 6     | 4,8  | 55  | 9  | 12 | 4 | 59,00  |
| 306486.0500.100    | • 5,0  | 2,5       | -  | 6     | -    | 100 | 9  | 12 | 4 | 76,00  |
| 306486.0500.35.100 | • 5,0  | 2,5       | 35 | 6     | 4,8  | 100 | 9  | 12 | 4 | 77,00  |
| 306486.0600.055    | • 6,0  | 3,0       | -  | 6     | -    | 55  | 10 | -  | 4 | 57,00  |
| 306486.0600.21.055 | • 6,0  | 3,0       | 21 | 6     | 5,8  | 55  | 10 | -  | 4 | 59,00  |
| 306486.0600.100    | • 6,0  | 3,0       | -  | 6     | -    | 100 | 10 | -  | 4 | 85,00  |
| 306486.0600.40.100 | • 6,0  | 3,0       | 40 | 6     | 5,8  | 100 | 10 | -  | 4 | 77,00  |
| 306486.0800.060    | • 8,0  | 4,0       | -  | 8     | -    | 60  | 12 | -  | 4 | 70,00  |
| 306486.0800.21.060 | • 8,0  | 4,0       | 21 | 8     | 7,8  | 60  | 12 | -  | 4 | 72,00  |
| 306486.0800.100    | • 8,0  | 4,0       | -  | 8     | -    | 100 | 12 | -  | 4 | 95,00  |
| 306486.0800.50.100 | • 8,0  | 4,0       | 50 | 8     | 7,8  | 100 | 12 | -  | 4 | 92,00  |
| 306486.1000.068    | • 10,0 | 5,0       | -  | 10    | -    | 68  | 14 | -  | 4 | 93,00  |
| 306486.1000.30.068 | • 10,0 | 5,0       | 30 | 10    | 9,8  | 68  | 14 | -  | 4 | 90,00  |
| 306486.1000.100    | • 10,0 | 5,0       | -  | 10    | -    | 100 | 14 | -  | 4 | 120,00 |
| 306486.1000.50.100 | • 10,0 | 5,0       | 50 | 10    | 9,8  | 100 | 14 | -  | 4 | 120,00 |
| 306486.1200.075    | • 12,0 | 6,0       | -  | 12    | -    | 75  | 16 | -  | 4 | 124,00 |
| 306486.1200.35.075 | • 12,0 | 6,0       | 35 | 12    | 11,8 | 75  | 16 | -  | 4 | 119,00 |
| 306486.1200.100    | • 12,0 | 6,0       | -  | 12    | -    | 100 | 16 | -  | 4 | 155,00 |
| 306486.1200.50.100 | • 12,0 | 6,0       | 50 | 12    | 11,8 | 100 | 16 | -  | 4 | 158,00 |

Art. 30.6490 VHM-Vorwärts- und Rückwärts Viertelkreisentgrater

- HRC < 68
- GG/G cast iron
- INOX stainless steel < 900 N/mm ferritic
- INOX stainless steel > 900 N/mm martensitic
- INOX stainless steel < 900 N/mm austenitic
- INCONEL HASTELLOY TITAN
- NE non-ferrous
- kurz-spanend short chip
- lang-spanend long chip



- Solid carbide-forward- and backward quatercircle - profile end mill
- Fresa metal duro de perfil de avance, marcha atrás, cuarto de círculo
- Твердосплавная двунаправленная квадрантная профильная фреза



| Art.            | r ± 0,008 | d1  | d2 h6 | d3 | l1  | l2 | Z | €      |
|-----------------|-----------|-----|-------|----|-----|----|---|--------|
| 306490.0020.075 | • 0,2     | 5,6 | 4     | 6  | 75  | 2  | 4 | 138,00 |
| 306490.0030.075 | • 0,3     | 5,4 | 4     | 6  | 75  | 2  | 4 | 138,00 |
| 306490.0040.075 | • 0,4     | 5,2 | 4     | 6  | 75  | 2  | 4 | 138,00 |
| 306490.0050.075 | • 0,5     | 5,0 | 4     | 6  | 75  | 2  | 4 | 138,00 |
| 306490.0080.100 | • 0,8     | 8,4 | 6     | 10 | 100 | 4  | 4 | 156,00 |
| 306490.0100.100 | • 1,0     | 8,0 | 6     | 10 | 100 | 4  | 4 | 156,00 |
| 306490.0120.100 | • 1,2     | 7,6 | 6     | 10 | 100 | 5  | 4 | 157,00 |
| 306490.0150.100 | • 1,5     | 7,0 | 6     | 10 | 100 | 5  | 4 | 157,00 |

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

0°

HHC HSC HPC

HXC-NANO<sup>3</sup>

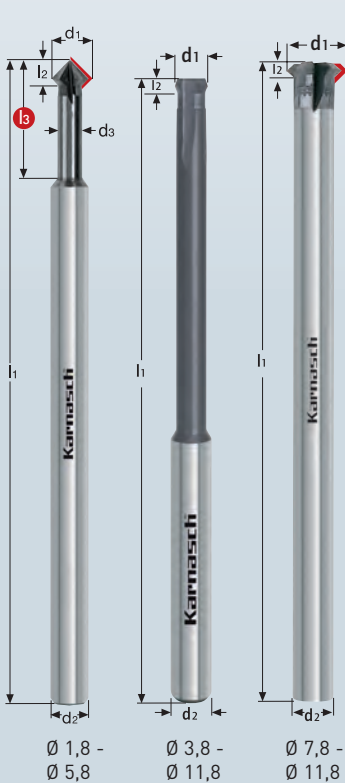
Schnittdaten  
Cutting data



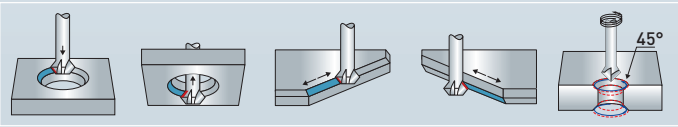
i S. 285

Art. 30.6491 VHM-Vorwärts- und Rückwärtsentgrater, extra lang, 45°

- HRC < 68
- GG/G cast iron
- INOX stainless steel < 900 N/mm ferritic
- INOX stainless steel > 900 N/mm martensitic
- INOX stainless steel < 900 N/mm austenitic
- INCONEL HASTELLOY TITAN
- NE non-ferrous
- kurz-spanend short chip
- lang-spanend long chip



- Forward- and backward burr remover, extra long, 45°
- Broca metal duro de avellanar de avance y marcha atrás, extra larga, 45°
- Твердосплавный инструмент для удаления грата, особенно длинный, 45°



| Art.               | d1 + 0,1 | l3 | d2 h6 | d3 +/- 0,05 | l1  | l2 + 0,5 | Z | €      |
|--------------------|----------|----|-------|-------------|-----|----------|---|--------|
| 306491.0180        | • 1,8    | 8  | 6     | 1,4         | 80  | 1,4      | 4 | 61,00  |
| 306491.0280        | • 2,8    | 10 | 6     | 2,2         | 100 | 2,0      | 4 | 64,00  |
| 306491.0380        | • 3,8    | 13 | 6     | 2,9         | 100 | 2,7      | 4 | 66,00  |
| NEU 306491.0380.15 | • 3,8    | 15 | 6     | 2,3         | 54  | 1,4      | 4 | 54,00  |
| 306491.0480        | • 4,8    | 15 | 6     | 3,9         | 100 | 3,0      | 4 | 64,00  |
| NEU 306491.0480.16 | • 4,8    | 16 | 6     | 2,8         | 54  | 1,9      | 4 | 54,00  |
| 306491.0580        | • 5,8    | 15 | 6     | 3,9         | 100 | 4,0      | 4 | 62,00  |
| NEU 306491.0580.18 | • 5,8    | 18 | 6     | 3,3         | 57  | 2,4      | 4 | 54,00  |
| NEU 306491.0580.28 | • 5,8    | 28 | 6     | 3,3         | 67  | 2,4      | 4 | 57,00  |
| NEU 306491.0780.27 | • 7,8    | 27 | 8     | 5,3         | 65  | 2,4      | 4 | 62,00  |
| NEU 306491.0780.42 | • 7,8    | 42 | 8     | 5,3         | 80  | 2,4      | 4 | 70,00  |
| 306491.0780        | • 7,8    | -  | 6     | -           | 100 | 2,0      | 4 | 98,00  |
| NEU 306491.0980.38 | • 9,8    | 38 | 10    | 7,3         | 80  | 2,4      | 6 | 84,00  |
| NEU 306491.0980.53 | • 9,8    | 53 | 10    | 7,3         | 95  | 2,4      | 6 | 89,00  |
| 306491.0980        | • 9,8    | -  | 6     | -           | 100 | 4,0      | 6 | 113,00 |
| NEU 306491.1180.48 | • 11,8   | 48 | 12    | 9,3         | 95  | 2,4      | 6 | 104,00 |
| NEU 306491.1180.63 | • 11,8   | 63 | 12    | 9,3         | 110 | 2,4      | 6 | 113,00 |
| 306491.1180        | • 11,8   | -  | 6     | -           | 100 | 6,0      | 6 | 136,00 |

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

15°

45°

HHC HSC HPC

UFX-3

Schnittdaten  
Cutting data

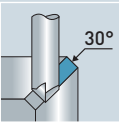


i S. 285

VHM-Entgrater, lang, 60°

Art. **30.6492**

- HRC < 68
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- INCONEL  
HASTELLOY  
TITAN
- kurz-  
spanend  
short chip



- Solid carbide deburr, long, 60°
- Broca metal duro de avellanar, larga, 60°
- Твердосплавный инструмент для удаления грата, длинный, 60°

MICRO GRAINKARNASCH NORM

N

DIN 6535  
Form HA

HHC  
HSC  
HPC

UFX-3

Schnittdaten  
Cutting data



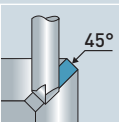
i S. 285

| Art.        | Ø d1 | l1 | d2 h6 | Z | €     |
|-------------|------|----|-------|---|-------|
| 306492.0400 | • 4  | 54 | 4     | 4 | 23,00 |
| 306492.0600 | • 6  | 57 | 6     | 4 | 28,00 |
| 306492.0800 | • 8  | 63 | 8     | 5 | 35,00 |
| 306492.1000 | • 10 | 72 | 10    | 6 | 47,00 |
| 306492.1200 | • 12 | 83 | 12    | 6 | 74,00 |

VHM-Entgrater, lang, 90°

Art. **30.6493**

- HRC < 68
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- INCONEL  
HASTELLOY  
TITAN
- kurz-  
spanend  
short chip
- lang-  
spanend  
long chip



- Solid carbide deburr, long, 90°
- Broca metal duro de avellanar, larga, 90°
- Твердосплавный инструмент для удаления грата, длинный, 90°

MICRO GRAINDIN 6527 L

N

DIN 6535  
Form HA

HHC  
HSC  
HPC

UFX-3

Schnittdaten  
Cutting data



i S. 285

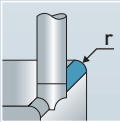
| Art.        | Ø d1 | l1 | d2 h6 | Z | €     |
|-------------|------|----|-------|---|-------|
| 306493.0400 | • 4  | 54 | 4     | 4 | 23,00 |
| 306493.0600 | • 6  | 57 | 6     | 4 | 28,00 |
| 306493.0800 | • 8  | 63 | 8     | 5 | 35,00 |
| 306493.1000 | • 10 | 72 | 10    | 6 | 47,00 |
| 306493.1200 | • 12 | 83 | 12    | 6 | 74,00 |

Art. 30.6494 Viertelkreis- Profilfräser, konkav, lang

- HRC<68
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- INCONEL  
HASTELLOY  
TITAN
- NE  
non-ferrous
- kurz-  
spanend  
short chip
- lang-  
spanend  
long chip



- Corner rounding cutters, concave
- Fresa metal duro de perfil de cuarto de círculo, cóncavo, larga
- Квадрантная профильная фреза, длинная



| Art.        | Radius r ± 0,01 | d1 h11 | d2 h6 | l1 | Z | €      |
|-------------|-----------------|--------|-------|----|---|--------|
| 306494.0020 | • 0,2           | 3,6    | 4     | 50 | 4 | 70,00  |
| 306494.0030 | • 0,3           | 3,4    | 4     | 50 | 4 | 70,00  |
| 306494.0040 | • 0,4           | 3,2    | 4     | 50 | 4 | 70,00  |
| 306494.0050 | • 0,5           | 7      | 8     | 70 | 4 | 86,00  |
| 306494.0060 | • 0,6           | 6,8    | 8     | 70 | 4 | 86,00  |
| 306494.0080 | • 0,8           | 6,4    | 8     | 70 | 4 | 86,00  |
| 306494.0100 | • 1,0           | 6      | 8     | 70 | 4 | 85,00  |
| 306494.0150 | • 1,5           | 7      | 10    | 75 | 4 | 99,00  |
| 306494.0200 | • 2,0           | 6      | 10    | 75 | 4 | 99,00  |
| 306494.0250 | • 2,5           | 7      | 12    | 75 | 4 | 112,00 |
| 306494.0300 | • 3,0           | 6      | 12    | 75 | 4 | 111,00 |
| 306494.0350 | • 3,5           | 9      | 16    | 80 | 4 | 144,00 |
| 306494.0400 | • 4,0           | 8      | 16    | 80 | 4 | 143,00 |
| 306494.0450 | • 4,5           | 7      | 16    | 80 | 4 | 143,00 |
| 306494.0500 | • 5,0           | 10     | 20    | 80 | 4 | 200,00 |
| 306494.0600 | • 6,0           | 8      | 20    | 80 | 4 | 200,00 |

Andere Radien kurzfristig lieferbar! / Other radiuses can be delivered short term!

MICRO GRAINKARNASCH NORM

N

DIN 6535  
Form HA

0°

HHC  
HSC  
HPC

UFX-3

Schnittdaten  
Cutting data



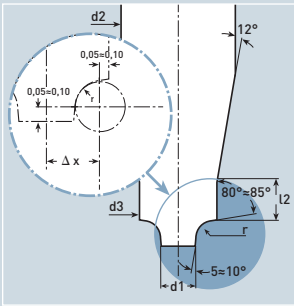
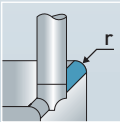
i S. 285

Art. 30.6495 Micro-VHM-Viertelkreis-Profilfräser, konkav

- HRC<68
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- INCONEL  
HASTELLOY  
TITAN
- NE  
non-ferrous
- kurz-  
spanend  
short chip
- lang-  
spanend  
long chip



- Miniature Micro Grain rounding cutter, concave
- Microfresa metal duro de perfil y círculo de cuarto, cóncavo
- Твердосплавная квадрантная профильная микро-фреза, вогнутая



| Art.        | r ± 0,008 | d1±0,008 | d2 h6 | d3   | l1 | l2    | Z | €      |
|-------------|-----------|----------|-------|------|----|-------|---|--------|
| 306495.0010 | • 0,10    | 0,5      | 3     | 0,8  | 50 | 2,5   | 2 | 53,00  |
| 306495.0020 | • 0,20    | 0,5      | 3     | 1,0  | 50 | 2,5   | 2 | 53,00  |
| 306495.0030 | • 0,30    | 0,5      | 3     | 1,2  | 50 | 2,5   | 2 | 51,00  |
| 306495.0040 | • 0,40    | 0,5      | 3     | 1,4  | 50 | 2,5   | 2 | 51,00  |
| 306495.0050 | • 0,50    | 0,5      | 3     | 1,6  | 50 | 2,5   | 2 | 51,00  |
| 306495.0060 | • 0,60    | 0,5      | 3     | 1,8  | 50 | 3,0   | 2 | 51,00  |
| 306495.0080 | • 0,80    | 0,8      | 3     | 2,5  | 50 | 4,0   | 2 | 51,00  |
| 306495.0100 | • 1,00    | 0,8      | 3     | 2,9  | 50 | 4,0   | 2 | 51,00  |
| 306495.0150 | • 1,50    | 1,5      | 5     | 4,6  | 50 | 6,0   | 2 | 63,00  |
| 306495.0200 | • 2,00    | 1,5      | 6     | 5,6  | 50 | 8,0   | 2 | 63,00  |
| 306495.0250 | • 2,50    | 1,5      | 8     | 6,5  | 50 | 10,00 | 2 | 79,00  |
| 306495.0300 | • 3,00    | 1,5      | 8     | 7,5  | 50 | 10,00 | 2 | 79,00  |
| 306495.0400 | • 4,00    | 1,9      | 10    | 10,0 | 55 | -     | 2 | 113,00 |
| 306495.0500 | • 5,00    | 1,9      | 12    | 12,0 | 63 | -     | 2 | 126,00 |

Andere Radien kurzfristig lieferbar! / Other radiuses can be delivered short term!

MICRO GRAINKARNASCH NORM

MF

DIN 6535  
Form HA

0°

HHC  
HSC  
HPC

OXS-V2

Schnittdaten  
Cutting data



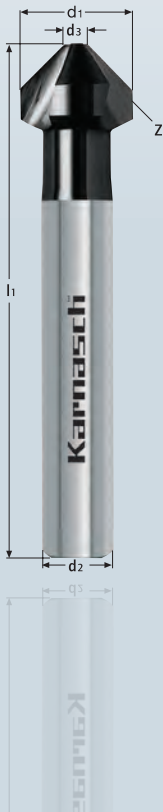
i S. 285



Kegelsenker 90°

Art. **30.6497**

- HRC < 68
- GG/G  
cast iron
- INOX  
stainless steel  
< 900 N/mm  
ferritic
- INOX  
stainless steel  
> 900 N/mm  
martensitic
- INOX  
stainless steel  
< 900 N/mm  
austenitic
- INCONEL  
HASTELLOY  
TITAN
- NE  
non-ferrous
- kurz-  
spanend  
short chip
- lang-  
spanend  
long chip



- Countersinker 90°
- Avellanador cónico de metal duro 90°
- Коническая зенковка из твердого металла, 90°

MICRO GRAIN

DIN 335 C

N

DIN 6535  
Form HA

HHC  
HSC  
HPC

UFX-2

Schnittdaten  
Cutting data



i S. 285

| Art.        | Ø d1 h7 | d2 h9 | d3  | l1 | Z | €      |
|-------------|---------|-------|-----|----|---|--------|
| 306497.0630 | • 6,3   | 5     | 1,5 | 45 | 3 | 67,00  |
| 306497.0830 | • 8,3   | 6     | 2,0 | 50 | 3 | 71,00  |
| 306497.1040 | • 10,4  | 6     | 2,5 | 50 | 3 | 75,00  |
| 306497.1240 | • 12,4  | 8     | 2,8 | 57 | 3 | 80,00  |
| 306497.1650 | • 16,5  | 10    | 3,2 | 60 | 3 | 106,00 |
| 306497.2050 | • 20,5  | 10    | 3,5 | 64 | 3 | 120,00 |
| 306497.2500 | • 25,0  | 10    | 3,8 | 68 | 3 | 152,00 |
| 306497.3100 | • 31,0  | 12    | 4,2 | 72 | 3 | 196,00 |

Ø6,3 – Ø10,4. Komplet aus VHM / Completely solid carbide  
Ø12,4 – Ø31,0 Mit aufgelötetem Stahlschaft / With a soldered steel shank

Qualitätsmerkmale diamantbeschichteter VHM-Fräser – **Konsequent** "Nur das Beste" bei einer 100% Kontrolle.  
Quality characteristics of diamond coated Karnasch solid carbide end mills – **Consistently** "Only the best" with a 100% control.



Höchstmögliche Standzeiten und Präzision werden nur erzielt wenn das verwendete Hartmetall, die Beschichtung sowie die Werkzeuggeometrien bis ins kleinste Detail aufeinander abgestimmt sind.

Diamantbeschichtete Karnasch-Fräser werden mit speziellen Geometrien für die Graphitbearbeitung sowie mit einer optimierten Nano-Kristallinen Diamantschicht geliefert. Zudem erfolgt eine 100% Kontrolle der Fräser

The highest possible service life and precision are only scoring, if the used hard metal, the coating and the tool geometries are designed to the last detail.

Diamond coated Karnasch-end mills are supplied with special geometries for machining graphite, as well as an optimized nano-crystalline diamond coating. In addition to that, all the tools will be checked by 100%

Karnasch-Hochleistungsfräser werden zur besseren Unterscheidung der jeweiligen Fräser und deren Anwendung in farblich unterschiedlichen Schutzhülsen verpackt und etikettiert. Diamantbeschichtete Fräser werden mit grauen Etiketten und grauen Verpackungen versendet.

For a better distinguish of our end mills and their application, are the Karnasch high performance end mills, packed and labelled in different coloured protective packaging tubes. Diamond coated end mills are labelled in grey with protective packaging tubes in grey.

Um ein Höchstmaß an Präzision zu gewährleisten, wird jedes µ gesucht. Aus diesem Grund werden Karnasch-Micro-Präzisionswerkzeuge auf dem Schaftboden beschriftet. Dadurch erreichen wir eine bessere Rundlaufgüte. Gleichzeitig erhöht sich die Standzeit bei messbar glatteren Oberflächen.

In order to guarantee the maximum level of precision, every micron will be searched. That's why Karnasch-Micro-Precision end mills are marked on the shank bottom side. Thereby we achieve a better concentricity. At the same time, the lifetime increases with measurable smoother surfaces.

- Rundlauftoleranzen von max. 3 µ  
Concentricity tolerance of max. 3 µ
- Durchmessertoleranzen von 0/-0,010 mm  
Diameter tolerance of 0/-0,010mm
- Radiuskontur von max. ± 0,003 mm  
Radius contour accuracy of max. ± 0,003mm

Dadurch lässt sich die Oberflächengüte sowie die Standzeit erheblich steigern.

This allows to increase considerably the surface finish and the tool life.

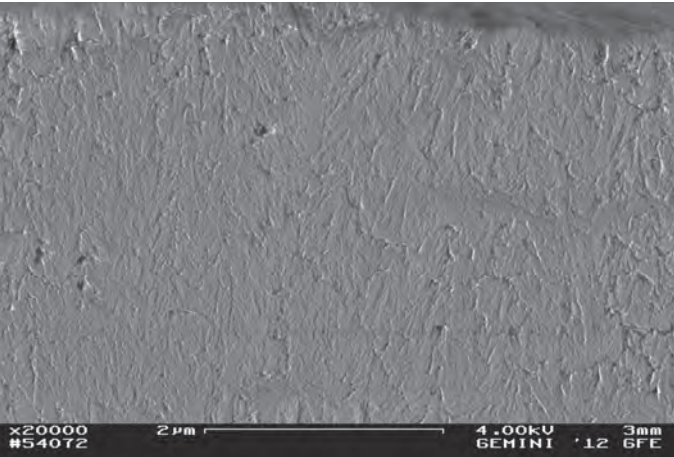
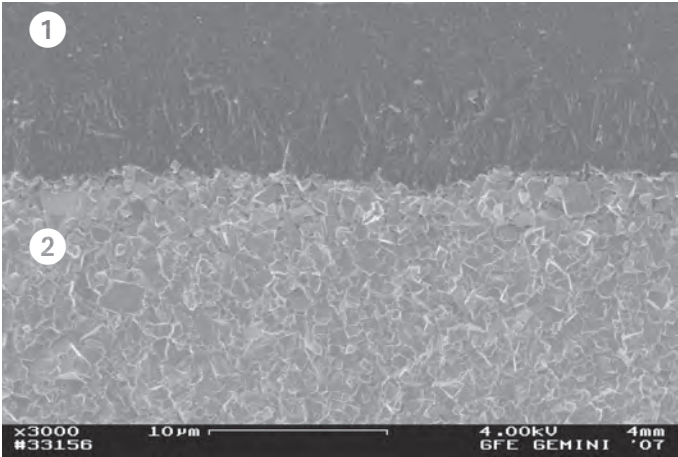
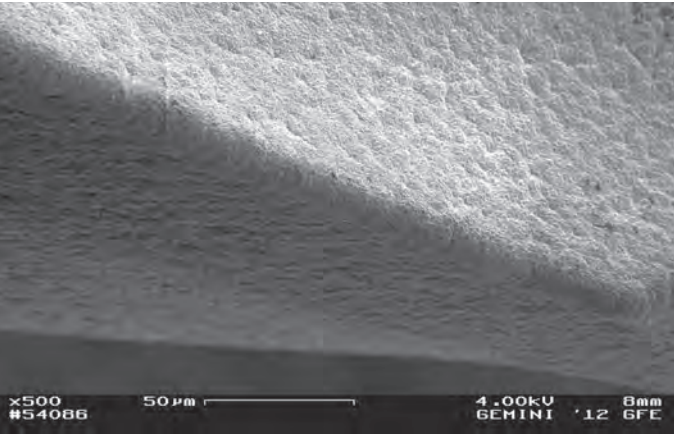


BILD DER DIAMANTSCHICHT  
Kompaktes Gefüge der nano-kristallinen Diamantschicht

PICTURE OF THE DIAMOND COATING  
Compact structure of nano-crystalline diamond coating.

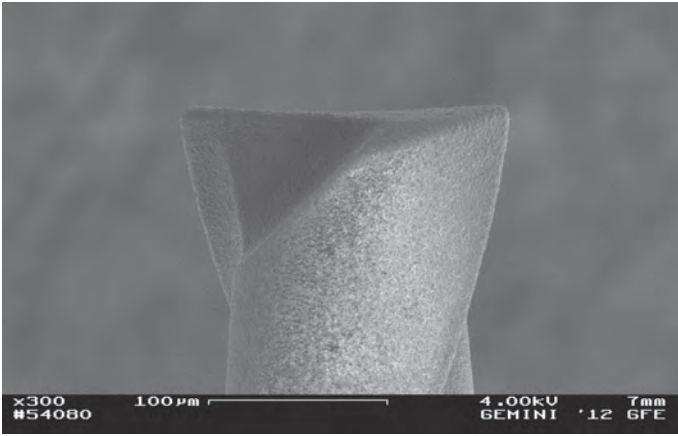


- 1 DIAMANTSCHICHT  
DIAMOND COATING
- 2 VHM-TRÄGERMATERIAL  
SOLID CARBIDE – SUBSTRATE



GLEICHMÄSSIGE BESCHICHTUNG AUCH AN DER SCHNEIDKANTE

CONSTAND COATING ALSO ON THE CUTTING EDGE



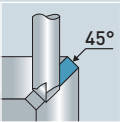
KONTURGETREUE DIAMANTBESCHICHTUNG AUCH BEI FRÄSERDURCHMESSER 0,2 MM

ACCURATE CONTOUR DIAMOND COATING EVEN WITH END MILL DIAMETER 0,2 MM.

Diamantbeschichteter VHM-Entgrater, lang, 90°

Art. **30.6539**

- GRAPHIT  
graphite
- GFK-CFK  
GFK-CFK
- PA66  
GF30
- PVDF  
GF30
- PEEK  
GF30
- PEEK  
CF30
- POM  
GF25
- PTFE  
CF25
- zirkon  
oxid



- Diamond coated solid carbide deburr, long, 90°
- Broca metal duro de avellanar recubierto de diamante, larga, 90°
- Твердосплавный инструмент для удаления грата, длинный, 90°

| Art.        | Ø d1 | l1 | d2 h6 | Z | €      |
|-------------|------|----|-------|---|--------|
| 306539.0400 | • 4  | 54 | 4     | 4 | 53,00  |
| 306539.0600 | • 6  | 57 | 6     | 4 | 71,00  |
| 306539.0800 | • 8  | 63 | 8     | 5 | 93,00  |
| 306539.1000 | • 10 | 72 | 10    | 6 | 114,00 |
| 306539.1200 | • 12 | 83 | 12    | 6 | 150,00 |

| Werkstoffgruppe / Material group | Vc<br>m/min | Ø 4-8<br>f mm/U | Ø 10-12<br>f mm/U |
|----------------------------------|-------------|-----------------|-------------------|
| 14,1 Feine Graphitkörnung        | 200         | 0,015 - 0,08    | 0,08-0,095        |
| 14,2 Mittlere Graphitkörnung     | 300         | 0,015 - 0,07    | 0,07-0,085        |
| 14,3 Grobe Graphitkörnung        | 400         | 0,01 - 0,06     | 0,06-0,075        |

**MICRO GRAIN**  
KARNASCH NORM

**N**  
DIN 6535 Form HA

0°

45°

90°

120°

150°

180°

210°

240°

270°

300°

330°

360°

Schnittdaten  
Cutting data

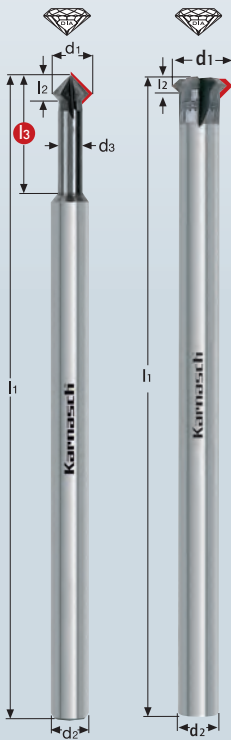


i s. 77

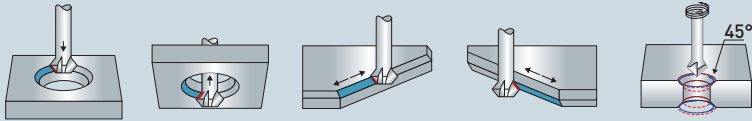
Diamantbeschichteter VHM-Vorwärts- und Rückwärtsentgrater, extra lang, 45°

Art. **30.6540**

- GRAPHIT  
graphite
- GFK-CFK  
GFK-CFK
- PA66  
GF30
- PVDF  
GF30
- PEEK  
GF30
- PEEK  
CF30
- POM  
GF25
- PTFE  
CF25
- zirkon  
oxid



- Diamond coated forward- and backward burr remover, extra long, 45°
- Broca metal duro de avellanar de avance y marcha atrás, recubierto de diamante extra larga, 45°
- Твердосплавный инструмент для удаления грата, особенно длинный, 45°



| Art.        | d1 + 0,1 | l3 | d2 h6 | d3  | l1  | l2 + 0,5 | Z | €      |
|-------------|----------|----|-------|-----|-----|----------|---|--------|
| 306540.0180 | • 1,8    | 8  | 6     | 1,4 | 80  | 1,4      | 4 | 112,00 |
| 306540.0280 | • 2,8    | 10 | 6     | 2,2 | 100 | 2,0      | 4 | 112,00 |
| 306540.0380 | • 3,8    | 13 | 6     | 2,9 | 100 | 2,7      | 4 | 112,00 |
| 306540.0480 | • 4,8    | 15 | 6     | 3,9 | 100 | 3,0      | 4 | 121,00 |
| 306540.0580 | • 5,8    | 15 | 6     | 3,9 | 100 | 4,0      | 4 | 119,00 |
| 306540.0780 | • 7,8    | -  | 6     | -   | 100 | 2,0      | 4 | 158,00 |
| 306540.0980 | • 9,8    | -  | 6     | -   | 100 | 4,0      | 6 | 203,00 |
| 306540.1180 | • 11,8   | -  | 6     | -   | 100 | 6,0      | 6 | 238,00 |

| Werkstoffgruppe / Material group | Vc<br>m/min | Ø 1,8-9,8<br>f mm/U | Ø 11,8<br>f mm/U |
|----------------------------------|-------------|---------------------|------------------|
| 14,1 Feine Graphitkörnung        | 400         | 0,015 - 0,08        | 0,095            |
| 14,2 Mittlere Graphitkörnung     | 600         | 0,015 - 0,07        | 0,085            |
| 14,3 Grobe Graphitkörnung        | 800         | 0,01 - 0,06         | 0,075            |

**MICRO GRAIN**  
KARNASCH NORM

**N**  
DIN 6535 Form HA

15°

45°

90°

120°

150°

180°

210°

240°

270°

300°

330°

360°

Schnittdaten  
Cutting data



i s. 77



Art. 29.0120

Diamantbeschichtete VHM-Hochleistungsbohrer für CFK/GFK – multidirektional mit 90° Spitzwinkel vermeidet Delamination

GRAPHIT  
graphite

COMPO-  
SITES

CFK

GFK

PEEK  
CF30

PEEK  
GF30

GF  
GF25

PVDF  
GF25

zirkon  
oxid



Diamond-coated solid-carbide drill for CFK/GFK material/multidirectional, with 90° tip angle, Prevents delamination



Broca de metal duro y macizo recubierta de diamante para CFK/GFK Material/ multidireccional, con ángulo de punta de 90°, Evita la deslaminación



Твердосплавные сверла с алмазным покрытием для углеродного волокна/ стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.

MICRO  
GRAIN

KARNASCH  
NORM

MF

DIN 6535  
Form HA



Composites



DCC  
0318

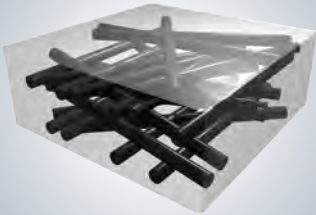


Schnittdaten  
Cutting data

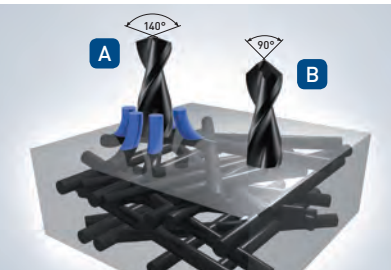


i S. 78

#### MULTIDIREKTIONAL



Chaotische Ausrichtung des Faserverlaufs  
Chaotic alignment of fibre progress  
Orientación caótica de la distribución de fibras  
Хаотическое направление волокна



**A** Delamination und  
Gradbildung mit  
konventionellen  
Bohrern.

**B** Sauberer  
Bohrungsaustritt  
durch optimierte  
Führungsflase des  
Bohrwerkzeuges.

|     | Art.             | d1 m7   | l3  | l2  | l1 | d2 h6 | €      |
|-----|------------------|---------|-----|-----|----|-------|--------|
| NEU | 290120.0050.0045 | • 0,5   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0060.0045 | • 0,6   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0070.0045 | • 0,7   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0080.0045 | • 0,8   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0090.0045 | • 0,9   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0100.005  | • 1,0   | 5   | 8   | 55 | 3     | 59,00  |
| NEU | 290120.0110.008  | • 1,1   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0120.008  | • 1,2   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0130.008  | • 1,3   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0140.008  | • 1,4   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0150.008  | • 1,5   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0160.011  | • 1,6   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0170.011  | • 1,7   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0180.011  | • 1,8   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0190.011  | • 1,9   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0200.011  | • 2,0   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0210.014  | • 2,1   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0220.014  | • 2,2   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0230.014  | • 2,3   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0240.014  | • 2,4   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0250.014  | • 2,5   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0260.016  | • 2,6   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0270.016  | • 2,7   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0280.016  | • 2,8   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0290.016  | • 2,9   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0300.023  | • 3,0   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0310.023  | • 3,1   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.03175.023 | • 3,175 | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0320.023  | • 3,2   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0330.023  | • 3,3   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0340.023  | • 3,4   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0350.023  | • 3,5   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0360.023  | • 3,6   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0370.023  | • 3,7   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0380.023  | • 3,8   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0390.023  | • 3,9   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0400.029  | • 4,0   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0410.029  | • 4,1   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0420.029  | • 4,2   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0430.029  | • 4,3   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0440.029  | • 4,4   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0450.029  | • 4,5   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0460.029  | • 4,6   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0470.029  | • 4,7   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.04763.029 | • 4,763 | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0480.029  | • 4,8   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0490.029  | • 4,9   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0500.035  | • 5,0   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0510.035  | • 5,1   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0520.035  | • 5,2   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0530.035  | • 5,3   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0540.035  | • 5,4   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0550.035  | • 5,5   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0560.035  | • 5,6   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0570.035  | • 5,7   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0580.035  | • 5,8   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0590.035  | • 5,9   | 35  | 44  | 82 | 6     | 116,00 |

#### Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |



|     | Art.             | d1 m7    | l3 | l2 | l1  | d2 h6 | €      |
|-----|------------------|----------|----|----|-----|-------|--------|
|     | 290120.0600.035  | • 6,0    | 35 | 44 | 82  | 6     | 116,00 |
| NEU | 290120.0610.043  | • 6,1    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0620.043  | • 6,2    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0630.043  | • 6,3    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0635.043  | • 6,350  | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0640.043  | • 6,4    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0650.043  | • 6,5    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0660.043  | • 6,6    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0670.043  | • 6,7    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0680.043  | • 6,8    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0690.043  | • 6,9    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0700.043  | • 7,0    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0710.043  | • 7,1    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0720.043  | • 7,2    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0730.043  | • 7,3    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0740.043  | • 7,4    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0750.043  | • 7,5    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0760.043  | • 7,6    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0770.043  | • 7,7    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0780.043  | • 7,8    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0790.043  | • 7,9    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.07938.043 | • 7,938  | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.09525.049 | • 9,525  | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.11111.056 | • 11,111 | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 225,00 |

Art. 30.6544 PROFESSIONAL

Diamantbeschichtete Micro Schaftfräser mit Eckenradius < 25 x D Schnitttiefe

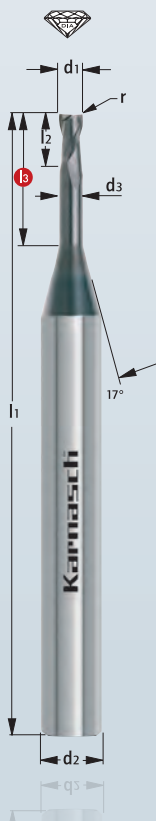
GRAPHIT  
graphite

ZIRKO-  
NIUM

Zirkonoxid  
Zr O<sub>2</sub>  
gepresst

Zirkonoxid  
Zr O<sub>2</sub>  
gehippt

GFK-CFK  
GFK-CFK



- Diamond coated solid carbide end mills with corner radius, < 25 x D using length
- Microfresa metal duro de mango con radio angular recubiertas de diamante < 25 xD profundidad de corte, HSC
- Концевая микро-фреза с угловым радиусом, глубина обработки < 25 xD, HSC

NEU / NEW

tol. r = -0,004

d1\* = Ø 0,2 - Ø 12    tol -0 / -0,010

MICRO GRAIN

KARNASCH NORM

ITX

DIN 6535 Form HA

30°

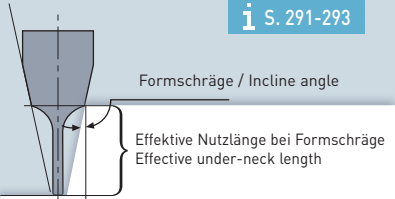
HSC High-Speed-Cutting

DCC 0318

Air

Schnittdaten  
Cutting data

i S. 291-293



| Art.               | d1*   | r - 0,004 | l3 | d2/h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|-------|-----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306544.0020.005.01 | • 0,2 | 0,05      | 1  | 3     | 0,18 | 55 | 0,3 | 51,00 | 1,70  | 1,92  | 2,34  | 2,73  |
| 306544.0030.005.01 | • 0,3 | 0,05      | 1  | 3     | 0,27 | 55 | 0,4 | 51,00 | 1,70  | 1,92  | 2,34  | 2,73  |
| 306544.0030.005.02 | • 0,3 | 0,05      | 2  | 3     | 0,27 | 55 | 0,4 | 51,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306544.0030.005.03 | • 0,3 | 0,05      | 3  | 3     | 0,27 | 55 | 0,4 | 51,00 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306544.0040.005.02 | ▲ 0,4 | 0,05      | 2  | 3     | 0,36 | 55 | 0,5 | 51,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306544.0040.005.04 | • 0,4 | 0,05      | 4  | 3     | 0,36 | 55 | 0,5 | 51,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306544.0040.005.06 | • 0,4 | 0,05      | 6  | 3     | 0,36 | 55 | 0,5 | 51,00 | 7,20  | 7,69  | 8,44  | 9,07  |
| 306544.0040.005.08 | • 0,4 | 0,05      | 8  | 3     | 0,36 | 55 | 0,5 | 51,00 | 9,35  | 9,90  | 10,74 | 11,43 |
| 306544.0050.005.02 | ▲ 0,5 | 0,05      | 2  | 3     | 0,45 | 55 | 0,6 | 49,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306544.0050.005.05 | • 0,5 | 0,05      | 5  | 3     | 0,45 | 55 | 0,6 | 49,00 | 6,12  | 6,57  | 7,28  | 7,87  |
| 306544.0050.005.08 | • 0,5 | 0,05      | 8  | 3     | 0,45 | 55 | 0,6 | 49,00 | -     | -     | -     | -     |
| 306544.0050.005.10 | • 0,5 | 0,05      | 10 | 3     | 0,45 | 55 | 0,6 | 49,00 | 11,48 | 12,09 | 13,01 | 13,74 |
| 306544.0060.006.03 | • 0,6 | 0,06      | 3  | 3     | 0,55 | 55 | 0,8 | 52,00 | 3,94  | 4,29  | 4,88  | 5,39  |
| 306544.0060.006.04 | ▲ 0,6 | 0,06      | 4  | 3     | 0,55 | 55 | 0,8 | 52,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306544.0060.006.06 | • 0,6 | 0,06      | 6  | 3     | 0,55 | 55 | 0,8 | 52,00 | 7,20  | 7,69  | 8,44  | 9,07  |
| 306544.0060.006.08 | ▲ 0,6 | 0,06      | 8  | 3     | 0,55 | 55 | 0,8 | 52,00 | 9,35  | 9,90  | 10,74 | 11,43 |
| 306544.0060.006.09 | ▲ 0,6 | 0,06      | 9  | 3     | 0,55 | 55 | 0,8 | 52,00 | 10,41 | 10,99 | 11,88 | 12,59 |
| 306544.0060.006.10 | ▲ 0,6 | 0,06      | 10 | 3     | 0,55 | 55 | 0,8 | 52,00 | -     | -     | -     | -     |
| 306544.0060.006.12 | • 0,6 | 0,06      | 12 | 3     | 0,55 | 55 | 0,8 | 52,00 | 13,60 | 14,26 | 15,24 | 16,03 |
| 306544.0080.008.04 | • 0,8 | 0,08      | 4  | 3     | 0,75 | 55 | 1,0 | 52,00 | 5,08  | 5,47  | 6,11  | 6,66  |
| 306544.0080.008.08 | • 0,8 | 0,08      | 8  | 3     | 0,75 | 55 | 1,0 | 52,00 | 9,38  | 9,92  | 10,76 | 11,44 |
| 306544.0080.008.12 | • 0,8 | 0,08      | 12 | 3     | 0,75 | 55 | 1,0 | 52,00 | 13,63 | 14,28 | 15,26 | 16,04 |
| 306544.0080.008.14 | ▲ 0,8 | 0,08      | 14 | 3     | 0,75 | 55 | 1,0 | 52,00 | -     | -     | -     | -     |
| 306544.0080.008.16 | • 0,8 | 0,08      | 16 | 3     | 0,75 | 55 | 1,0 | 52,00 | 17,84 | 18,58 | 19,67 | 20,53 |
| 306544.0100.010.05 | • 1,0 | 0,10      | 5  | 3     | 0,95 | 55 | 1,2 | 55,00 | 6,25  | 6,67  | 7,34  | 7,92  |
| 306544.0100.010.10 | • 1,0 | 0,10      | 10 | 3     | 0,95 | 55 | 1,2 | 55,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306544.0100.010.15 | • 1,0 | 0,10      | 15 | 3     | 0,95 | 55 | 1,2 | 55,00 | 16,84 | 17,55 | 18,60 | -     |
| 306544.0100.010.20 | • 1,0 | 0,10      | 20 | 3     | 0,95 | 55 | 1,2 | 55,00 | 22,07 | 22,88 | 24,06 | -     |
| 306544.0100.010.25 | • 1,0 | 0,10      | 25 | 3     | 0,95 | 55 | 1,2 | 55,00 | 27,27 | 28,17 | -     | -     |
| 306544.0120.012.05 | ▲ 1,2 | 0,12      | 5  | 3     | 1,15 | 55 | 1,4 | 55,00 | 6,25  | 6,66  | 7,34  | 7,91  |
| 306544.0120.012.10 | • 1,2 | 0,12      | 10 | 3     | 1,15 | 55 | 1,4 | 55,00 | 11,58 | 12,16 | 13,05 | 13,78 |
| 306544.0120.012.15 | • 1,2 | 0,12      | 15 | 3     | 1,15 | 55 | 1,4 | 55,00 | 16,84 | 17,54 | 18,60 | -     |
| 306544.0150.015.05 | • 1,5 | 0,15      | 5  | 3     | 1,44 | 55 | 1,8 | 55,00 | 6,29  | 6,69  | 7,36  | 7,93  |
| 306544.0150.015.10 | • 1,5 | 0,15      | 10 | 3     | 1,44 | 55 | 1,8 | 55,00 | 11,61 | 12,18 | 13,06 | 13,79 |
| 306544.0150.015.15 | • 1,5 | 0,15      | 15 | 3     | 1,44 | 55 | 1,8 | 55,00 | 16,87 | 17,56 | 18,61 | -     |
| 306544.0150.015.20 | • 1,5 | 0,15      | 20 | 3     | 1,44 | 55 | 1,8 | 55,00 | 22,09 | 22,89 | -     | -     |
| 306544.0150.015.25 | • 1,5 | 0,15      | 25 | 3     | 1,44 | 55 | 1,8 | 55,00 | 27,29 | 28,18 | -     | -     |
| 306544.0180.018.10 | ▲ 1,8 | 0,18      | 10 | 3     | 1,74 | 55 | 1,9 | 55,00 | 11,61 | 12,17 | 13,06 | -     |
| 306544.0180.018.20 | ▲ 1,8 | 0,18      | 20 | 3     | 1,74 | 55 | 1,9 | 55,00 | 22,09 | 22,89 | -     | -     |
| 306544.0200.020.10 | • 2,0 | 0,20      | 10 | 3     | 1,92 | 65 | 2,0 | 57,00 | 11,67 | 12,22 | 13,09 | -     |
| 306544.0200.020.15 | • 2,0 | 0,20      | 15 | 3     | 1,92 | 65 | 2,0 | 57,00 | 16,92 | 17,60 | -     | -     |
| 306544.0200.020.20 | • 2,0 | 0,20      | 20 | 3     | 1,92 | 65 | 2,0 | 57,00 | 22,14 | 22,92 | -     | -     |
| 306544.0200.020.25 | • 2,0 | 0,20      | 25 | 3     | 1,92 | 65 | 2,0 | 57,00 | 27,34 | 28,21 | -     | -     |

Alternative 30.6545 bis / until Ø2,0 mit Schaft / with shank 4mm  
Alternative 30.6546 bis / until Ø3,0 mit Schaft / with shank 6mm

| Art.                | d1*    | r - 0,004 | l3  | d2/h5 | d3    | l1  | l2   | €      | 0,5°  | 1°    | 2°    | 3° |
|---------------------|--------|-----------|-----|-------|-------|-----|------|--------|-------|-------|-------|----|
| 306544.0200.050.10  | • 2,0  | 0,50      | 10  | 3     | 1,92  | 65  | 2,0  | 57,00  | 11,65 | 12,20 | 13,06 | –  |
| 306544.0200.050.15  | • 2,0  | 0,50      | 15  | 3     | 1,92  | 65  | 2,0  | 57,00  | 16,91 | 17,58 | –     | –  |
| 306544.0200.050.20  | • 2,0  | 0,50      | 20  | 3     | 1,92  | 65  | 2,0  | 57,00  | 22,13 | 22,90 | –     | –  |
| 306544.0200.050.25  | • 2,0  | 0,50      | 25  | 3     | 1,92  | 65  | 2,0  | 57,00  | 27,33 | 28,19 | –     | –  |
| 306544.0300.030.15  | • 3,0  | 0,30      | 15  | 4     | 2,90  | 65  | 3,0  | 54,00  | 16,97 | 17,63 | –     | –  |
| 306544.0300.030.25  | • 3,0  | 0,30      | 25  | 4     | 2,90  | 75  | 3,0  | 56,00  | 27,38 | 28,23 | –     | –  |
| 306544.0300.050.15  | • 3,0  | 0,50      | 15  | 4     | 2,90  | 65  | 3,0  | 54,00  | 16,96 | 17,62 | –     | –  |
| 306544.0300.050.20  | • 3,0  | 0,50      | 20  | 4     | 2,90  | 65  | 3,0  | 54,00  | 22,17 | 22,94 | –     | –  |
| 306544.0300.050.25  | • 3,0  | 0,50      | 25  | 4     | 2,90  | 75  | 3,0  | 56,00  | 27,37 | 28,22 | –     | –  |
| 306544.0300.050.30  | • 3,0  | 0,50      | 30  | 4     | 2,90  | 75  | 3,0  | 56,00  | 32,55 | –     | –     | –  |
| 306544.0400.040.25  | • 4,0  | 0,40      | 25  | 6     | 3,90  | 75  | 4,0  | 68,00  | 27,37 | 28,23 | –     | –  |
| 306544.0400.050.20  | • 4,0  | 0,50      | 20  | 6     | 3,90  | 65  | 4,0  | 66,00  | 22,17 | 22,94 | –     | –  |
| 306544.0400.050.30  | • 4,0  | 0,50      | 30  | 6     | 3,90  | 75  | 4,0  | 68,00  | 32,55 | –     | –     | –  |
| 306544.0400.050.40  | • 4,0  | 0,50      | 40  | 6     | 3,90  | 90  | 4,0  | 86,00  | 42,87 | –     | –     | –  |
| 306544.0500.050.20  | • 5,0  | 0,50      | 20  | 6     | 4,90  | 75  | 5,0  | 72,00  | 22,17 | 22,94 | –     | –  |
| 306544.0500.050.30  | • 5,0  | 0,50      | 30  | 6     | 4,90  | 75  | 5,0  | 72,00  | 32,55 | –     | –     | –  |
| 306544.0500.050.40  | • 5,0  | 0,50      | 40  | 6     | 4,90  | 90  | 5,0  | 91,00  | 42,87 | –     | –     | –  |
| 306544.0500.050.50  | • 5,0  | 0,50      | 50  | 6     | 4,90  | 90  | 5,0  | 91,00  | 53,15 | –     | –     | –  |
| 306544.0600.050.030 | • 6,0  | 0,50      | 30  | 6     | 5,90  | 75  | 6,0  | 82,00  | –     | –     | –     | –  |
| 306544.0600.050.040 | • 6,0  | 0,50      | 40  | 6     | 5,90  | 90  | 6,0  | 101,00 | –     | –     | –     | –  |
| 306544.0600.050.050 | • 6,0  | 0,50      | 50  | 6     | 5,90  | 90  | 6,0  | 101,00 | –     | –     | –     | –  |
| 306544.0600.050.060 | • 6,0  | 0,50      | 60  | 6     | 5,90  | 100 | 6,0  | 103,00 | –     | –     | –     | –  |
| 306544.0600.050.100 | ▲ 6,0  | 0,50      | 100 | 6     | 5,90  | 150 | 6,0  | 112,00 | –     | –     | –     | –  |
| 306544.0600.100.030 | • 6,0  | 1,00      | 30  | 6     | 5,90  | 75  | 6,0  | 82,00  | –     | –     | –     | –  |
| 306544.0600.100.040 | • 6,0  | 1,00      | 40  | 6     | 5,90  | 90  | 6,0  | 101,00 | –     | –     | –     | –  |
| 306544.0600.100.100 | ▲ 6,0  | 1,00      | 100 | 6     | 5,90  | 150 | 6,0  | 113,00 | –     | –     | –     | –  |
| 306544.0800.050.030 | • 8,0  | 0,50      | 30  | 8     | 7,80  | 80  | 8,0  | 139,00 | –     | –     | –     | –  |
| 306544.0800.050.060 | • 8,0  | 0,50      | 60  | 8     | 7,80  | 100 | 8,0  | 148,00 | –     | –     | –     | –  |
| 306544.0800.050.100 | ▲ 8,0  | 0,50      | 100 | 8     | 7,80  | 150 | 8,0  | 149,00 | –     | –     | –     | –  |
| 306544.0800.100.100 | ▲ 8,0  | 1,00      | 100 | 10    | 7,80  | 150 | 8,0  | 149,00 | –     | –     | –     | –  |
| 306544.1000.050.030 | • 10,0 | 0,50      | 30  | 10    | 9,80  | 80  | 10,0 | 168,00 | –     | –     | –     | –  |
| 306544.1000.050.060 | • 10,0 | 0,50      | 60  | 10    | 9,80  | 100 | 10,0 | 181,00 | –     | –     | –     | –  |
| 306544.1000.100.30  | ▲ 10,0 | 1,00      | 30  | 10    | 9,80  | 80  | 10,0 | 129,00 | –     | –     | –     | –  |
| 306544.1000.100.060 | • 10,0 | 1,00      | 60  | 10    | 9,80  | 100 | 10,0 | 181,00 | –     | –     | –     | –  |
| 306544.1200.050.30  | ▲ 12,0 | 0,50      | 30  | 12    | 11,80 | 80  | 12,0 | 148,00 | –     | –     | –     | –  |
| 306544.1200.050.60  | ▲ 12,0 | 0,50      | 60  | 12    | 11,80 | 100 | 12,0 | 212,00 | –     | –     | –     | –  |
| 306544.1200.100.30  | ▲ 12,0 | 1,00      | 30  | 12    | 11,80 | 80  | 12,0 | 148,00 | –     | –     | –     | –  |

Alternative 30.6523

PKD **EXTREME** Schaftfräser mit Eckenradius

GRAPHIT  
graphite

ALU  
≤ 6% Si

ALU  
> 6% Si

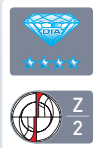
MESSING  
brass

KUPFER  
copper

GFK-CFK  
GFK-CFK

kurz-  
spanend  
short chip

lang-  
spanend  
long chip



PCD EXTREME 3D- ball milling cutter, 3xD-5xD-7xD, HSC high-speed-cutting

PCD EXTREME 3D- fresa de radio con frente cónico, 3xD-5xD-7xD, HSC

PCD EXTREME 3D - радиусная фреза с шаровым торцом, 3xD-5xD-7xD, высокоскоростная резка HSC

PKD **EXTREME**

PKD (Kristalliner Diamant) ist der derzeit dominierende Schneidstoff in industriellen Anwendungen, nicht zuletzt wegen seiner leichteren Verarbeitbarkeit gegenüber dem reinen Diamant. PKD-EXTREME ist ein neues, gesintertes Diamantpulver in einer metallischen Bindungsmatrix. Die Bearbeitung ist nur durch Lasern möglich.

PCD **EXTREME**

PCD (Polycrystalline Diamond) is currently the dominant tool material in industrial applications, not least because of its easy workability compared to pure diamond. PCD-EXTREME is a new sintered diamondpowder in a metallic bond matrix. Machining is possible only by laser.

PKD  
**EXTREME**

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HSC  
High-Speed-  
Cutting



POLIERT  
POLISHED



Schnittdaten  
Cutting data



i S. 336

| Art.              | d1 0/-0,01 | r ± 0,005 | l3 | d2 h6 | d3  | l1  | l2 | Z | €      |
|-------------------|------------|-----------|----|-------|-----|-----|----|---|--------|
| 306523.0600.05.60 | • 6        | 0,5       | 60 | 6     | 5,9 | 100 | 6  | 2 | 219,00 |
| 306523.0800.05.60 | • 8        | 0,5       | 60 | 8     | 7,8 | 100 | 8  | 2 | 249,00 |
| 306523.0800.10.60 | • 8        | 1,0       | 60 | 8     | 7,8 | 100 | 8  | 2 | 249,00 |
| 306523.1000.05.60 | • 10       | 0,5       | 60 | 10    | 9,8 | 105 | 10 | 2 | 262,00 |
| 306523.1000.10.60 | • 10       | 1,0       | 60 | 10    | 9,8 | 105 | 10 | 2 | 262,00 |

Art. 30.6545 PROFESSIONAL ★ ★ ★ Diamantbeschichteter Micro Schaftfräser mit Eckenradius < 20 x D Schnitttiefe

GRAPHIT  
graphite

ZIRKO-  
NIUM

Zirkonoxid  
Zr O<sub>2</sub>  
gepresst

Zirkonoxid  
Zr O<sub>2</sub>  
gehippt

GFK-CFK  
GFK-CFK

Diamond coated solid carbide end mills with corner radius,  
< 20 x D diameter

Microfresa metal duro de mango con radio angular recubierta  
de diamante < 20 x D profundidad de corte, HSC

Концевая микро-фреза с угловым радиусом,  
глубина обработки < 20 x D, HSC

NEU / NEW

tol. r = -0,004

d1\* = Ø 0,1 - Ø 2    tol -0 / -0,010

Formsschräge / Incline angle

Effektive Nutzlänge bei Formsschräge  
Effective under-neck length

Schnittdaten  
Cutting data

i S. 291-293

| Art.                | d1*    | r -0,004 | l3  | d2/h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|--------|----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306545.0010.001.002 | • 0,1  | 0,01     | 0,2 | 4     | 0,08 | 40 | 0,15 | 55,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306545.0010.001.004 | • 0,1  | 0,01     | 0,4 | 4     | 0,08 | 40 | 0,15 | 55,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306545.0015.001.003 | • 0,15 | 0,01     | 0,3 | 4     | 0,13 | 40 | 0,20 | 55,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306545.0015.001.006 | • 0,15 | 0,01     | 0,6 | 4     | 0,13 | 40 | 0,20 | 55,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306545.0020.002.004 | • 0,2  | 0,02     | 0,4 | 4     | 0,18 | 40 | 0,30 | 55,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306545.0020.002.006 | • 0,2  | 0,02     | 0,6 | 4     | 0,18 | 40 | 0,30 | 55,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306545.0020.002.008 | • 0,2  | 0,02     | 0,8 | 4     | 0,18 | 40 | 0,30 | 55,00 | 1,48  | 1,69  | 2,08  | 2,46  |
| 306545.0020.002.010 | • 0,2  | 0,02     | 1   | 4     | 0,18 | 40 | 0,30 | 55,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306545.0020.002.015 | • 0,2  | 0,02     | 1,5 | 4     | 0,18 | 40 | 0,30 | 55,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306545.0030.002.005 | • 0,3  | 0,02     | 0,5 | 4     | 0,27 | 40 | 0,50 | 55,00 | 1,13  | 1,31  | 1,67  | 2,02  |
| 306545.0030.002.010 | • 0,3  | 0,02     | 1   | 4     | 0,27 | 40 | 0,50 | 55,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306545.0030.002.015 | • 0,3  | 0,02     | 1,5 | 4     | 0,27 | 40 | 0,50 | 55,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306545.0030.002.020 | • 0,3  | 0,02     | 2   | 4     | 0,27 | 40 | 0,50 | 55,00 | 2,83  | 3,14  | 3,65  | 4,11  |
| 306545.0030.002.030 | • 0,3  | 0,02     | 3   | 4     | 0,27 | 40 | 0,50 | 55,00 | 3,94  | 4,30  | 4,89  | 5,40  |
| 306545.0030.002.045 | • 0,3  | 0,02     | 4,5 | 4     | 0,27 | 40 | 0,50 | 55,00 | 5,58  | 6,01  | 6,69  | 7,27  |
| 306545.0030.002.060 | • 0,3  | 0,02     | 6   | 4     | 0,27 | 40 | 0,50 | 55,00 | 7,21  | 7,69  | 8,45  | 9,08  |
| 306545.0040.002.020 | • 0,4  | 0,02     | 2   | 4     | 0,36 | 40 | 0,60 | 55,00 | 2,96  | 3,23  | 3,73  | 4,17  |
| 306545.0040.002.040 | • 0,4  | 0,02     | 4   | 4     | 0,36 | 40 | 0,60 | 55,00 | 5,14  | 5,52  | 6,15  | 6,70  |
| 306545.0040.002.060 | • 0,4  | 0,02     | 6   | 4     | 0,36 | 40 | 0,60 | 55,00 | 7,29  | 7,76  | 8,50  | 9,12  |
| 306545.0040.002.080 | • 0,4  | 0,02     | 8   | 4     | 0,36 | 60 | 0,60 | 57,00 | 9,43  | 9,96  | 10,79 | 11,47 |
| 306545.0050.005.020 | • 0,5  | 0,05     | 2   | 4     | 0,45 | 40 | 0,70 | 55,00 | 3,01  | 3,28  | 3,76  | 4,20  |
| 306545.0050.005.040 | • 0,5  | 0,05     | 4   | 4     | 0,45 | 40 | 0,70 | 55,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306545.0050.005.060 | • 0,5  | 0,05     | 6   | 4     | 0,45 | 40 | 0,70 | 55,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306545.0050.005.080 | • 0,5  | 0,05     | 8   | 4     | 0,45 | 60 | 0,70 | 57,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306545.0050.005.100 | • 0,5  | 0,05     | 10  | 4     | 0,45 | 60 | 0,70 | 57,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306545.0060.005.030 | • 0,6  | 0,05     | 3   | 4     | 0,55 | 40 | 1,0  | 57,00 | 4,10  | 4,43  | 4,99  | 5,48  |
| 306545.0060.005.060 | • 0,6  | 0,05     | 6   | 4     | 0,55 | 40 | 1,0  | 57,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306545.0060.005.090 | • 0,6  | 0,05     | 9   | 4     | 0,55 | 60 | 1,0  | 59,00 | 10,52 | 11,08 | 11,94 | 12,64 |
| 306545.0060.005.120 | • 0,6  | 0,05     | 12  | 4     | 0,55 | 60 | 1,0  | 59,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306545.0080.005.040 | • 0,8  | 0,05     | 4   | 4     | 0,75 | 40 | 1,2  | 57,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306545.0080.005.060 | • 0,8  | 0,05     | 6   | 4     | 0,75 | 40 | 1,2  | 57,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306545.0080.005.080 | • 0,8  | 0,05     | 8   | 4     | 0,75 | 60 | 1,2  | 59,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306545.0080.005.120 | • 0,8  | 0,05     | 12  | 4     | 0,75 | 60 | 1,2  | 59,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306545.0080.005.160 | • 0,8  | 0,05     | 16  | 4     | 0,75 | 60 | 1,2  | 59,00 | 17,89 | 18,62 | 19,71 | 20,57 |
| 306545.0100.005.050 | • 1,0  | 0,05     | 5   | 4     | 0,95 | 40 | 1,6  | 59,00 | 6,26  | 6,68  | 7,36  | 7,94  |
| 306545.0100.005.100 | • 1,0  | 0,05     | 10  | 4     | 0,95 | 60 | 1,6  | 61,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306545.0100.005.150 | • 1,0  | 0,05     | 15  | 4     | 0,95 | 60 | 1,6  | 61,00 | 16,85 | 17,55 | 18,61 | 19,45 |
| 306545.0100.005.200 | • 1,0  | 0,05     | 20  | 4     | 0,95 | 60 | 1,6  | 61,00 | 22,07 | 22,88 | 24,07 | 24,99 |





PROFESSIONAL  
★ ★ ★

Art. 30.6545

| Art.                | d1*   | r -0,004 | l3 | d2/h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|-------|----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306545.0100.010.050 | • 1,0 | 0,10     | 5  | 4     | 0,95 | 40 | 1,6 | 59,00 | 6,26  | 6,68  | 7,36  | 7,94  |
| 306545.0100.010.100 | • 1,0 | 0,10     | 10 | 4     | 0,95 | 60 | 1,6 | 61,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306545.0100.010.150 | • 1,0 | 0,10     | 15 | 4     | 0,95 | 60 | 1,6 | 61,00 | 16,85 | 17,55 | 18,61 | 19,45 |
| 306545.0100.010.200 | • 1,0 | 0,10     | 20 | 4     | 0,95 | 60 | 1,6 | 61,00 | 22,07 | 22,88 | 24,07 | 24,99 |
| 306545.0150.005.050 | • 1,5 | 0,05     | 5  | 4     | 1,44 | 40 | 2,4 | 59,00 | 6,30  | 6,61  | 7,38  | 7,96  |
| 306545.0150.005.100 | • 1,5 | 0,05     | 10 | 4     | 1,44 | 60 | 2,4 | 61,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306545.0150.005.150 | • 1,5 | 0,05     | 15 | 4     | 1,44 | 60 | 2,4 | 61,00 | 16,87 | 17,57 | 18,63 | -     |
| 306545.0150.005.200 | • 1,5 | 0,05     | 20 | 4     | 1,44 | 60 | 2,4 | 61,00 | 22,01 | 22,80 | -     | -     |
| 306545.0150.015.050 | • 1,5 | 0,15     | 5  | 4     | 1,44 | 40 | 2,4 | 61,00 | 6,30  | 6,61  | 7,38  | 7,96  |
| 306545.0150.015.100 | • 1,5 | 0,15     | 10 | 4     | 1,44 | 60 | 2,4 | 61,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306545.0150.015.150 | • 1,5 | 0,15     | 15 | 4     | 1,44 | 60 | 2,4 | 61,00 | 16,87 | 17,57 | 18,63 | 19,46 |
| 306545.0150.015.200 | • 1,5 | 0,15     | 20 | 4     | 1,44 | 60 | 2,4 | 61,00 | 22,01 | 22,90 | -     | -     |
| 306545.0200.005.060 | • 2,0 | 0,05     | 6  | 4     | 1,92 | 40 | 3,0 | 59,00 | 7,54  | 7,88  | 8,58  | 9,19  |
| 306545.0200.005.120 | • 2,0 | 0,05     | 12 | 4     | 1,92 | 60 | 3,0 | 62,00 | 19,78 | 14,40 | 15,34 | 16,11 |
| 306545.0200.005.180 | • 2,0 | 0,05     | 18 | 4     | 1,92 | 60 | 3,0 | 62,00 | 20,06 | 20,81 | 21,93 | -     |
| 306545.0200.005.240 | • 2,0 | 0,05     | 24 | 4     | 1,92 | 60 | 3,0 | 62,00 | 26,31 | 27,17 | 28,43 | -     |
| 306545.0200.005.300 | • 2,0 | 0,05     | 30 | 4     | 1,92 | 60 | 3,0 | 62,00 | 32,52 | 33,48 | -     | -     |
| 306545.0200.030.060 | • 2,0 | 0,30     | 6  | 4     | 1,92 | 40 | 3,0 | 59,00 | 7,54  | 7,88  | 8,58  | 9,19  |
| 306545.0200.030.120 | • 2,0 | 0,30     | 12 | 4     | 1,92 | 60 | 3,0 | 62,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306545.0200.030.180 | • 2,0 | 0,30     | 18 | 4     | 1,92 | 60 | 3,0 | 62,00 | 20,06 | 20,81 | 21,93 | -     |
| 306545.0200.030.240 | • 2,0 | 0,30     | 24 | 4     | 1,92 | 60 | 3,0 | 62,00 | 26,31 | 27,17 | 28,43 | -     |
| 306545.0200.030.300 | • 2,0 | 0,30     | 30 | 4     | 1,92 | 60 | 3,0 | 62,00 | 32,52 | 33,48 | -     | -     |
| 306545.0200.050.060 | • 2,0 | 0,50     | 6  | 4     | 1,92 | 40 | 3,0 | 59,00 | 7,54  | 7,88  | 8,58  | 9,19  |
| 306545.0200.050.120 | • 2,0 | 0,50     | 12 | 4     | 1,92 | 60 | 3,0 | 62,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306545.0200.050.180 | • 2,0 | 0,50     | 18 | 4     | 1,92 | 60 | 3,0 | 62,00 | 20,06 | 20,81 | 21,93 | -     |
| 306545.0200.050.240 | • 2,0 | 0,50     | 24 | 4     | 1,92 | 60 | 3,0 | 62,00 | 26,31 | 27,17 | 28,43 | -     |
| 306545.0200.050.300 | • 2,0 | 0,50     | 30 | 4     | 1,92 | 60 | 3,0 | 62,00 | 32,52 | 33,48 | -     | -     |

**Karnasch™**  
PROFESSIONAL TOOLS

DIAMOND COATED



CBN



PKD  
PCD



Naturdiamant  
ND



Monokristallin  
Diamant  
MCD



CVD /  
Diamant coated

PKD/PCD **EXTREME**

Art. **30.6544** **PROFESSIONAL** **★ ★ ★** Diamantbeschichteter Micro Schaftfräser mit Eckenradius < 20 x D Schnitttiefe

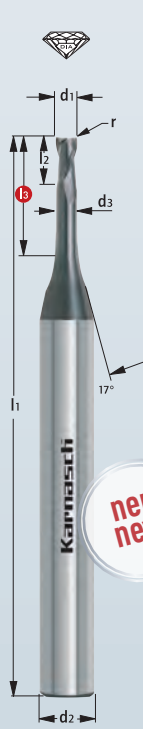
GRAPHIT  
graphite

ZIRKO-  
NIUM

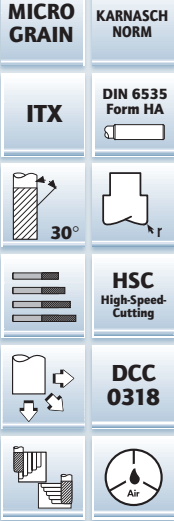
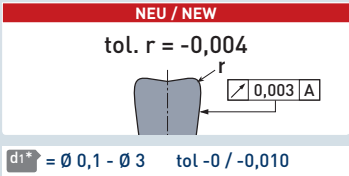
Zirkonoxid  
Zr O<sub>2</sub>  
gepresst

Zirkonoxid  
Zr O<sub>2</sub>  
gehippt

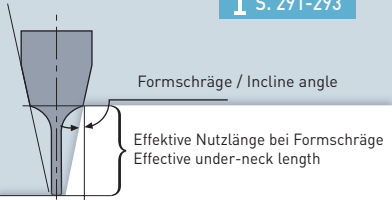
GFK-CFK  
GFK-CFK



- Diamond coated solid carbide end mills with corner radius,  
< 20 x D using length
- Microfresa metal duro de mango con radio angular recubierta  
de diamante < 20 x D profundidad de corte, HSC
- Концевая микро-фреза с угловым радиусом,  
глубина обработки < 20 x D, HSC



Schnittdaten  
Cutting data



| Art.                | d1*    | r -0,004 | l3  | d2/h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|---------------------|--------|----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306546.0010.001.002 | • 0,1  | 0,01     | 0,2 | 6     | 0,08 | 60 | 0,15 | 61,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306546.0010.001.004 | • 0,1  | 0,01     | 0,4 | 6     | 0,08 | 60 | 0,15 | 61,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306546.0015.001.003 | • 0,15 | 0,01     | 0,3 | 6     | 0,13 | 60 | 0,2  | 61,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306546.0015.001.006 | • 0,15 | 0,01     | 0,6 | 6     | 0,13 | 60 | 0,2  | 61,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306546.0020.002.004 | • 0,2  | 0,02     | 0,4 | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306546.0020.002.006 | • 0,2  | 0,02     | 0,6 | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306546.0020.002.008 | • 0,2  | 0,02     | 0,8 | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,48  | 1,69  | 2,08  | 2,46  |
| 306546.0020.002.010 | • 0,2  | 0,02     | 1   | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306546.0020.002.015 | • 0,2  | 0,02     | 1,5 | 6     | 0,18 | 60 | 0,3  | 61,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306546.0030.002.005 | • 0,3  | 0,02     | 0,5 | 6     | 0,27 | 60 | 0,5  | 61,00 | 1,13  | 1,31  | 1,67  | 2,02  |
| 306546.0030.002.01  | • 0,3  | 0,02     | 1   | 6     | 0,27 | 60 | 0,5  | 61,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306546.0030.002.015 | • 0,3  | 0,02     | 1,5 | 6     | 0,27 | 60 | 0,5  | 61,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306546.0030.002.02  | • 0,3  | 0,02     | 2   | 6     | 0,27 | 60 | 0,5  | 61,00 | 2,83  | 3,14  | 3,65  | 4,11  |
| 306546.0030.002.03  | • 0,3  | 0,02     | 3   | 6     | 0,27 | 60 | 0,5  | 61,00 | 3,94  | 4,30  | 4,89  | 5,40  |
| 306546.0030.002.045 | • 0,3  | 0,02     | 4,5 | 6     | 0,27 | 60 | 0,5  | 61,00 | 5,58  | 6,01  | 6,69  | 7,27  |
| 306546.0030.002.06  | • 0,3  | 0,02     | 6   | 6     | 0,27 | 60 | 0,5  | 61,00 | 7,21  | 7,69  | 8,45  | 9,08  |
| 306546.0040.002.02  | • 0,4  | 0,02     | 2   | 6     | 0,36 | 60 | 0,6  | 61,00 | 2,96  | 3,23  | 3,73  | 4,17  |
| 306546.0040.002.04  | • 0,4  | 0,02     | 4   | 6     | 0,36 | 60 | 0,6  | 61,00 | 5,14  | 5,52  | 6,15  | 6,70  |
| 306546.0040.002.06  | • 0,4  | 0,02     | 6   | 6     | 0,36 | 60 | 0,6  | 61,00 | 7,29  | 7,76  | 8,50  | 9,12  |
| 306546.0040.002.08  | • 0,4  | 0,02     | 8   | 6     | 0,36 | 60 | 0,6  | 61,00 | 9,43  | 9,96  | 10,79 | 11,47 |
| 306546.0050.005.02  | • 0,5  | 0,05     | 2   | 6     | 0,45 | 60 | 0,7  | 61,00 | 3,01  | 3,28  | 3,76  | 4,20  |
| 306546.0050.005.04  | • 0,5  | 0,05     | 4   | 6     | 0,45 | 60 | 0,7  | 61,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306546.0050.005.06  | • 0,5  | 0,05     | 6   | 6     | 0,45 | 60 | 0,7  | 61,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306546.0050.005.08  | • 0,5  | 0,05     | 8   | 6     | 0,45 | 60 | 0,7  | 61,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306546.0050.005.10  | • 0,5  | 0,05     | 10  | 6     | 0,45 | 60 | 0,7  | 61,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306546.0060.005.03  | • 0,6  | 0,05     | 3   | 6     | 0,55 | 60 | 1,0  | 63,00 | 4,10  | 4,43  | 4,99  | 5,48  |
| 306546.0060.005.06  | • 0,6  | 0,05     | 6   | 6     | 0,55 | 60 | 1,0  | 63,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306546.0060.005.09  | • 0,6  | 0,05     | 9   | 6     | 0,55 | 60 | 1,0  | 63,00 | 10,52 | 11,08 | 11,94 | 12,64 |
| 306546.0060.005.12  | • 0,6  | 0,05     | 12  | 6     | 0,55 | 60 | 1,0  | 63,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306546.0080.005.04  | • 0,8  | 0,05     | 4   | 6     | 0,75 | 60 | 1,2  | 63,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306546.0080.005.06  | • 0,8  | 0,05     | 6   | 6     | 0,75 | 60 | 1,2  | 63,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306546.0080.005.08  | • 0,8  | 0,05     | 8   | 6     | 0,75 | 60 | 1,2  | 63,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306546.0080.005.12  | • 0,8  | 0,05     | 12  | 6     | 0,75 | 60 | 1,2  | 63,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306546.0080.005.16  | • 0,8  | 0,05     | 16  | 6     | 0,75 | 60 | 1,2  | 63,00 | 17,89 | 18,62 | 19,71 | 20,57 |
| 306546.0100.005.05  | • 1,0  | 0,05     | 5   | 6     | 0,95 | 60 | 1,6  | 65,00 | 6,26  | 6,68  | 7,36  | 7,94  |
| 306546.0100.005.10  | • 1,0  | 0,05     | 10  | 6     | 0,95 | 60 | 1,6  | 65,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306546.0100.005.15  | • 1,0  | 0,05     | 15  | 6     | 0,95 | 60 | 1,6  | 65,00 | 16,85 | 17,55 | 18,61 | 19,45 |
| 306546.0100.005.20  | • 1,0  | 0,05     | 20  | 6     | 0,95 | 60 | 1,6  | 65,00 | 22,07 | 22,88 | 24,07 | 24,99 |

Alternative 30.6544 mit Schaft / with shank 3mm  
Alternative 30.6545 bis / until Ø2,0 mit Schaft / with shank 4mm



PROFESSIONAL  
★ ★ ★

Art. **30.6546**

| Art.               | d1*   | r -0,004 | l3 | d2/h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|--------------------|-------|----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306546.0100.010.05 | • 1,0 | 0,10     | 5  | 6     | 0,95 | 60 | 1,6 | 65,00 | 6,26  | 6,68  | 7,36  | 7,94  |
| 306546.0100.010.10 | • 1,0 | 0,10     | 10 | 6     | 0,95 | 60 | 1,6 | 65,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306546.0100.010.15 | • 1,0 | 0,10     | 15 | 6     | 0,95 | 60 | 1,6 | 65,00 | 16,85 | 17,55 | 18,61 | 19,45 |
| 306546.0100.010.20 | • 1,0 | 0,10     | 20 | 6     | 0,95 | 60 | 1,6 | 65,00 | 22,07 | 22,88 | 24,07 | 24,99 |
| 306546.0150.005.05 | • 1,5 | 0,05     | 5  | 6     | 1,44 | 60 | 2,4 | 65,00 | 6,30  | 6,61  | 7,38  | 7,96  |
| 306546.0150.005.10 | • 1,5 | 0,05     | 10 | 6     | 1,44 | 60 | 2,4 | 65,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306546.0150.005.15 | • 1,5 | 0,05     | 15 | 6     | 1,44 | 60 | 2,4 | 65,00 | 16,87 | 17,57 | 18,63 | 19,46 |
| 306546.0150.005.20 | • 1,5 | 0,05     | 20 | 6     | 1,44 | 60 | 2,4 | 65,00 | 22,01 | 22,90 | 24,08 | -     |
| 306546.0150.015.05 | • 1,5 | 0,15     | 5  | 6     | 1,44 | 60 | 2,4 | 65,00 | 6,30  | 6,61  | 7,38  | 7,96  |
| 306546.0150.015.10 | • 1,5 | 0,15     | 10 | 6     | 1,44 | 60 | 2,4 | 65,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306546.0150.015.15 | • 1,5 | 0,15     | 15 | 6     | 1,44 | 60 | 2,4 | 65,00 | 16,87 | 17,57 | 18,63 | 19,46 |
| 306546.0150.015.20 | • 1,5 | 0,15     | 20 | 6     | 1,44 | 60 | 2,4 | 65,00 | 22,01 | 22,90 | 24,08 | -     |
| 306546.0200.005.06 | • 2,0 | 0,05     | 6  | 6     | 1,92 | 60 | 3   | 66,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306546.0200.005.12 | • 2,0 | 0,05     | 12 | 6     | 1,92 | 60 | 3   | 66,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306546.0200.005.18 | • 2,0 | 0,05     | 18 | 6     | 1,92 | 60 | 3   | 66,00 | 20,06 | 20,81 | 21,93 | -     |
| 306546.0200.005.24 | • 2,0 | 0,05     | 24 | 6     | 1,92 | 60 | 3   | 66,00 | 26,31 | 27,17 | 28,43 | -     |
| 306546.0200.005.30 | • 2,0 | 0,05     | 30 | 6     | 1,92 | 60 | 3   | 66,00 | 32,52 | 33,48 | -     | -     |
| 306546.0200.030.06 | • 2,0 | 0,30     | 6  | 6     | 1,92 | 60 | 3   | 66,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306546.0200.030.12 | • 2,0 | 0,30     | 12 | 6     | 1,92 | 60 | 3   | 66,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306546.0200.030.18 | • 2,0 | 0,30     | 18 | 6     | 1,92 | 60 | 3   | 66,00 | 20,06 | 20,81 | 21,93 | -     |
| 306546.0200.030.24 | • 2,0 | 0,30     | 24 | 6     | 1,92 | 60 | 3   | 66,00 | 26,31 | 27,17 | 28,43 | -     |
| 306546.0200.030.30 | • 2,0 | 0,30     | 30 | 6     | 1,92 | 60 | 3   | 66,00 | 32,52 | 33,48 | -     | -     |
| 306546.0200.050.06 | • 2,0 | 0,50     | 6  | 6     | 1,92 | 60 | 3   | 66,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306546.0200.050.12 | • 2,0 | 0,50     | 12 | 6     | 1,92 | 60 | 3   | 66,00 | 13,78 | 14,40 | 15,34 | 16,11 |
| 306546.0200.050.18 | • 2,0 | 0,50     | 18 | 6     | 1,92 | 60 | 3   | 66,00 | 20,06 | 20,81 | 21,93 | -     |
| 306546.0200.050.24 | • 2,0 | 0,50     | 24 | 6     | 1,92 | 60 | 3   | 66,00 | 26,31 | 27,17 | 28,43 | -     |
| 306546.0200.050.30 | • 2,0 | 0,50     | 30 | 6     | 1,92 | 60 | 3   | 66,00 | 32,52 | 33,48 | -     | -     |
| 306546.0300.005.09 | • 3,0 | 0,05     | 9  | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306546.0300.005.18 | • 3,0 | 0,05     | 18 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306546.0300.005.30 | • 3,0 | 0,05     | 30 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306546.0300.030.09 | • 3,0 | 0,30     | 9  | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306546.0300.030.18 | • 3,0 | 0,30     | 18 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306546.0300.030.30 | • 3,0 | 0,30     | 30 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |

**Karnasch**™  
PROFESSIONAL TOOLS

NÄHER AN DER PERFEKTION  
CLOSER TO PERFECTION



Art. 30.6551 PROFESSIONAL ★ ★ ★ Diamantbeschichtete Micro-3D-Radiusfräser < 30 x D Schnitttiefe

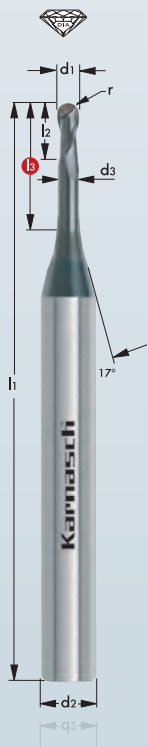
GRAPHIT  
graphite

ZIRKO-  
NIUM

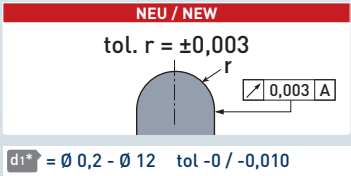
Zirkonoxid  
Zr O<sub>2</sub>  
gepresst

Zirkonoxid  
Zr O<sub>2</sub>  
gehippt

GFK-CFK  
GFK-CFK



- Diamond coated solid carbide 3D ball nose end mills, < 30 x diameter, HSC
- Microfresa metal duro de radio de 3D recubierta de diamante < 30 xD profundidad de corte, HSC
- Концевая микро-фреза 3D с угловым радиусом, глубина обработки < 30 xD, HSC



MICRO  
GRAIN

KARNASCH  
NORM

ITX

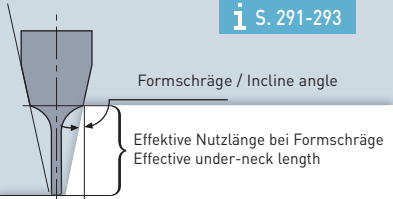
DIN 6535  
Form HA

35°

HSC  
High-Speed-  
Cutting

DCC  
0318

Schnittdaten  
Cutting data



| Art.           | d1*   | r ±0,003 | l3 | d2 h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|----------------|-------|----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306551.0020.01 | • 0,2 | 0,10     | 1  | 3     | 0,18 | 55 | 0,3 | 51,00 | 1,69  | 1,91  | 2,32  | 2,71  |
| 306551.0030.01 | • 0,3 | 0,15     | 1  | 3     | 0,27 | 55 | 0,4 | 51,00 | 1,68  | 1,90  | 2,30  | 2,68  |
| 306551.0030.02 | • 0,3 | 0,15     | 2  | 3     | 0,27 | 55 | 0,4 | 51,00 | 2,83  | 3,13  | 3,64  | 4,10  |
| 306551.0030.03 | • 0,3 | 0,15     | 3  | 3     | 0,27 | 55 | 0,4 | 51,00 | 3,93  | 4,28  | 4,86  | 5,36  |
| 306551.0030.05 | • 0,3 | 0,15     | 5  | 3     | 0,27 | 55 | 0,4 | 51,00 | 6,11  | 6,56  | 7,26  | 7,85  |
| 306551.0040.04 | • 0,4 | 0,20     | 4  | 3     | 0,36 | 55 | 0,5 | 51,00 | 5,02  | 5,42  | 6,06  | 6,61  |
| 306551.0040.06 | • 0,4 | 0,20     | 6  | 3     | 0,36 | 55 | 0,5 | 51,00 | 7,19  | 7,67  | 8,42  | 9,04  |
| 306551.0040.08 | • 0,4 | 0,20     | 8  | 3     | 0,36 | 55 | 0,5 | 51,00 | 9,34  | 9,88  | 10,72 | 11,40 |
| 306551.0050.05 | • 0,5 | 0,25     | 5  | 3     | 0,45 | 55 | 0,6 | 49,00 | 6,10  | 6,54  | 7,24  | 7,82  |
| 306551.0050.08 | • 0,5 | 0,25     | 8  | 3     | 0,45 | 55 | 0,6 | 49,00 | -     | -     | -     | -     |
| 306551.0050.10 | • 0,5 | 0,25     | 10 | 3     | 0,45 | 55 | 0,6 | 49,00 | 11,46 | 12,07 | 12,98 | 13,72 |
| 306551.0060.04 | • 0,6 | 0,30     | 4  | 3     | 0,55 | 55 | 0,8 | 52,00 | 5,03  | 5,44  | 6,09  | 6,64  |
| 306551.0060.06 | • 0,6 | 0,30     | 6  | 3     | 0,55 | 55 | 0,8 | 52,00 | 7,18  | 7,66  | 8,40  | 9,02  |
| 306551.0060.08 | ▲ 0,6 | 0,30     | 8  | 3     | 0,55 | 55 | 0,8 | 52,00 | 9,35  | 9,90  | 10,74 | 11,43 |
| 306551.0060.09 | • 0,6 | 0,30     | 9  | 3     | 0,55 | 55 | 0,8 | 52,00 | 10,40 | 10,97 | 11,84 | 12,55 |
| 306551.0060.10 | ▲ 0,6 | 0,30     | 10 | 3     | 0,55 | 55 | 0,8 | 52,00 | -     | -     | -     | -     |
| 306551.0060.12 | • 0,6 | 0,30     | 12 | 3     | 0,55 | 55 | 0,8 | 52,00 | 13,58 | 14,24 | 15,21 | 15,99 |
| 306551.0070.14 | ▲ 0,7 | 0,35     | 14 | 3     | 0,68 | 55 | 0,9 | 52,00 | 15,69 | 16,39 | 17,43 | 18,25 |
| 306551.0080.08 | • 0,8 | 0,40     | 8  | 3     | 0,75 | 55 | 1,0 | 52,00 | 9,36  | 9,89  | 10,71 | 11,39 |
| 306551.0080.10 | • 0,8 | 0,40     | 10 | 3     | 0,75 | 55 | 1,0 | 52,00 | -     | -     | -     | -     |
| 306551.0080.12 | • 0,8 | 0,40     | 12 | 3     | 0,75 | 55 | 1,0 | 52,00 | 13,61 | 14,25 | 15,22 | 15,99 |
| 306551.0080.14 | ▲ 0,8 | 0,40     | 14 | 3     | 0,75 | 55 | 1,0 | 52,00 | -     | -     | -     | -     |
| 306551.0080.16 | • 0,8 | 0,40     | 16 | 3     | 0,75 | 55 | 1,0 | 52,00 | 17,82 | 18,55 | 19,64 | 20,50 |
| 306551.0100.05 | • 1,0 | 0,50     | 5  | 3     | 0,95 | 55 | 1,2 | 55,00 | 6,22  | 6,62  | 7,27  | 7,83  |
| 306551.0100.10 | • 1,0 | 0,50     | 10 | 3     | 0,95 | 55 | 1,2 | 55,00 | 11,55 | 12,12 | 13,00 | 13,72 |
| 306551.0100.15 | • 1,0 | 0,50     | 15 | 3     | 0,95 | 55 | 1,2 | 55,00 | 16,82 | 17,52 | 18,56 | 19,39 |
| 306551.0100.20 | • 1,0 | 0,50     | 20 | 3     | 0,95 | 55 | 1,2 | 55,00 | 22,05 | 22,85 | 24,03 | -     |
| 306551.0100.25 | • 1,0 | 0,50     | 25 | 3     | 0,95 | 55 | 1,2 | 55,00 | 27,26 | 28,15 | -     | -     |
| 306551.0100.30 | • 1,0 | 0,50     | 30 | 3     | 0,95 | 65 | 1,2 | 56,00 | 32,45 | 33,41 | -     | -     |
| 306551.0120.10 | • 1,2 | 0,60     | 10 | 3     | 1,15 | 55 | 1,4 | 55,00 | 11,55 | 12,11 | 12,99 | 13,71 |
| 306551.0120.15 | • 1,2 | 0,60     | 15 | 3     | 1,15 | 55 | 1,4 | 55,00 | 16,82 | 17,51 | 18,55 | -     |
| 306551.0150.05 | ▲ 1,5 | 0,75     | 5  | 3     | 1,44 | 55 | 1,8 | 55,00 | 6,25  | 6,62  | 7,25  | 7,80  |
| 306551.0150.10 | • 1,5 | 0,75     | 10 | 3     | 1,44 | 55 | 1,8 | 55,00 | 11,57 | 12,13 | 12,99 | 13,70 |
| 306551.0150.15 | • 1,5 | 0,75     | 15 | 3     | 1,44 | 55 | 1,8 | 55,00 | 16,84 | 17,52 | 18,55 | -     |
| 306551.0150.20 | • 1,5 | 0,75     | 20 | 3     | 1,44 | 55 | 1,8 | 55,00 | 22,07 | 22,85 | -     | -     |
| 306551.0150.25 | • 1,5 | 0,75     | 25 | 3     | 1,44 | 55 | 1,8 | 55,00 | 27,27 | 28,15 | -     | -     |
| 306551.0180.10 | ▲ 1,8 | 0,90     | 10 | 3     | 1,74 | 55 | 1,9 | 55,00 | 11,56 | 12,11 | 12,97 | -     |
| 306551.0180.20 | ▲ 1,8 | 0,90     | 20 | 3     | 1,74 | 55 | 1,9 | 55,00 | 22,06 | 22,84 | -     | -     |



| Art.            | d1*    | r ±0,003 | l3  | d2 h5 | d3    | l1  | l2   | €      | 0,5°  | 1°    | 2°    | 3° |
|-----------------|--------|----------|-----|-------|-------|-----|------|--------|-------|-------|-------|----|
| 306551.0200.10  | • 2,0  | 1,00     | 10  | 3     | 1,92  | 65  | 2,0  | 57,00  | 11,62 | 12,15 | 12,99 | –  |
| 306551.0200.15  | • 2,0  | 1,00     | 15  | 3     | 1,92  | 65  | 2,0  | 57,00  | 16,88 | 17,54 | –     | –  |
| 306551.0200.20  | • 2,0  | 1,00     | 20  | 3     | 1,92  | 65  | 2,0  | 57,00  | 22,11 | 22,87 | –     | –  |
| 306551.0200.25  | • 2,0  | 1,00     | 25  | 3     | 1,92  | 65  | 2,0  | 57,00  | 27,31 | 28,17 | –     | –  |
| 306551.0200.30  | • 2,0  | 1,00     | 30  | 3     | 1,92  | 65  | 2,0  | 57,00  | 32,49 | –     | –     | –  |
| 306551.0300.10  | • 3,0  | 1,50     | 10  | 4     | 2,90  | 65  | 3,0  | 54,00  | 11,66 | 12,16 | 12,97 | –  |
| 306551.0300.15  | • 3,0  | 1,50     | 15  | 4     | 2,90  | 65  | 3,0  | 54,00  | 16,91 | 17,55 | –     | –  |
| 306551.0300.20  | • 3,0  | 1,50     | 20  | 4     | 2,90  | 65  | 3,0  | 54,00  | 22,13 | 22,88 | –     | –  |
| 306551.0300.25  | • 3,0  | 1,50     | 25  | 4     | 2,90  | 75  | 3,0  | 56,00  | 27,33 | 28,17 | –     | –  |
| 306551.0300.30  | • 3,0  | 1,50     | 30  | 4     | 2,90  | 75  | 3,0  | 56,00  | 32,51 | –     | –     | –  |
| 306551.0400.20  | • 4,0  | 2,00     | 20  | 6     | 3,90  | 65  | 4,0  | 66,00  | 22,11 | 22,85 | 22,85 | –  |
| 306551.0400.30  | • 4,0  | 2,00     | 30  | 6     | 3,90  | 75  | 4,0  | 68,00  | 32,49 | –     | –     | –  |
| 306551.0400.40  | • 4,0  | 2,00     | 40  | 6     | 3,90  | 90  | 4,0  | 86,00  | 42,82 | –     | –     | –  |
| 306551.0500.20  | • 5,0  | 2,50     | 20  | 6     | 4,90  | 65  | 5,0  | 70,00  | 22,09 | 22,82 | –     | –  |
| 306551.0500.30  | • 5,0  | 2,50     | 30  | 6     | 4,90  | 75  | 5,0  | 72,00  | 32,48 | –     | –     | –  |
| 306551.0500.40  | • 5,0  | 2,50     | 40  | 6     | 4,90  | 90  | 5,0  | 91,00  | 42,81 | –     | –     | –  |
| 306551.0500.50  | • 5,0  | 2,50     | 50  | 6     | 4,90  | 90  | 5,0  | 91,00  | 53,10 | –     | –     | –  |
| 306551.0600.030 | • 6,0  | 3,00     | 30  | 6     | 5,90  | 75  | 6,0  | 82,00  | –     | –     | –     | –  |
| 306551.0600.040 | • 6,0  | 3,00     | 40  | 6     | 5,90  | 90  | 6,0  | 101,00 | –     | –     | –     | –  |
| 306551.0600.050 | • 6,0  | 3,00     | 50  | 6     | 5,90  | 90  | 6,0  | 101,00 | –     | –     | –     | –  |
| 306551.0600.060 | • 6,0  | 3,00     | 60  | 6     | 5,90  | 100 | 6,0  | 103,00 | –     | –     | –     | –  |
| 306551.0600.100 | ▲ 6,0  | 3,00     | 100 | 8     | 5,90  | 150 | 6,0  | 113,00 | –     | –     | –     | –  |
| 306551.0800.030 | • 8,0  | 4,00     | 30  | 8     | 7,80  | 80  | 8,0  | 139,00 | –     | –     | –     | –  |
| 306551.0800.060 | • 8,0  | 4,00     | 60  | 8     | 7,80  | 100 | 8,0  | 148,00 | –     | –     | –     | –  |
| 306551.1000.030 | ▲ 10,0 | 5,00     | 30  | 10    | 9,80  | 80  | 10,0 | 129,00 | –     | –     | –     | –  |
| 306551.1000.060 | • 10,0 | 5,00     | 60  | 10    | 9,80  | 100 | 10,0 | 181,00 | –     | –     | –     | –  |
| 306551.1000.100 | ▲ 10,0 | 5,00     | 100 | 10    | 9,80  | 150 | 10,0 | 182,00 | –     | –     | –     | –  |
| 306551.1200.030 | ▲ 12,0 | 6,00     | 30  | 12    | 11,80 | 80  | 12,0 | 148,00 | –     | –     | –     | –  |
| 306551.1200.060 | ▲ 12,0 | 6,00     | 60  | 12    | 11,80 | 100 | 12,0 | 212,00 | –     | –     | –     | –  |
| 306551.1200.100 | ▲ 12,0 | 6,00     | 100 | 12    | 11,80 | 150 | 12,0 | 206,00 | –     | –     | –     | –  |

Alternative 30.6522

PKD **EXTREME** 3D- Radiusfräser mit Kugelstirn

GRAPHIT  
graphite

ALU  
< 6% Si

ALU  
> 6% Si

MESSING  
brass

KUPFER  
copper

GFK-CFK  
GFK-CFK

kurz-  
spanend  
short chip

lang-  
spanend  
long chip

Technical drawing of the PKD EXTREME 3D ball mill cutter. Dimensions shown: d1 (cutting diameter), d2 (shank diameter), d3 (cutting diameter), l1 (total length), l2 (cutting length), l3 (cutting length), r (radius), and q3 (cutting length).

PCD EXTREME 3D- ball milling cutter, 3xD-5xD-7xD, HSC high-speed-cutting

PCD EXTREME 3D- fresa de radio con frente cónico, 3xD-5xD-7xD, HSC

PCD EXTREME 3D - радиусная фреза с шаровым торцом, 3xD-5xD-7xD, высокоскоростная резка HSC

**PCD EXTREME**

PKD (Kristalliner Diamant) ist der derzeit dominierende Schneidstoff in industriellen Anwendungen, nicht zuletzt wegen seiner leichteren Verarbeitbarkeit gegenüber dem reinen Diamant. PKD-EXTREME ist ein neues gesinteres Diamantpulver in einer metallischen Bindungsmatrix. Die Bearbeitung ist nur durch Lasern möglich.

**PCD EXTREME**

PCD (Polycrystalline Diamond) is currently the dominant tool material in industrial applications, not least because of its easy workability compared to pure diamond. PCD-EXTREME is a new sintered diamondpowder in a metallic bond matrix. Machining is possible only by laser.

**PKD EXTREME**

KARNASCH NORM

**SPEZIAL**

DIN 6535 Form HA

**HSC**  
High-Speed-Cutting

**POLIERT**  
POLISHED

Schnittdaten  
Cutting data

i S. 336

| Art.           | d1 0/-0,01 | r ±0,005 | l3 | d2 h6 | d3  | l1  | l2 | Z | €      |
|----------------|------------|----------|----|-------|-----|-----|----|---|--------|
| 306522.0600.60 | • 6        | 3        | 60 | 6     | 5,9 | 100 | 6  | 2 | 208,00 |
| 306522.0800.60 | • 8        | 4        | 60 | 8     | 7,8 | 100 | 8  | 2 | 225,00 |
| 306522.1000.60 | • 10       | 5        | 60 | 10    | 9,8 | 105 | 10 | 2 | 268,00 |

87

Art. **30.6552** **PROFESSIONAL**  Micro-3D-Radiusfräser

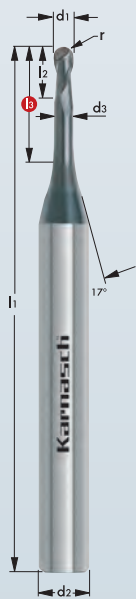
**GRAPHIT**  
*graphite*

**ZIRKO-  
NIUM**

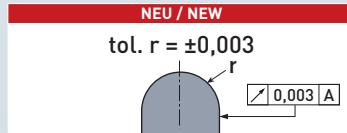
**Zirkonoxid  
Zr O<sub>2</sub>  
gehippt**

**Zirkonoxid  
Zr O<sub>2</sub>  
gepresst**

**GFK-CFK**  
*GFK-CFK*

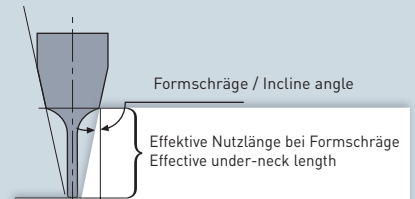
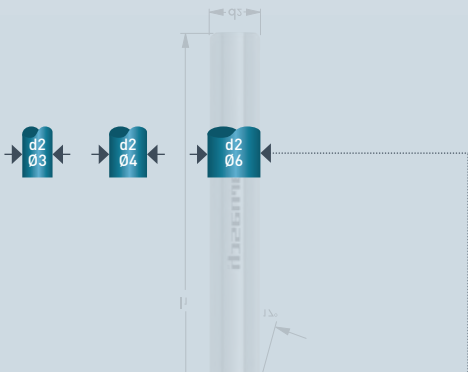


|                                                                                   |                                                 |
|-----------------------------------------------------------------------------------|-------------------------------------------------|
|  | Solid Carbide 3D ball nose end mills, HSC       |
|  | Microfresa metal duro de radio de 3D, HSC       |
|  | Концевая микро-фреза 3D с угловым радиусом, HSC |



|                                                                                                |                                                                                                       |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>MICRO<br/>GRAIN<br/>CLEAN</b>                                                               | <b>KARNASCH<br/>NORM</b>                                                                              |
| <b>SPEZIAL</b>                                                                                 | <b>Form HA</b><br> |
|  <b>30°</b> |                    |
|             | <b>HSC</b><br>High-Speed-<br>Cutting                                                                  |
|             | <b>DCC<br/>0318</b>                                                                                   |
|             |  <b>Air</b>        |

Schnittdaten  
Cutting data

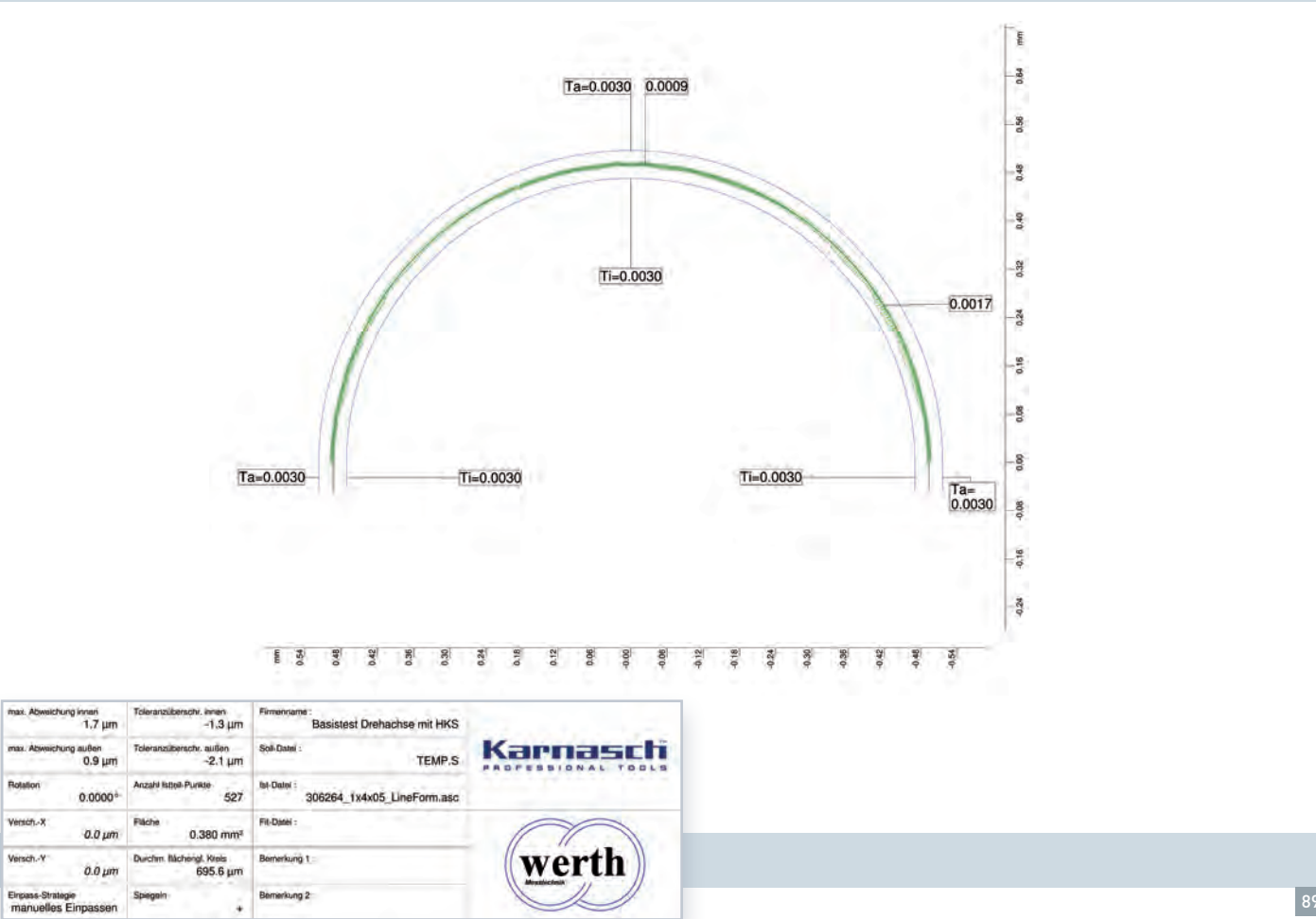


| Art.              | d1 -0,008 | r ± 0,003 | l3 | d2 h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|-------------------|-----------|-----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306552.0100.14.03 | • 1,0     | 0,5       | 14 | 3     | 0,95 | 45 | 1,5 | 55,00 | 15,80 | 16,48 | 17,51 | 18,33 |
| 306552.0100.16.03 | • 1,0     | 0,5       | 16 | 3     | 0,95 | 45 | 1,5 | 55,00 | 17,89 | 18,62 | 19,71 | –     |
| 306552.0100.18.03 | • 1,0     | 0,5       | 18 | 3     | 0,95 | 45 | 1,5 | 55,00 | 19,99 | 20,76 | 21,89 | –     |
| 306552.0100.20.03 | • 1,0     | 0,5       | 20 | 3     | 0,95 | 45 | 1,5 | 55,00 | 22,07 | 22,88 | 24,07 | –     |
| 306552.0100.14.04 | • 1,0     | 0,5       | 14 | 4     | 0,95 | 45 | 1,5 | 60,00 | 15,80 | 16,48 | 17,51 | 18,33 |
| 306552.0100.16.04 | • 1,0     | 0,5       | 16 | 4     | 0,95 | 45 | 1,5 | 60,00 | 17,89 | 18,62 | 19,71 | 20,57 |
| 306552.0100.18.04 | • 1,0     | 0,5       | 18 | 4     | 0,95 | 45 | 1,5 | 60,00 | 19,99 | 20,76 | 21,89 | 22,78 |
| 306552.0100.20.04 | • 1,0     | 0,5       | 20 | 4     | 0,95 | 45 | 1,5 | 60,00 | 20,07 | 22,88 | 24,07 | 24,99 |
| 306552.0100.14.06 | • 1,0     | 0,5       | 14 | 6     | 0,95 | 45 | 1,5 | 64,00 | 15,80 | 16,48 | 17,51 | 18,33 |
| 306552.0100.16.06 | • 1,0     | 0,5       | 16 | 6     | 0,95 | 45 | 1,5 | 64,00 | 17,89 | 18,62 | 19,71 | 20,57 |
| 306552.0100.18.06 | • 1,0     | 0,5       | 18 | 6     | 0,95 | 45 | 1,5 | 64,00 | 19,38 | 19,89 | 20,63 | 21,17 |
| 306552.0100.20.06 | • 1,0     | 0,5       | 20 | 6     | 0,95 | 45 | 1,5 | 64,00 | 21,44 | 21,98 | 22,74 | 23,30 |
| 306552.0200.14.03 | • 2,0     | 1,0       | 14 | 3     | 1,92 | 45 | 3,0 | 57,00 | 15,88 | 16,54 | –     | –     |
| 306552.0200.16.03 | • 2,0     | 1,0       | 16 | 3     | 1,92 | 45 | 3,0 | 57,00 | 17,97 | 18,68 | –     | –     |
| 306552.0200.18.03 | • 2,0     | 1,0       | 18 | 3     | 1,92 | 45 | 3,0 | 57,00 | 20,06 | 20,81 | –     | –     |
| 306552.0200.20.03 | • 2,0     | 1,0       | 20 | 3     | 1,92 | 45 | 3,0 | 57,00 | 22,15 | 22,93 | –     | –     |
| 306552.0200.14.04 | • 2,0     | 1,0       | 14 | 4     | 1,92 | 45 | 3,0 | 60,00 | 15,88 | 16,54 | 17,55 | 18,36 |
| 306552.0200.16.04 | • 2,0     | 1,0       | 16 | 4     | 1,92 | 45 | 3,0 | 60,00 | 17,97 | 18,68 | 19,75 | –     |
| 306552.0200.18.04 | • 2,0     | 1,0       | 18 | 4     | 1,92 | 45 | 3,0 | 60,00 | 20,06 | 20,81 | 21,93 | –     |
| 306552.0200.20.04 | • 2,0     | 1,0       | 20 | 4     | 1,92 | 45 | 3,0 | 60,00 | 22,15 | 22,93 | 24,11 | –     |
| 306552.0200.14.06 | • 2,0     | 1,0       | 14 | 6     | 1,92 | 45 | 3,0 | 65,00 | 15,88 | 16,54 | 17,55 | 18,36 |
| 306552.0200.16.06 | • 2,0     | 1,0       | 16 | 6     | 1,92 | 45 | 3,0 | 65,00 | 17,97 | 18,68 | 19,75 | 20,60 |
| 306552.0200.18.06 | • 2,0     | 1,0       | 18 | 6     | 1,92 | 45 | 3,0 | 65,00 | 19,43 | 19,93 | 20,65 | 21,19 |
| 306552.0200.20.06 | • 2,0     | 1,0       | 20 | 6     | 1,92 | 45 | 3,0 | 65,00 | 21,49 | 22,02 | 22,77 | 23,32 |
| 306552.0300.14.03 | • 3,0     | 1,5       | 14 | 3     | 2,90 | 45 | 3,5 | 54,00 | –     | –     | –     | –     |
| 306552.0300.16.03 | • 3,0     | 1,5       | 16 | 3     | 2,90 | 45 | 3,5 | 54,00 | –     | –     | –     | –     |
| 306552.0300.18.03 | • 3,0     | 1,5       | 18 | 3     | 2,90 | 45 | 3,5 | 54,00 | –     | –     | –     | –     |
| 306552.0300.20.03 | • 3,0     | 1,5       | 20 | 3     | 2,90 | 45 | 3,5 | 54,00 | –     | –     | –     | –     |
| 306552.0300.14.04 | • 3,0     | 1,5       | 14 | 4     | 2,90 | 45 | 3,5 | 60,00 | 15,94 | 16,58 | –     | –     |
| 306552.0300.16.04 | • 3,0     | 1,5       | 16 | 4     | 2,90 | 45 | 3,5 | 60,00 | 18,03 | 18,72 | –     | –     |
| 306552.0300.18.04 | • 3,0     | 1,5       | 18 | 4     | 2,90 | 45 | 3,5 | 60,00 | 20,11 | 20,86 | –     | –     |
| 306552.0300.20.04 | • 3,0     | 1,5       | 20 | 4     | 2,90 | 45 | 3,5 | 60,00 | 22,19 | –     | –     | –     |
| 306552.0300.14.06 | • 3,0     | 1,5       | 14 | 6     | 2,90 | 45 | 3,5 | 73,00 | 15,94 | 16,58 | 17,58 | 18,39 |
| 306552.0300.16.06 | • 3,0     | 1,5       | 16 | 6     | 2,90 | 45 | 3,5 | 73,00 | 18,03 | 18,72 | 19,78 | 20,62 |
| 306552.0300.18.06 | • 3,0     | 1,5       | 18 | 6     | 2,90 | 45 | 3,5 | 73,00 | 19,47 | 19,96 | 20,67 | 21,20 |
| 306552.0300.20.06 | • 3,0     | 1,5       | 20 | 6     | 2,90 | 45 | 3,5 | 73,00 | 21,52 | 22,04 | 22,78 | 23,33 |

30.6264 Drm.1.0

| Parameter              | Ist       | Soll   | UT      | OT      | Diff    | Fehler | Status      |
|------------------------|-----------|--------|---------|---------|---------|--------|-------------|
| Durchmesser D1         | 0.9965 mm | 1.0000 | -0.0100 | -0.0020 | -0.0035 | 0.0000 | <div></div> |
| Rundlauf               | 0.0003 mm |        |         |         |         |        | <div></div> |
| Diameter w/o Runout    | 0.9962 mm |        |         |         |         |        | <div></div> |
| Radius 0.0°            | 0.4985 mm | 0.4982 | -0.0030 | 0.0030  | 0.0003  | 0.0000 | <div></div> |
| Radius 10.0°           | 0.4988 mm | 0.4982 | -0.0030 | 0.0030  | 0.0005  | 0.0000 | <div></div> |
| Radius 20.0°           | 0.4985 mm | 0.4982 | -0.0030 | 0.0030  | 0.0003  | 0.0000 | <div></div> |
| Radius 30.0°           | 0.4990 mm | 0.4982 | -0.0030 | 0.0030  | 0.0008  | 0.0000 | <div></div> |
| Radius 40.0°           | 0.4990 mm | 0.4982 | -0.0030 | 0.0030  | 0.0008  | 0.0000 | <div></div> |
| Radius 50.0°           | 0.4993 mm | 0.4982 | -0.0030 | 0.0030  | 0.0010  | 0.0000 | <div></div> |
| Radius 60.0°           | 0.5000 mm | 0.4982 | -0.0030 | 0.0030  | 0.0018  | 0.0000 | <div></div> |
| Radius 70.0°           | 0.4988 mm | 0.4982 | -0.0030 | 0.0030  | 0.0005  | 0.0000 | <div></div> |
| Radius 80.0°           | 0.4990 mm | 0.4982 | -0.0030 | 0.0030  | 0.0008  | 0.0000 | <div></div> |
| Radius 90.0°           | 0.4990 mm | 0.4982 | -0.0030 | 0.0030  | 0.0008  | 0.0000 | <div></div> |
| Radius 100.0°          | 0.4975 mm | 0.4982 | -0.0030 | 0.0030  | -0.0007 | 0.0000 | <div></div> |
| Radius 110.0°          | 0.4978 mm | 0.4982 | -0.0030 | 0.0030  | -0.0005 | 0.0000 | <div></div> |
| Radius 120.0°          | 0.4988 mm | 0.4982 | -0.0030 | 0.0030  | 0.0005  | 0.0000 | <div></div> |
| Radius 130.0°          | 0.4985 mm | 0.4982 | -0.0030 | 0.0030  | 0.0003  | 0.0000 | <div></div> |
| Radius 140.0°          | 0.4983 mm | 0.4982 | -0.0030 | 0.0030  | 0.0000  | 0.0000 | <div></div> |
| Radius 150.0°          | 0.4988 mm | 0.4982 | -0.0030 | 0.0030  | 0.0005  | 0.0000 | <div></div> |
| Radius 160.0°          | 0.4985 mm | 0.4982 | -0.0030 | 0.0030  | 0.0003  | 0.0000 | <div></div> |
| Radius 170.0°          | 0.4988 mm | 0.4982 | -0.0030 | 0.0030  | 0.0005  | 0.0000 | <div></div> |
| Radius 180.0°          | 0.4983 mm | 0.4982 | -0.0030 | 0.0030  | 0.0000  | 0.0000 | <div></div> |
| Average Ballnose Radii | 0.4988 mm | 0.4982 | -0.0030 | 0.0030  | 0.0005  | 0.0000 | <div></div> |
| Minimum Radius         | 0.4975 mm |        |         |         |         |        | <div></div> |
| Minimum Radius Pos.    | 100.0 °   |        |         |         |         |        | <div></div> |
| Maximum Radius         | 0.5000 mm |        |         |         |         |        | <div></div> |
| Maximum Radius Pos.    | 60.0 °    |        |         |         |         |        | <div></div> |
| Linienform             | 0.0022 mm |        |         |         |         |        | <div></div> |

Darstellung der Radiuskontur eines Karnasch-Fräser  
Picture of the radius shape accuracy from a Karnasch ball nose end mill



Art. **30.6553** **PROFESSIONAL** ★ ★ ★

Diamantbeschichteter Micro-3D-Radiusfräser < 25 x D Schnitttiefe

GRAPHIT  
graphite

ZIRKO-  
NIUM

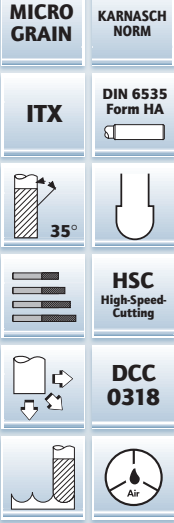
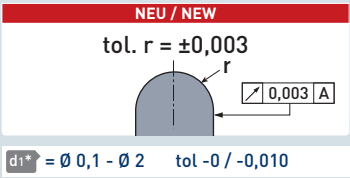
Zirkonoxid  
Zr O<sub>2</sub>  
gepresst

Zirkonoxid  
Zr O<sub>2</sub>  
gehippt

GFK-CFK  
GFK-CFK



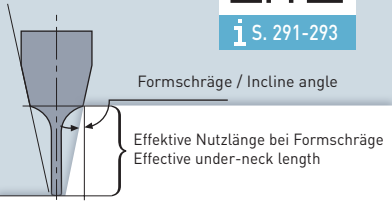
- Diamond coated solid carbide 3D ball nose end mills, < 25 x diameter, HSC
- Microfresa metal duro de radio de 3D recubierta de diamante < 25 x D profundidad de corte, HSC
- Концевая микро-фреза 3D с угловым радиусом, глубина обработки < 25 x D, HSC



Schnittdaten  
Cutting data



i S. 291-293



| Art.            | d1*    | r ±0,003 | l3  | d2/h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|--------|----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306553.0010.002 | • 0,1  | 0,05     | 0,2 | 4     | 0,09 | 40 | 0,15 | 55,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306553.0010.004 | • 0,1  | 0,05     | 0,4 | 4     | 0,09 | 40 | 0,15 | 55,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306553.0015.003 | • 0,15 | 0,075    | 0,3 | 4     | 0,14 | 40 | 0,2  | 55,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306553.0015.006 | • 0,15 | 0,075    | 0,6 | 4     | 0,14 | 40 | 0,2  | 55,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306553.0020.006 | • 0,2  | 0,10     | 0,6 | 4     | 0,18 | 40 | 0,3  | 55,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306553.0020.008 | • 0,2  | 0,10     | 0,8 | 4     | 0,18 | 40 | 0,3  | 55,00 | 1,48  | 1,69  | 2,08  | 2,46  |
| 306553.0020.010 | • 0,2  | 0,10     | 1   | 4     | 0,18 | 40 | 0,3  | 55,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306553.0020.015 | • 0,2  | 0,10     | 1,5 | 4     | 0,18 | 40 | 0,3  | 55,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306553.0030.005 | • 0,3  | 0,15     | 0,5 | 4     | 0,27 | 40 | 0,5  | 55,00 | 1,13  | 1,31  | 1,67  | 2,02  |
| 306553.0030.010 | • 0,3  | 0,15     | 1   | 4     | 0,27 | 40 | 0,5  | 55,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306553.0030.015 | • 0,3  | 0,15     | 1,5 | 4     | 0,27 | 40 | 0,5  | 55,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306553.0030.020 | • 0,3  | 0,15     | 2   | 4     | 0,27 | 40 | 0,5  | 55,00 | 2,83  | 3,14  | 3,65  | 4,11  |
| 306553.0030.030 | • 0,3  | 0,15     | 3   | 4     | 0,27 | 40 | 0,5  | 55,00 | 3,94  | 4,30  | 4,89  | 5,40  |
| 306553.0030.045 | • 0,3  | 0,15     | 4,5 | 4     | 0,27 | 40 | 0,5  | 55,00 | 5,58  | 6,01  | 6,69  | 7,27  |
| 306553.0030.060 | • 0,3  | 0,15     | 6   | 4     | 0,27 | 40 | 0,5  | 55,00 | 7,21  | 7,69  | 8,45  | 9,08  |
| 306553.0040.010 | • 0,4  | 0,20     | 1   | 4     | 0,36 | 40 | 0,6  | 55,00 | 1,85  | 2,06  | 2,45  | 2,83  |
| 306553.0040.020 | • 0,4  | 0,20     | 2   | 4     | 0,36 | 40 | 0,6  | 55,00 | 2,96  | 3,23  | 3,73  | 4,17  |
| 306553.0040.030 | • 0,4  | 0,20     | 3   | 4     | 0,36 | 40 | 0,6  | 55,00 | 4,05  | 4,39  | 4,96  | 5,45  |
| 306553.0040.040 | • 0,4  | 0,20     | 4   | 4     | 0,36 | 40 | 0,6  | 55,00 | 5,14  | 5,52  | 6,15  | 6,70  |
| 306553.0040.060 | • 0,4  | 0,20     | 6   | 4     | 0,36 | 40 | 0,6  | 55,00 | 7,29  | 7,76  | 8,50  | 9,12  |
| 306553.0040.080 | • 0,4  | 0,20     | 8   | 4     | 0,36 | 60 | 0,6  | 57,00 | 9,43  | 9,96  | 10,79 | 11,47 |
| 306553.0050.020 | • 0,5  | 0,25     | 2   | 4     | 0,45 | 40 | 0,7  | 55,00 | 3,01  | 3,28  | 3,76  | 4,20  |
| 306553.0050.040 | • 0,5  | 0,25     | 4   | 4     | 0,45 | 40 | 0,7  | 55,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306553.0050.060 | • 0,5  | 0,25     | 6   | 4     | 0,45 | 40 | 0,7  | 55,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306553.0050.080 | • 0,5  | 0,25     | 8   | 4     | 0,45 | 60 | 0,7  | 57,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306553.0050.100 | • 0,5  | 0,25     | 10  | 4     | 0,45 | 60 | 0,7  | 57,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306553.0060.030 | • 0,6  | 0,30     | 3   | 4     | 0,55 | 40 | 1,0  | 57,00 | 4,10  | 4,43  | 4,99  | 5,48  |
| 306553.0060.060 | • 0,6  | 0,30     | 6   | 4     | 0,55 | 40 | 1,0  | 57,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306553.0060.090 | • 0,6  | 0,30     | 9   | 4     | 0,55 | 60 | 1,0  | 59,00 | 10,52 | 11,08 | 11,94 | 12,64 |
| 306553.0060.120 | • 0,6  | 0,30     | 12  | 4     | 0,55 | 60 | 1,0  | 59,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306553.0080.040 | • 0,8  | 0,40     | 4   | 4     | 0,75 | 40 | 1,2  | 57,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306553.0080.060 | • 0,8  | 0,40     | 6   | 4     | 0,75 | 40 | 1,2  | 57,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306553.0080.080 | • 0,8  | 0,40     | 8   | 4     | 0,75 | 60 | 1,2  | 59,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306553.0080.120 | • 0,8  | 0,40     | 12  | 4     | 0,75 | 60 | 1,2  | 59,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306553.0080.160 | • 0,8  | 0,40     | 16  | 4     | 0,75 | 60 | 1,2  | 59,00 | 17,89 | 18,62 | 19,71 | 20,57 |
| 306553.0100.050 | • 1,0  | 0,50     | 5   | 4     | 0,95 | 40 | 1,6  | 59,00 | 6,26  | 6,68  | 7,36  | 7,94  |
| 306553.0100.100 | • 1,0  | 0,50     | 10  | 4     | 0,95 | 60 | 1,6  | 61,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306553.0100.150 | • 1,0  | 0,50     | 15  | 4     | 0,95 | 60 | 1,6  | 61,00 | 16,85 | 17,55 | 18,61 | 19,45 |
| 306553.0100.200 | • 1,0  | 0,50     | 20  | 4     | 0,95 | 60 | 1,6  | 61,00 | 22,07 | 22,88 | 24,07 | 24,99 |
| 306553.0100.250 | • 1,0  | 0,50     | 25  | 4     | 0,95 | 60 | 1,6  | 61,00 | 27,28 | 28,17 | 29,47 | -     |

Alternative 30.6551 - Schaft / Shank 3mm  
Alternative 30.6554 - Schaft / Shank 6mm





PROFESSIONAL  
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Art. **30.6553**

| Art.            | d1*   | r ±0,003 | l3 | d2/h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|-------|----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306553.0150.050 | • 1,5 | 0,75     | 5  | 4     | 1,45 | 40 | 2,4 | 59,00 | 6,30  | 6,61  | 7,38  | 7,96  |
| 306553.0150.100 | • 1,5 | 0,75     | 10 | 4     | 1,45 | 60 | 2,4 | 61,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306553.0150.150 | • 1,5 | 0,75     | 15 | 4     | 1,45 | 60 | 2,4 | 61,00 | 16,87 | 17,57 | 18,63 | 19,46 |
| 306553.0150.200 | • 1,5 | 0,75     | 20 | 4     | 1,45 | 60 | 2,4 | 61,00 | 22,01 | 22,90 | 24,08 | -     |
| 306553.0150.250 | • 1,5 | 0,75     | 25 | 4     | 1,45 | 60 | 2,4 | 61,00 | 27,28 | 28,17 | 29,47 | -     |
| 306553.0200.060 | • 2,0 | 1,00     | 6  | 4     | 1,92 | 40 | 3,0 | 59,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306553.0200.080 | • 2,0 | 1,00     | 8  | 4     | 1,92 | 60 | 3,0 | 62,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306553.0200.100 | • 2,0 | 1,00     | 10 | 4     | 1,92 | 60 | 3,0 | 62,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306553.0200.120 | • 2,0 | 1,00     | 12 | 4     | 1,92 | 60 | 3,0 | 62,00 | 13,72 | 14,40 | 15,34 | 16,11 |
| 306553.0200.160 | • 2,0 | 1,00     | 16 | 4     | 1,92 | 60 | 3,0 | 62,00 | 17,97 | 18,68 | 19,75 | -     |
| 306553.0200.180 | • 2,0 | 1,00     | 18 | 4     | 1,92 | 60 | 3,0 | 62,00 | 20,06 | 20,81 | 21,93 | -     |
| 306553.0200.200 | • 2,0 | 1,00     | 20 | 4     | 1,92 | 60 | 3,0 | 62,00 | 22,15 | 22,93 | 24,11 | -     |
| 306553.0200.240 | • 2,0 | 1,00     | 24 | 4     | 1,92 | 60 | 3,0 | 62,00 | 26,31 | 27,17 | 28,43 | -     |
| 306553.0200.300 | • 2,0 | 1,00     | 30 | 4     | 1,92 | 60 | 3,0 | 62,00 | 32,52 | 33,48 | -     | -     |

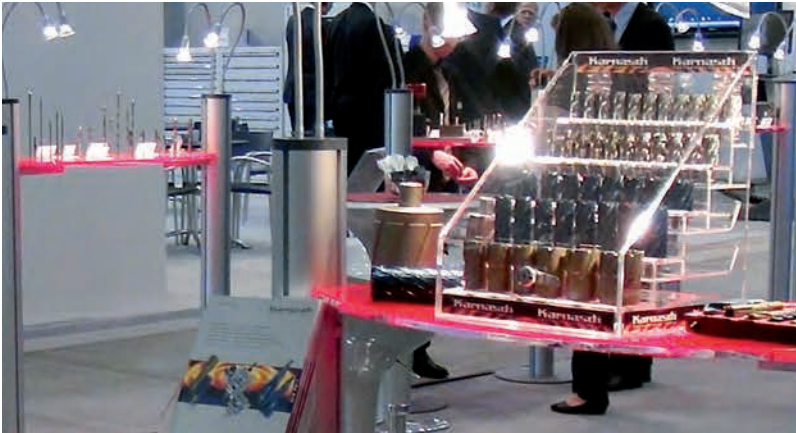
Alternative 30.6551 - Schaft / Shank 3mm  
Alternative 30.6554 - Schaft / Shank 6mm



Internationale Messevorstellungen  
International Trade Fairs

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**Karnasch**™  
PROFESSIONAL TOOLS



Art. **30.6554** **PROFESSIONAL** **DIAMANTBESCHICHTETER MICRO-3D-RADIUSFRÄSER < 25 x D SCHNITTtiefe**

GRAPHIT  
graphite

ZIRKO-  
NIUM

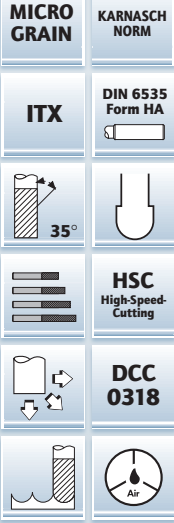
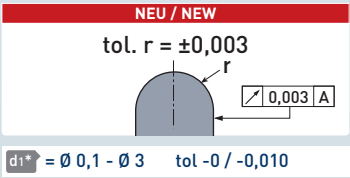
Zirkonoxid  
Zr O<sub>2</sub>  
gepresst

Zirkonoxid  
Zr O<sub>2</sub>  
gehippt

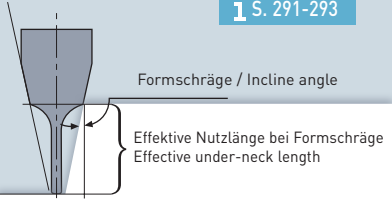
GFK-CFK  
GFK-CFK



- Diamond coated solid carbide 3D ball nose end mills, < 25 x diameter, HSC
- Microfresa metal duro de radio de 3D recubierta de diamante < 25 x D profundidad de corte, HSC
- Концевая микро-фреза 3D с угловым радиусом, глубина обработки < 25 x D, HSC



Schnittdaten  
Cutting data



| Art.            | d1*    | r ±0,003 | l3  | d2/h5 | d3   | l1 | l2   | €     | 0,5°  | 1°    | 2°    | 3°    |
|-----------------|--------|----------|-----|-------|------|----|------|-------|-------|-------|-------|-------|
| 306554.0010.002 | • 0,1  | 0,05     | 0,2 | 6     | 0,09 | 60 | 0,15 | 61,00 | 0,78  | 0,92  | 1,23  | 1,55  |
| 306554.0010.004 | • 0,1  | 0,05     | 0,4 | 6     | 0,09 | 60 | 0,15 | 61,00 | 1,01  | 1,18  | 1,52  | 1,86  |
| 306554.0015.003 | • 0,15 | 0,075    | 0,3 | 6     | 0,14 | 60 | 0,2  | 61,00 | 0,90  | 1,05  | 1,38  | 1,71  |
| 306554.0015.006 | • 0,15 | 0,075    | 0,6 | 6     | 0,14 | 60 | 0,2  | 61,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306554.0020.006 | • 0,2  | 0,10     | 0,6 | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,25  | 1,44  | 1,81  | 2,17  |
| 306554.0020.008 | • 0,2  | 0,10     | 0,8 | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,48  | 1,69  | 2,08  | 2,46  |
| 306554.0020.010 | • 0,2  | 0,10     | 1   | 6     | 0,18 | 60 | 0,3  | 61,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306554.0020.015 | • 0,2  | 0,10     | 1,5 | 6     | 0,18 | 60 | 0,3  | 61,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306554.0030.005 | • 0,3  | 0,15     | 0,5 | 6     | 0,27 | 60 | 0,5  | 61,00 | 1,13  | 1,31  | 1,67  | 2,02  |
| 306554.0030.01  | • 0,3  | 0,15     | 1   | 6     | 0,27 | 60 | 0,5  | 61,00 | 1,70  | 1,93  | 2,36  | 2,75  |
| 306554.0030.015 | • 0,3  | 0,15     | 1,5 | 6     | 0,27 | 60 | 0,5  | 61,00 | 2,27  | 2,54  | 3,01  | 3,44  |
| 306554.0030.02  | • 0,3  | 0,15     | 2   | 6     | 0,27 | 60 | 0,5  | 61,00 | 2,83  | 3,14  | 3,65  | 4,11  |
| 306554.0030.03  | • 0,3  | 0,15     | 3   | 6     | 0,27 | 60 | 0,5  | 61,00 | 3,94  | 4,30  | 4,89  | 5,40  |
| 306554.0030.045 | • 0,3  | 0,15     | 4,5 | 6     | 0,27 | 60 | 0,5  | 61,00 | 5,58  | 6,01  | 6,69  | 7,27  |
| 306554.0030.06  | • 0,3  | 0,15     | 6   | 6     | 0,27 | 60 | 0,5  | 61,00 | 7,21  | 7,69  | 8,45  | 9,08  |
| 306554.0040.01  | • 0,4  | 0,20     | 1   | 6     | 0,36 | 60 | 0,6  | 61,00 | 1,85  | 2,06  | 2,45  | 2,83  |
| 306554.0040.02  | • 0,4  | 0,20     | 2   | 6     | 0,36 | 60 | 0,6  | 61,00 | 2,96  | 3,23  | 3,73  | 4,17  |
| 306554.0040.03  | • 0,4  | 0,20     | 3   | 6     | 0,36 | 60 | 0,6  | 61,00 | 4,05  | 4,39  | 4,96  | 5,45  |
| 306554.0040.04  | • 0,4  | 0,20     | 4   | 6     | 0,36 | 60 | 0,6  | 61,00 | 5,14  | 5,52  | 6,15  | 6,70  |
| 306554.0040.06  | • 0,4  | 0,20     | 6   | 6     | 0,36 | 60 | 0,6  | 61,00 | 7,29  | 7,76  | 8,50  | 9,12  |
| 306554.0040.08  | • 0,4  | 0,20     | 8   | 6     | 0,36 | 60 | 0,6  | 61,00 | 9,43  | 9,96  | 10,79 | 11,47 |
| 306554.0050.02  | • 0,5  | 0,25     | 2   | 6     | 0,45 | 60 | 0,7  | 61,00 | 3,01  | 3,28  | 3,76  | 4,20  |
| 306554.0050.04  | • 0,5  | 0,25     | 4   | 6     | 0,45 | 60 | 0,7  | 61,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306554.0050.06  | • 0,5  | 0,25     | 6   | 6     | 0,45 | 60 | 0,7  | 61,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306554.0050.08  | • 0,5  | 0,25     | 8   | 6     | 0,45 | 60 | 0,7  | 61,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306554.0050.10  | • 0,5  | 0,25     | 10  | 6     | 0,45 | 60 | 0,7  | 61,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306554.0060.03  | • 0,6  | 0,30     | 3   | 6     | 0,55 | 60 | 1,0  | 63,00 | 4,10  | 4,43  | 4,99  | 5,48  |
| 306554.0060.06  | • 0,6  | 0,30     | 6   | 6     | 0,55 | 60 | 1,0  | 63,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306554.0060.09  | • 0,6  | 0,30     | 9   | 6     | 0,55 | 60 | 1,0  | 63,00 | 10,52 | 11,08 | 11,94 | 12,64 |
| 306554.0060.12  | • 0,6  | 0,30     | 12  | 6     | 0,55 | 60 | 1,0  | 63,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306554.0080.04  | • 0,8  | 0,40     | 4   | 6     | 0,75 | 60 | 1,2  | 63,00 | 5,18  | 5,56  | 6,18  | 6,72  |
| 306554.0080.06  | • 0,8  | 0,40     | 6   | 6     | 0,75 | 60 | 1,2  | 63,00 | 7,33  | 7,79  | 8,52  | 9,13  |
| 306554.0080.08  | • 0,8  | 0,40     | 8   | 6     | 0,75 | 60 | 1,2  | 63,00 | 9,46  | 9,99  | 10,81 | 11,48 |
| 306554.0080.12  | • 0,8  | 0,40     | 12  | 6     | 0,75 | 60 | 1,2  | 63,00 | 13,69 | 14,33 | 15,30 | 16,07 |
| 306554.0080.16  | • 0,8  | 0,40     | 16  | 6     | 0,75 | 60 | 1,2  | 63,00 | 17,89 | 18,62 | 19,71 | 20,57 |
| 306554.0100.05  | • 1,0  | 0,50     | 5   | 6     | 0,95 | 60 | 1,6  | 65,00 | 6,26  | 6,68  | 7,36  | 7,94  |
| 306554.0100.10  | • 1,0  | 0,50     | 10  | 6     | 0,95 | 60 | 1,6  | 65,00 | 11,58 | 12,17 | 13,06 | 13,79 |
| 306554.0100.15  | • 1,0  | 0,50     | 15  | 6     | 0,95 | 60 | 1,6  | 65,00 | 16,85 | 17,55 | 18,61 | 19,45 |
| 306554.0100.20  | • 1,0  | 0,50     | 20  | 6     | 0,95 | 60 | 1,6  | 65,00 | 22,07 | 22,88 | 24,07 | 24,99 |
| 306554.0100.25  | • 1,0  | 0,50     | 25  | 6     | 0,95 | 60 | 1,6  | 65,00 | 27,28 | 28,17 | 29,47 | -     |

Alternative 30.6551 - Schaft / Shank 3mm  
Alternative 30.6553 bis / until Ø2,0 - Schaft / Shank 4mm





PROFESSIONAL  
★ ★ ★

Art. **30.6554**

| Art.           | d1*   | r ±0,003 | l3 | d2/h5 | d3   | l1 | l2  | €     | 0,5°  | 1°    | 2°    | 3°    |
|----------------|-------|----------|----|-------|------|----|-----|-------|-------|-------|-------|-------|
| 306554.0150.05 | • 1,5 | 0,75     | 5  | 6     | 1,45 | 60 | 2,4 | 65,00 | 6,30  | 6,61  | 7,38  | 7,96  |
| 306554.0150.10 | • 1,5 | 0,75     | 10 | 6     | 1,45 | 60 | 2,4 | 65,00 | 11,62 | 12,19 | 13,08 | 13,81 |
| 306554.0150.15 | • 1,5 | 0,75     | 15 | 6     | 1,45 | 60 | 2,4 | 65,00 | 16,87 | 17,57 | 18,63 | 19,46 |
| 306554.0150.20 | • 1,5 | 0,75     | 20 | 6     | 1,45 | 60 | 2,4 | 65,00 | 22,01 | 22,90 | 24,08 | -     |
| 306554.0150.25 | • 1,5 | 0,75     | 25 | 6     | 1,45 | 60 | 2,4 | 65,00 | 27,28 | 28,17 | 29,47 | -     |
| 306554.0200.06 | • 2,0 | 1,00     | 6  | 6     | 1,92 | 60 | 3,0 | 66,00 | 7,45  | 7,88  | 8,58  | 9,19  |
| 306554.0200.08 | • 2,0 | 1,00     | 8  | 6     | 1,92 | 60 | 3,0 | 66,00 | 9,57  | 10,07 | 10,87 | 11,53 |
| 306554.0200.10 | • 2,0 | 1,00     | 10 | 6     | 1,92 | 60 | 3,0 | 66,00 | 11,68 | 12,24 | 13,12 | 13,84 |
| 306554.0200.12 | • 2,0 | 1,00     | 12 | 6     | 1,92 | 60 | 3,0 | 66,00 | 13,72 | 14,40 | 15,34 | 16,11 |
| 306554.0200.16 | • 2,0 | 1,00     | 16 | 6     | 1,92 | 60 | 3,0 | 66,00 | 17,97 | 18,68 | 19,75 | -     |
| 306554.0200.18 | • 2,0 | 1,00     | 18 | 6     | 1,92 | 60 | 3,0 | 66,00 | 20,06 | 20,81 | 21,93 | -     |
| 306554.0200.20 | • 2,0 | 1,00     | 20 | 6     | 1,92 | 60 | 3,0 | 66,00 | 22,15 | 22,93 | 24,11 | -     |
| 306554.0200.24 | • 2,0 | 1,00     | 24 | 6     | 1,92 | 60 | 3,0 | 66,00 | 26,31 | 27,17 | 28,43 | -     |
| 306554.0200.30 | • 2,0 | 1,00     | 30 | 6     | 1,92 | 60 | 3,0 | 66,00 | 32,52 | 33,48 | -     | -     |
| 306554.0300.09 | • 3,0 | 1,50     | 9  | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306554.0300.14 | • 3,0 | 1,50     | 14 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306554.0300.18 | • 3,0 | 1,50     | 18 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306554.0300.24 | • 3,0 | 1,50     | 24 | 6     | 2,90 | 60 | 3,5 | 74,00 | -     | -     | -     | -     |
| 306554.0300.30 | • 3,0 | 1,50     | 30 | 6     | 2,90 | 60 | 3,5 | 74,00 | 32,51 | 33,43 | 34,77 | -     |

Alternative 30.6551 - Schaft / Shank 3mm  
Alternative 30.6553 bis / until Ø2,0 - Schaft / Shank 4mm

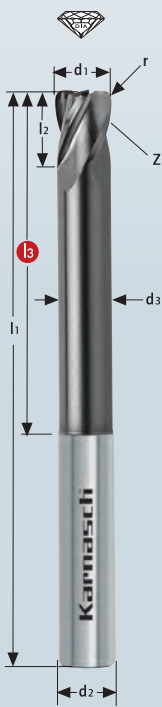
# KARNASCH COMPOSITES-TOOLS für die Carbonbearbeitung in der Automobilindustrie

→ PCD - CVD - MCD - ND



Art. 30.6560 EXPERT Diamantbeschichteter Gesenkfräser mit Eckenradius, < 12 x D Schnitttiefe

- GRAPHIT graphite
- GFK-CFK GFK-CFK
- zirkon oxid



- Solid Carbide end mills with corner radius, < 12 x diameter, extra long, HSC
- Fresadora metal duro de matrices con radio angular < 12 x D profundidad de corte, extra larga, HSC
- Штамповочная фреза с угловым радиусом, глубина обработки < 12 x D, особенно длинная, HSC

|     |              |                |
|-----|--------------|----------------|
| d1* | Ø 6,0 - 10,0 | -0,010 - 0,020 |
| d1* | Ø 12,0       | -0,010 - 0,025 |

| Art.                | d1*    | r   | l3  | d2 h5 | d3   | l1  | l2 | Z | €      |
|---------------------|--------|-----|-----|-------|------|-----|----|---|--------|
| 306560.0600.050.30  | • 6,0  | 0,5 | 30  | 6     | 5,7  | 100 | 9  | 4 | 122,00 |
| 306560.0600.050.60  | • 6,0  | 0,5 | 60  | 6     | 5,7  | 100 | 9  | 4 | 129,00 |
| 306560.0600.100.30  | • 6,0  | 1,0 | 30  | 6     | 5,7  | 100 | 9  | 4 | 122,00 |
| 306560.0600.100.60  | • 6,0  | 1,0 | 60  | 6     | 5,7  | 100 | 9  | 4 | 129,00 |
| 306560.0800.050.030 | • 8,0  | 0,5 | 30  | 8     | 7,6  | 100 | 12 | 4 | 146,00 |
| 306560.0800.050.060 | • 8,0  | 0,5 | 60  | 8     | 7,6  | 120 | 12 | 4 | 167,00 |
| 306560.0800.050.100 | • 8,0  | 0,5 | 100 | 8     | 7,6  | 150 | 12 | 4 | 185,00 |
| 306560.0800.100.030 | • 8,0  | 1,0 | 30  | 8     | 7,6  | 100 | 12 | 4 | 146,00 |
| 306560.0800.100.060 | • 8,0  | 1,0 | 60  | 8     | 7,6  | 120 | 12 | 4 | 167,00 |
| 306560.0800.100.100 | • 8,0  | 1,0 | 100 | 8     | 7,6  | 150 | 12 | 4 | 185,00 |
| 306560.1000.050.030 | • 10,0 | 0,5 | 30  | 10    | 9,5  | 100 | 15 | 4 | 172,00 |
| 306560.1000.050.060 | • 10,0 | 0,5 | 60  | 10    | 9,5  | 120 | 15 | 4 | 193,00 |
| 306560.1000.050.100 | • 10,0 | 0,5 | 100 | 10    | 9,5  | 150 | 15 | 4 | 223,00 |
| 306560.1000.100.030 | • 10,0 | 1,0 | 30  | 10    | 9,5  | 100 | 15 | 4 | 172,00 |
| 306560.1000.100.060 | • 10,0 | 1,0 | 60  | 10    | 9,5  | 120 | 15 | 4 | 193,00 |
| 306560.1000.100.100 | • 10,0 | 1,0 | 100 | 10    | 9,5  | 150 | 15 | 4 | 223,00 |
| 306560.1200.100.45  | • 12,0 | 1,0 | 45  | 12    | 11,0 | 100 | 18 | 4 | 199,00 |
| 306560.1200.100.60  | • 12,0 | 1,0 | 60  | 12    | 11,0 | 150 | 18 | 4 | 232,00 |

MICRO GRAIN KARNASCH NORM

ITX DIN 6535 Form HA

30°

HSC High-Speed-Cutting

DCC 0318

Air

Schnittdaten  
Cutting data



30.6551 Ø 8,0 Diamantbeschichtung

DIAMOND COATED

Objektiv Z 250 : 500x

Ø 8,0  
Diamantbeschichtete Schneidkante  
Diamond coated cutting edge  
Bordo di taglio diamantato  
Резущая кромка с алмазным слоем



## VHM-3D-Radiusfräser/Schaftfräser, CAD/CAM

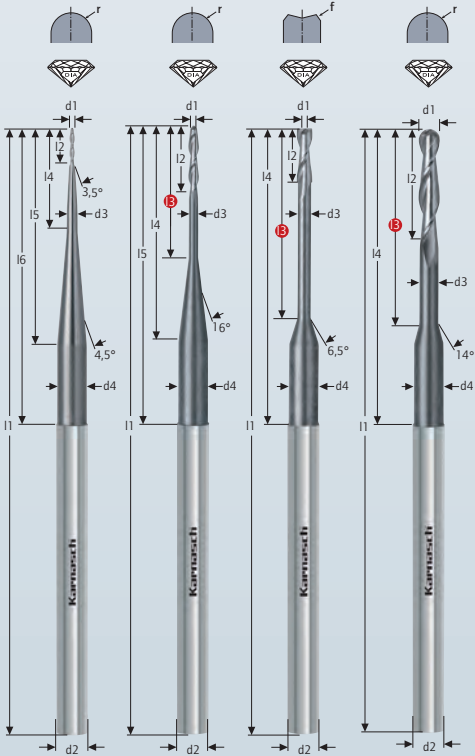
Art. 30.6561-5TEC

**GRAPHIT**  
*graphite*

## ZIRKONIUM

**Zirkonoxid  
Zr O<sub>2</sub>  
gepresst**

**Zirkonoxid  
Zr O<sub>2</sub>  
gehippt**



 Solid carbide 3D ball nose and corner chamfer end mills, HSC, CAD/CAM

 Microfresa metal duro de radio de 3D y esquina chaflán,  
HSC, CAD/CAM

 Цельно-твердосплавная радиусная фреза для 3D-фрезерования и концевая фреза для высокоскоростной резки (HSC), для систем CAD/CAM



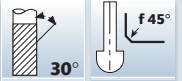
Preise siehe Katalog Dental  
Prices please see catalogue Dental

**MICRO  
GRAIN  
CLEAN**

### KARNASCH NORM

**SPEZIAL**

Form HA



## HSC



Schnittdaten  
Cutting data



**i** S. 292

| Art.             | d1    | r/f  | l3   | d2 h6 | d3    | d4  | l4   | l5   | l6   | l2 | l1 |
|------------------|-------|------|------|-------|-------|-----|------|------|------|----|----|
| 306561.0050-5TEC | • 0,5 | 0,25 | -    | 3     | 1,045 | 2,8 | 9,45 | 20,0 | 27,4 | 3  | 51 |
| 306561.0100-5TEC | • 1,0 | 0,5  | 12,0 | 3     | 0,9   | 2,8 | 20,0 | 27,4 | -    | 6  | 57 |
| 306561.0150-5TEC | • 1,5 | f    | 17,5 | 3     | 1,3   | 2,8 | 27,4 | -    | -    | 5  | 57 |
| 306561.0200-5TEC | • 2,0 | 1,0  | 18,0 | 3     | 1,8   | 2,8 | 27,4 | -    | -    | 10 | 57 |

Zirkonium

Chrom-Cobalt



E-MAX Rohling



Mehr Details finden Sie unter  
[www.karnasch.com](http://www.karnasch.com)



Art. 29.0305

EXPERT  
★ ★ ★

Diamantbeschichteter Vollhartmetall Schlichtfräser "UGT"

GRAPHIT  
graphite

COMPO-  
SITES

GFK

CFK

AFK  
Aramid



- Diamond coated solid carbide smooth milling cutter, non symmetrical spirals
- Fresa de acabado de metal duro macizo recubierta de diamante, espiral desigual
- Цельно-твёрдосплавная чистовая фреза с алмазным напылением  
неравная спираль

| Empfohlene<br>Schnittdaten | GFK     | CFK     |
|----------------------------|---------|---------|
| Vc m/min.                  | 100-180 | 100-180 |
| f/U mm                     | 0,3-0,5 | 0,2-0,4 |

Optimale Bearbeitungsdaten müssen  
während der Einlaufphase ermittelt werden.

| Art.              | d1     | l2 | d2   | l1  | Z | €      |
|-------------------|--------|----|------|-----|---|--------|
| 290305.0300.10.04 | • 3,0  | 10 | 4    | 40  | 4 | 78,00  |
| 290305.0400.15.04 | • 4,0  | 15 | 6    | 50  | 4 | 100,00 |
| 290305.0500.15.04 | • 5,0  | 15 | 6    | 50  | 4 | 113,00 |
| 290305.0600.15.04 | • 6,0  | 15 | 6    | 50  | 4 | 113,00 |
| 290305.0600.25.04 | • 6,0  | 25 | 6    | 64  | 4 | 128,00 |
| 290305.0635.26.04 | • 6,35 | 26 | 6,35 | 64  | 4 | 144,00 |
| 290305.0800.15.04 | • 8,0  | 15 | 8    | 60  | 4 | 144,00 |
| 290305.0800.30.04 | • 8,0  | 30 | 8    | 76  | 4 | 161,00 |
| 290305.0953.30.04 | • 9,53 | 30 | 9,53 | 64  | 4 | 185,00 |
| 290305.1000.20.04 | • 10,0 | 20 | 10   | 73  | 4 | 176,00 |
| 290305.1000.40.04 | • 10,0 | 40 | 10   | 93  | 4 | 200,00 |
| 290305.1200.20.04 | • 12,0 | 20 | 12   | 73  | 4 | 196,00 |
| 290305.1200.40.04 | • 12,0 | 40 | 12   | 96  | 4 | 222,00 |
| 290305.1600.20.04 | • 16,0 | 20 | 16   | 80  | 4 | 276,00 |
| 290305.1600.20.06 | • 16,0 | 20 | 16   | 80  | 6 | 287,00 |
| 290305.1600.40.04 | • 16,0 | 40 | 16   | 100 | 4 | 311,00 |
| 290305.1600.40.06 | • 16,0 | 40 | 16   | 100 | 6 | 323,00 |
| 290305.2000.20.04 | • 20,0 | 20 | 20   | 80  | 4 | 372,00 |
| 290305.2000.20.08 | • 20,0 | 20 | 20   | 80  | 8 | 391,00 |
| 290305.2000.42.04 | • 20,0 | 42 | 20   | 105 | 4 | 427,00 |
| 290305.2000.42.08 | • 20,0 | 42 | 20   | 105 | 8 | 442,00 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HSC  
HPC

DCA-06  
PLUS



Schnittdaten  
Cutting data



i S. 96

Art. 30.6572

T O P  
★ ★ ★

Diamantbeschichteter Vollhartmetall Schruppfräser, gerade Stirn mit Eckfase

GRAPHIT  
graphite

GFK-CFK  
GFK-CFK

PA66  
GF30

PVDF  
GF30

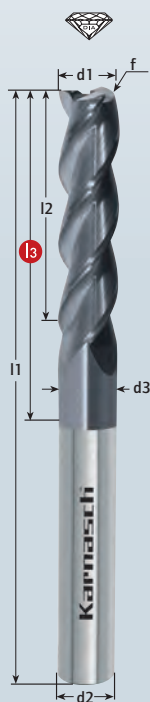
PEEK  
GF30

PEEK  
CF30

GF  
GF25

PVDF  
GF25

zirkon  
oxid



- Graphite – roughing end mills for large working depths with a straight front
- Fresa desbastadora de grafito para gran profundidad de trabajo, versión frontal recta
- Графитовая обдирная фреза для большой рабочей глубины с прямым торцом

| Art.                | d1*    | f    | l2  | l3 | d2 h5 | d3  | l1  | Z | €      |
|---------------------|--------|------|-----|----|-------|-----|-----|---|--------|
| 306572.0300.005.10  | • 3,0  | 0,05 | 10  | -  | 4     | -   | 50  | 3 | 69,00  |
| 306572.0300.005.20  | • 3,0  | 0,05 | 20  | -  | 4     | -   | 60  | 3 | 79,00  |
| 306572.0300.005.30  | • 3,0  | 0,05 | 30  | -  | 4     | -   | 75  | 3 | 85,00  |
| 306572.0300.005.35  | • 3,0  | 0,05 | 35  | 50 | 4     | 2,8 | 100 | 3 | 93,00  |
| 306572.0400.005.10  | • 4,0  | 0,05 | 10  | -  | 6     | -   | 50  | 3 | 82,00  |
| 306572.0400.005.20  | • 4,0  | 0,05 | 20  | -  | 6     | -   | 60  | 3 | 92,00  |
| 306572.0400.005.30  | • 4,0  | 0,05 | 30  | -  | 6     | -   | 75  | 3 | 100,00 |
| 306572.0400.005.40  | • 4,0  | 0,05 | 40  | 50 | 6     | 3,8 | 100 | 3 | 109,00 |
| 306572.0500.005.20  | • 5,0  | 0,05 | 20  | -  | 6     | -   | 60  | 3 | 100,00 |
| 306572.0500.005.30  | • 5,0  | 0,05 | 30  | -  | 6     | -   | 75  | 3 | 108,00 |
| 306572.0500.005.40  | • 5,0  | 0,05 | 40  | 50 | 6     | 4,8 | 100 | 3 | 117,00 |
| 306572.0600.005.30  | • 6,0  | 0,05 | 30  | -  | 6     | -   | 75  | 3 | 107,00 |
| 306572.0600.005.40  | • 6,0  | 0,05 | 40  | 50 | 6     | -   | 100 | 3 | 121,00 |
| 306572.0800.005.30  | • 8,0  | 0,05 | 30  | -  | 8     | -   | 75  | 3 | 131,00 |
| 306572.0800.005.40  | • 8,0  | 0,05 | 40  | 60 | 8     | 7,8 | 120 | 3 | 148,00 |
| 306572.1000.005.30  | • 10,0 | 0,05 | 30  | -  | 10    | -   | 75  | 4 | 163,00 |
| 306572.1000.005.40  | • 10,0 | 0,05 | 40  | -  | 10    | -   | 100 | 4 | 175,00 |
| 306572.1000.005.60  | • 10,0 | 0,05 | 60  | -  | 10    | -   | 120 | 4 | 220,00 |
| 306572.1200.005.45  | • 12,0 | 0,05 | 45  | -  | 12    | -   | 100 | 4 | 194,00 |
| 306572.1200.005.75  | • 12,0 | 0,05 | 75  | -  | 12    | -   | 120 | 4 | 235,00 |
| 306572.1600.005.45  | • 16,0 | 0,05 | 45  | -  | 16    | -   | 100 | 4 | 334,00 |
| 306572.1600.005.75  | • 16,0 | 0,05 | 75  | -  | 16    | -   | 150 | 4 | 410,00 |
| 306572.2000.005.055 | • 20,0 | 0,05 | 55  | -  | 20    | -   | 100 | 4 | 476,00 |
| 306572.2000.005.075 | • 20,0 | 0,05 | 75  | -  | 20    | -   | 150 | 4 | 595,00 |
| 306572.2000.005.110 | • 20,0 | 0,05 | 110 | -  | 20    | -   | 180 | 4 | 917,00 |

MICRO  
GRAIN

KARNASCH  
NORM

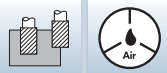
ITX

DIN 6535  
Form HA



HSC  
HPC

DCC  
0318



Schnittdaten  
Cutting data



i S. 304

Diamantbeschichteter Vollhartmetall Schruppfräser, Eckradius

T O P  
★ ★ ★ Art. **30.6573**

GRAPHIT  
graphite

GFK-CFK  
GFK-CFK

PA66  
GF30

PVDF  
GF30

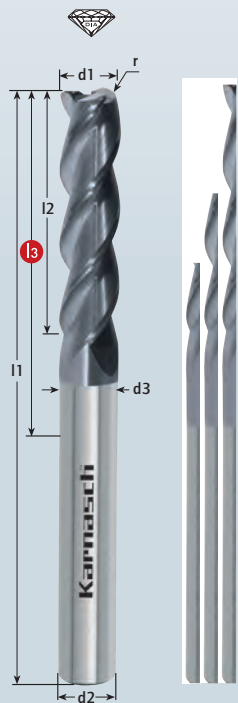
PEEK  
GF30

PEEK  
CF30

GF  
GF25

PVDF  
GF25

zirkon  
oxid



|     |              |                 |
|-----|--------------|-----------------|
| d1* | Ø 3,0 - 6,0  | -0,002 / -0,022 |
| d1* | Ø 8,0 - 16,0 | -0,002 / -0,032 |
| d1* | Ø 20         | -0,002 / -0,037 |



Ø 3 - Ø 8



Ø 10 - Ø 20

- Graphite – roughing end mills for large working depths with corner radius
- Fresa desbastadora de grafito para gran profundidad de trabajo, con radio angular
- Графитовая обдирная фреза для большой рабочей глубины с угловым радиусом

| Test 1                       | Reale Schnittdaten<br>Real cutting data                                                                                                                                                     | Test 2                       | Reale Schnittdaten<br>Real cutting data                                                                                                                                              |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Werkstoff /<br>Work material | Graphit / Graphite<br>Tool Ø10x40 r = 0,5<br>Vorschlichten / Semi finishing<br>Vc = 267 m/min<br>n = 8500 min <sup>-1</sup><br>Vf = 3000 mm/min<br>fz = 0,088 mm<br>ap = 40 mm<br>ae = 2 mm | Werkstoff /<br>Work material | Graphit / Graphite<br>Tool Ø10x40 r=0,5<br>Schlichten / Finishing<br>Vc = 361 m/min<br>n = 11500 min <sup>-1</sup><br>Vf = 3000 mm/min<br>fz = 0,065 mm<br>ap = 40 mm<br>ae = 2,5 mm |

| Art.                | d1*    | r    | l2  | l3 | d2 h5 | d3  | l1  | Z | €      |
|---------------------|--------|------|-----|----|-------|-----|-----|---|--------|
| 306573.0300.030.10  | • 3,0  | 0,30 | 10  | -  | 4     | -   | 50  | 3 | 69,00  |
| 306573.0300.030.20  | • 3,0  | 0,30 | 20  | -  | 4     | -   | 60  | 3 | 79,00  |
| 306573.0300.030.30  | • 3,0  | 0,30 | 30  | -  | 4     | -   | 75  | 3 | 85,00  |
| 306573.0300.030.35  | • 3,0  | 0,30 | 35  | 50 | 4     | 2,8 | 100 | 3 | 93,00  |
| 306573.0400.030.10  | • 4,0  | 0,30 | 10  | -  | 6     | -   | 50  | 3 | 82,00  |
| 306573.0400.030.20  | • 4,0  | 0,30 | 20  | -  | 6     | -   | 60  | 3 | 92,00  |
| 306573.0400.030.30  | • 4,0  | 0,30 | 30  | -  | 6     | -   | 75  | 3 | 100,00 |
| 306573.0400.030.40  | • 4,0  | 0,30 | 40  | 50 | 6     | 3,8 | 100 | 3 | 109,00 |
| 306573.0500.030.20  | • 5,0  | 0,30 | 20  | -  | 6     | -   | 60  | 3 | 100,00 |
| 306573.0500.030.30  | • 5,0  | 0,30 | 30  | -  | 6     | -   | 75  | 3 | 108,00 |
| 306573.0500.030.40  | • 5,0  | 0,30 | 40  | 50 | 6     | 4,8 | 100 | 3 | 117,00 |
| 306573.0600.030.30  | • 6,0  | 0,30 | 30  | -  | 6     | -   | 75  | 3 | 107,00 |
| 306573.0600.030.40  | • 6,0  | 0,30 | 40  | 50 | 6     | -   | 100 | 3 | 121,00 |
| 306573.0800.050.30  | • 8,0  | 0,50 | 30  | -  | 8     | -   | 75  | 3 | 131,00 |
| 306573.0800.050.40  | • 8,0  | 0,50 | 40  | 60 | 8     | 7,8 | 120 | 3 | 148,00 |
| 306573.1000.050.30  | • 10,0 | 0,50 | 30  | -  | 10    | -   | 75  | 4 | 163,00 |
| 306573.1000.050.40  | • 10,0 | 0,50 | 40  | -  | 10    | -   | 100 | 4 | 175,00 |
| 306573.1000.050.60  | • 10,0 | 0,50 | 60  | -  | 10    | -   | 120 | 4 | 220,00 |
| 306573.1200.050.45  | • 12,0 | 0,50 | 45  | -  | 12    | -   | 100 | 4 | 194,00 |
| 306573.1200.050.75  | • 12,0 | 0,50 | 75  | -  | 12    | -   | 120 | 4 | 235,00 |
| 306573.1600.100.45  | • 16,0 | 1,00 | 45  | -  | 16    | -   | 100 | 4 | 334,00 |
| 306573.1600.100.75  | • 16,0 | 1,00 | 75  | -  | 16    | -   | 150 | 4 | 410,00 |
| 306573.2000.100.055 | • 20,0 | 1,00 | 55  | -  | 20    | -   | 100 | 4 | 476,00 |
| 306573.2000.100.075 | • 20,0 | 1,00 | 75  | -  | 20    | -   | 150 | 4 | 595,00 |
| 306573.2000.100.110 | • 20,0 | 1,00 | 110 | -  | 20    | -   | 180 | 4 | 917,00 |

MICRO  
GRAIN

KARNASCH  
NORM

ITX

DIN 6535  
Form HA



HSC  
HPC



DCC  
0318



Schnittdaten  
Cutting data



i S. 304



MOVIE

Diamantbeschichteter Vollhartmetall Graphit Schruppfräser, Kugelstirn

T O P  
★ ★ ★ Art. **30.6574**

GRAPHIT  
graphite

GFK-CFK  
GFK-CFK

PA66  
GF30

PVDF  
GF30

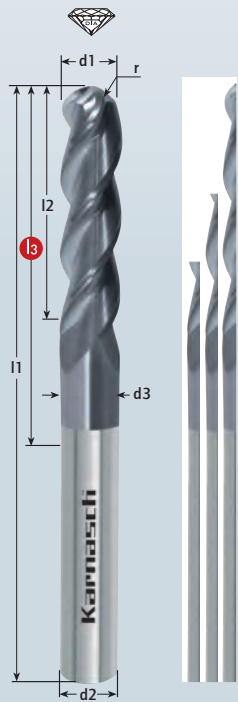
PEEK  
GF30

PEEK  
CF30

GF  
GF25

PVDF  
GF25

zirkon  
oxid



|     |              |                 |
|-----|--------------|-----------------|
| d1* | Ø 3,0 - 6,0  | -0,002 / -0,022 |
| d1* | Ø 8,0 - 16,0 | -0,002 / -0,032 |
| d1* | Ø 20         | -0,002 / -0,037 |



Ø 3 - Ø 8



Ø 10 - Ø 20

- Graphite roughing end mills for large working depths with 3D ball nose end mill
- Fresa desbastadora de grafito para gran profundidad de trabajo, con radio entero
- Графитовая обдирная фреза для большой рабочей глубины с полным радиусом

| Art.            | d1*    | r    | l2  | l3 | d2 h5 | d3  | l1  | Z | €      |
|-----------------|--------|------|-----|----|-------|-----|-----|---|--------|
| 306574.0300.010 | • 3,0  | 1,5  | 10  | -  | 4     | -   | 50  | 3 | 69,00  |
| 306574.0300.020 | • 3,0  | 1,5  | 20  | -  | 4     | -   | 60  | 3 | 79,00  |
| 306574.0300.030 | • 3,0  | 1,5  | 30  | -  | 4     | -   | 75  | 3 | 85,00  |
| 306574.0300.035 | • 3,0  | 1,5  | 35  | 50 | 4     | 2,8 | 100 | 3 | 93,00  |
| 306574.0400.010 | • 4,0  | 2,0  | 10  | -  | 6     | -   | 50  | 3 | 82,00  |
| 306574.0400.020 | • 4,0  | 2,0  | 20  | -  | 6     | -   | 60  | 3 | 92,00  |
| 306574.0400.030 | • 4,0  | 2,0  | 30  | -  | 6     | -   | 75  | 3 | 100,00 |
| 306574.0400.040 | • 4,0  | 2,0  | 40  | 50 | 6     | 3,8 | 100 | 3 | 109,00 |
| 306574.0500.020 | • 5,0  | 2,5  | 20  | -  | 6     | -   | 60  | 3 | 100,00 |
| 306574.0500.030 | • 5,0  | 2,5  | 30  | -  | 6     | -   | 75  | 3 | 108,00 |
| 306574.0500.040 | • 5,0  | 2,5  | 40  | 50 | 6     | 4,8 | 100 | 3 | 117,00 |
| 306574.0600.030 | • 6,0  | 3,0  | 30  | -  | 6     | -   | 75  | 3 | 107,00 |
| 306574.0600.040 | • 6,0  | 3,0  | 40  | 50 | 6     | -   | 100 | 3 | 121,00 |
| 306574.0800.030 | • 8,0  | 4,0  | 30  | -  | 8     | -   | 75  | 3 | 131,00 |
| 306574.0800.040 | • 8,0  | 4,0  | 40  | 60 | 8     | 7,8 | 120 | 3 | 148,00 |
| 306574.1000.030 | • 10,0 | 5,0  | 30  | -  | 10    | -   | 75  | 4 | 163,00 |
| 306574.1000.040 | • 10,0 | 5,0  | 40  | -  | 10    | -   | 100 | 4 | 175,00 |
| 306574.1000.060 | • 10,0 | 5,0  | 60  | -  | 10    | -   | 120 | 4 | 220,00 |
| 306574.1200.045 | • 12,0 | 6,0  | 45  | -  | 12    | -   | 100 | 4 | 194,00 |
| 306574.1200.075 | • 12,0 | 6,0  | 75  | -  | 12    | -   | 120 | 4 | 235,00 |
| 306574.1600.045 | • 16,0 | 8,0  | 45  | -  | 16    | -   | 100 | 4 | 334,00 |
| 306574.1600.075 | • 16,0 | 8,0  | 75  | -  | 16    | -   | 150 | 4 | 410,00 |
| 306574.2000.055 | • 20,0 | 10,0 | 55  | -  | 20    | -   | 100 | 4 | 476,00 |
| 306574.2000.075 | • 20,0 | 10,0 | 75  | -  | 20    | -   | 150 | 4 | 595,00 |
| 306574.2000.110 | • 20,0 | 10,0 | 110 | -  | 20    | -   | 180 | 4 | 917,00 |

MICRO  
GRAIN

KARNASCH  
NORM

ITX

DIN 6535  
Form HA



HSC  
HPC



DCC  
0318



Schnittdaten  
Cutting data



i S. 304



Art. 30.6591

T O P

Diamantbeschichteter Schruppfräser < 7xD Schnitttiefe, HSC

GRAPHIT  
graphite

GF  
GF25

ALU  
> 6% Si

PVDF  
GF25

GFK-CFK  
GFK-CFK

kurz-  
spanend  
short chip

Aramid-  
faser  
AFK-SFK

Hybrid-  
stoffe

Schicht-  
stoffe  
Laminat

zirkon  
oxid

PVDF  
GF30

PEEK  
GF30

PEEK  
CF30



- Diamond coated roughing end mills, < 7xD cutting depth, HSC
- Fresa metal duro recubierta de diamante de desbastar < 7xD profundidad de corte, HSC
- Обдирочная фреза, глубина обработки < 7xD, HSC

| Test                         | Reale Schnittdaten<br>Real cutting data                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Werkstoff /<br>Work material | Graphit / Graphite<br>Tool Ø 12,0<br>Vc= 320 m/min<br>n= 8500 min <sup>-1</sup><br>Vf= 4000 mm/min<br>ap= 10 mm<br>ae= 3 mm |

| Art.            | d1 +0/-0,12 | l1  | l2 | l3 | d2 h6 | d3   | Z | €      |
|-----------------|-------------|-----|----|----|-------|------|---|--------|
| 306591.0300.050 | • 3         | 50  | 13 | -  | 3     | -    | 6 | 48,00  |
| 306591.0400.050 | • 4         | 50  | 16 | -  | 4     | -    | 6 | 65,00  |
| 306591.0600.063 | • 6         | 63  | 19 | -  | 6     | -    | 6 | 88,00  |
| 306591.0600.100 | • 6         | 100 | 19 | 45 | 6     | 5,5  | 6 | 103,00 |
| 306591.0800.063 | • 8         | 63  | 25 | -  | 8     | -    | 6 | 115,00 |
| 306591.0800.100 | • 8         | 100 | 25 | 55 | 8     | 7,5  | 6 | 135,00 |
| 306591.1000.072 | • 10        | 72  | 25 | -  | 10    | -    | 6 | 141,00 |
| 306591.1000.100 | • 10        | 100 | 25 | 60 | 10    | 9,5  | 6 | 172,00 |
| 306591.1200.083 | • 12        | 83  | 30 | -  | 12    | -    | 6 | 190,00 |
| 306591.1200.100 | • 12        | 100 | 30 | 60 | 12    | 11,5 | 6 | 230,00 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

DCA-  
06

Schnittdaten  
Cutting data



i S. 293



Art. 30.6592

T O P

Diamantbeschichteter Schruppfräser < 7xD Schnitttiefe, HSC

GRAPHIT  
graphite

GF  
GF25

ALU  
> 6% Si

PVDF  
GF25

GFK-CFK  
GFK-CFK

kurz-  
spanend  
short chip

Aramid-  
faser  
AFK-SFK

Hybrid-  
stoffe

Schicht-  
stoffe  
Laminat

zirkon  
oxid

PVDF  
GF30

PEEK  
GF30

PEEK  
CF30



- Diamond coated Roughing end mills, < 7xD cutting legth, HSC
- Fresa metal duro recubierta de diamante de desbastar < 7xD profundidad de corte, HSC
- Обдирочная фреза, глубина обработки < 7xD, HSC

| Art.            | d1 +0/-0,12 | r   | l1  | l2 | l3 | d2/h6 | d3   | Z | €      |
|-----------------|-------------|-----|-----|----|----|-------|------|---|--------|
| 306592.0300.050 | • 3         | 1,5 | 50  | 13 | -  | 3     | -    | 6 | 51,00  |
| 306592.0400.050 | • 4         | 2,0 | 50  | 16 | -  | 4     | -    | 6 | 68,00  |
| 306592.0600.063 | • 6         | 3,0 | 63  | 19 | -  | 6     | -    | 6 | 92,00  |
| 306592.0600.100 | • 6         | 3,0 | 100 | 19 | 45 | 6     | 5,5  | 6 | 106,00 |
| 306592.0800.063 | • 8         | 4,0 | 63  | 25 | -  | 8     | -    | 6 | 120,00 |
| 306592.0800.100 | • 8         | 4,0 | 100 | 25 | 55 | 8     | 7,5  | 6 | 142,00 |
| 306592.1000.072 | • 10        | 5,0 | 72  | 25 | -  | 10    | -    | 6 | 147,00 |
| 306592.1000.100 | • 10        | 5,0 | 100 | 25 | 60 | 10    | 9,5  | 6 | 180,00 |
| 306592.1200.083 | • 12        | 6,0 | 83  | 30 | -  | 12    | -    | 6 | 201,00 |
| 306592.1200.100 | • 12        | 6,0 | 100 | 30 | 60 | 12    | 11,5 | 6 | 242,00 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

DCA-  
06

Schnittdaten  
Cutting data



i S. 293



Schruppfräser < 7xD Schnitttiefe, HSC

T O P  
★ ★ ★ Art. **30.6593**

GRAPHIT  
graphite

ALU  
> 6% Si

GFK-CFK  
GFK-CFK

kurz-  
spanend  
short chip

zirkon  
oxid



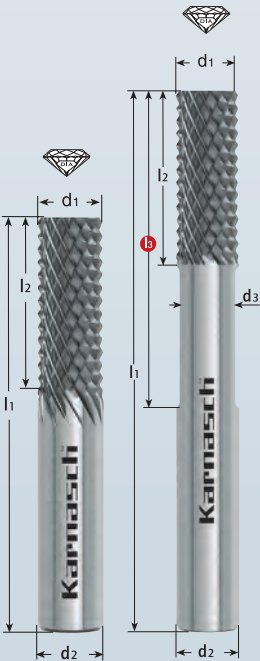
- Diamond coated Roughing end mills, < 7xD cutting depth, HSC
- Fresa metal duro recubierta de diamante de desbastar < 7xD profundidad de corte, HSC
- Обдирочная фреза, глубина обработки < 7xD, HSC

**MICRO GRAIN**  
KARNASCH NORM

**DIACUT**  
DIN 6535 Form HA

**HSC**  
High-Speed-Cutting

**DCA-06**



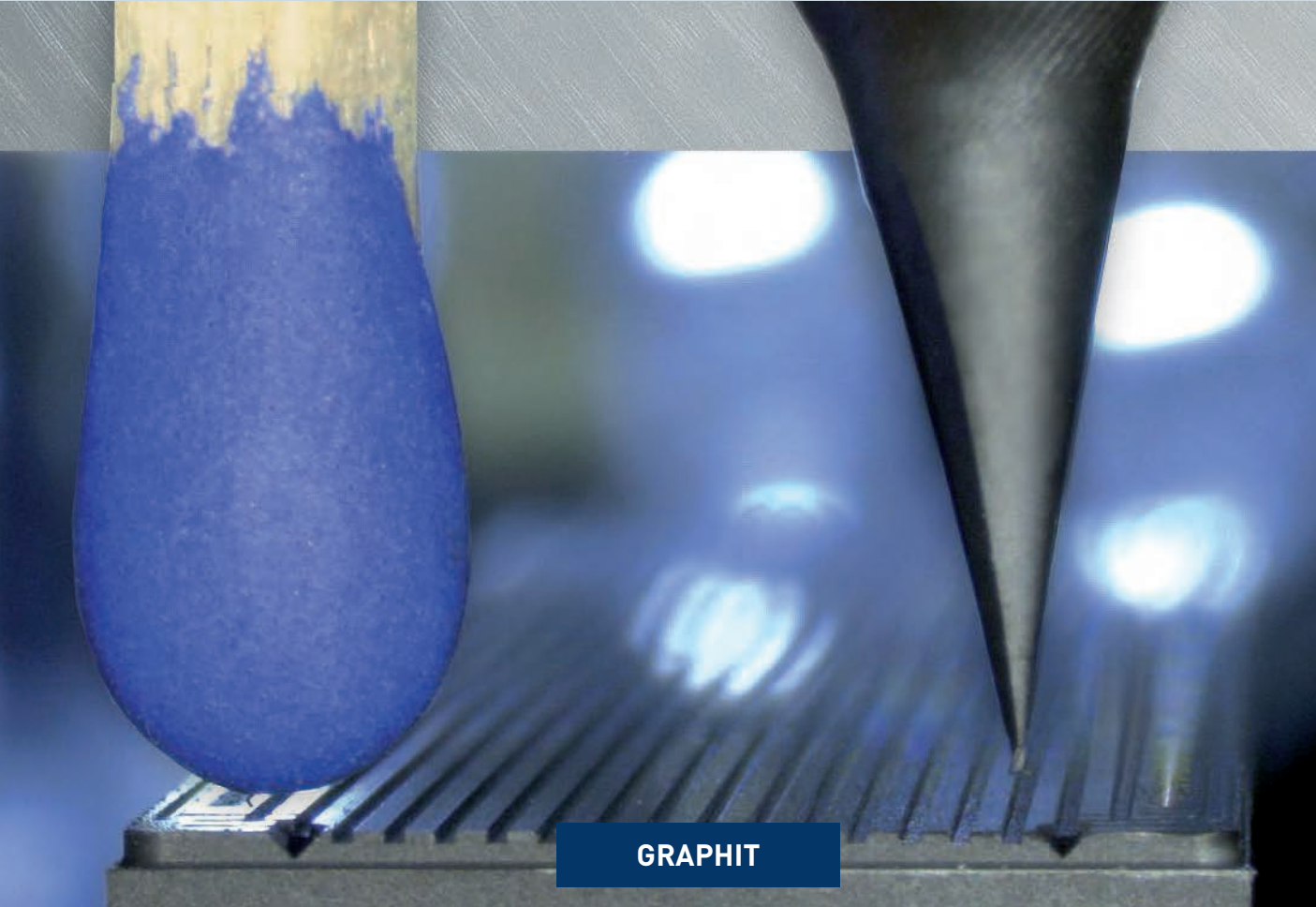
| Art.           | d1 +0/-0,12 | l1 | l3 | l2 | d3   | d2 h6 | €      |
|----------------|-------------|----|----|----|------|-------|--------|
| 306593.0300.45 | • 3,0       | 45 | -  | 10 | -    | 3     | 25,00  |
| 306593.0400.45 | • 4,0       | 45 | -  | 10 | -    | 4     | 33,00  |
| 306593.0600.58 | • 6,0       | 58 | -  | 15 | -    | 6     | 50,00  |
| 306593.0600.95 | • 6,0       | 95 | 40 | 15 | 5,5  | 6     | 59,00  |
| 306593.0800.58 | • 8,0       | 58 | -  | 20 | -    | 8     | 71,00  |
| 306593.0800.95 | • 8,0       | 95 | 50 | 20 | 7,5  | 8     | 83,00  |
| 306593.1000.65 | • 10,0      | 65 | -  | 20 | -    | 10    | 92,00  |
| 306593.1000.95 | • 10,0      | 95 | 50 | 20 | 9,5  | 10    | 98,00  |
| 306593.1200.75 | • 12,0      | 75 | -  | 20 | -    | 12    | 109,00 |
| 306593.1200.92 | • 12,0      | 92 | 50 | 20 | 11,5 | 12    | 115,00 |

Nachfolgewerkzeug / Replacement article 30.6591

Schnittdaten  
Cutting data



i S. 293



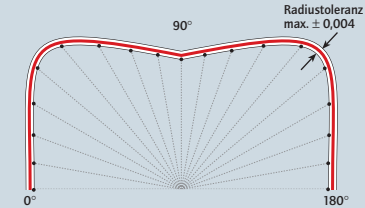
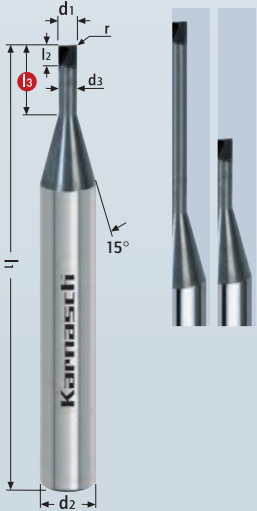
GRAPHIT

Art. 30.6632 PROFESSIONAL CBN Eckenradius High-End Micro Schaftfräser < 6 x D Schnitttiefe, Schaft 4 mm / 6 mm

- VANADIS 4  
Extra  
Superclean
- PULVER-  
METALLE  
über  
> 60 HRC
- HRC  
< 72
- HRC  
< 65
- HRC  
< 60
- NI-ALLOYS  
< 900 N/mm
- GJL
- GJS
- GTW  
GTS



- CBN end mills with corner radius < 6 x D cutting depth, shank 4 mm / 6 mm
- Fresas de CBN con radio, < 6 x D profundidad de corte, vástago 4 mm / 6 mm.
- Концевая фреза CBN с угловым радиусом, рабочая глубина < 6 x D, хвостовик 4 мм / 6 мм



| Art.                | d1 +0/- 0,01 | rp ± 0,004 | l3  | d2 h5 | d3   | l1 | l2  | Z | €      |
|---------------------|--------------|------------|-----|-------|------|----|-----|---|--------|
| 306632.0030.003.01  | • 0,3        | 0,03       | 1   | 6     | 0,26 | 50 | 0,3 | 2 | 100,00 |
| 306632.0030.003.02  | • 0,3        | 0,03       | 2   | 6     | 0,26 | 50 | 0,3 | 2 | 100,00 |
| 306632.0040.004.01  | • 0,4        | 0,04       | 1   | 6     | 0,36 | 50 | 0,4 | 2 | 100,00 |
| 306632.0040.004.02  | • 0,4        | 0,04       | 2   | 6     | 0,36 | 50 | 0,4 | 2 | 100,00 |
| 306632.0040.005     | • 0,4        | 0,05       | -   | 4     | 0,38 | 48 | 0,3 | 2 | 100,00 |
| 306632.0040.005.010 | • 0,4        | 0,05       | 1   | 4     | 0,38 | 48 | 0,3 | 2 | 100,00 |
| 306632.0040.005.015 | • 0,4        | 0,05       | 1,5 | 4     | 0,38 | 48 | 0,3 | 2 | 100,00 |
| 306632.0040.005.020 | • 0,4        | 0,05       | 2   | 4     | 0,38 | 48 | 0,3 | 2 | 100,00 |
| 306632.0050.005     | • 0,5        | 0,05       | -   | 4     | 0,48 | 48 | 0,4 | 2 | 97,00  |
| 306632.0050.005.01  | • 0,5        | 0,05       | 1   | 6     | 0,48 | 50 | 0,5 | 2 | 97,00  |
| 306632.0050.005.010 | • 0,5        | 0,05       | 1   | 4     | 0,48 | 48 | 0,4 | 2 | 97,00  |
| 306632.0050.005.015 | • 0,5        | 0,05       | 1,5 | 4     | 0,48 | 48 | 0,4 | 2 | 97,00  |
| 306632.0050.005.02  | • 0,5        | 0,05       | 2   | 6     | 0,48 | 50 | 0,5 | 2 | 97,00  |
| 306632.0050.005.020 | • 0,5        | 0,05       | 2   | 4     | 0,48 | 48 | 0,4 | 2 | 97,00  |
| 306632.0050.005.03  | • 0,5        | 0,05       | 3   | 6     | 0,48 | 50 | 0,5 | 2 | 107,00 |
| 306632.0050.005.030 | • 0,5        | 0,05       | 3   | 4     | 0,48 | 48 | 0,4 | 2 | 107,00 |
| 306632.0050.005.040 | • 0,5        | 0,05       | 4   | 4     | 0,48 | 48 | 0,4 | 2 | 107,00 |
| 306632.0050.005.050 | • 0,5        | 0,05       | 5   | 4     | 0,48 | 48 | 0,4 | 2 | 107,00 |
| 306632.0060.005     | • 0,6        | 0,05       | -   | 4     | 0,58 | 48 | 0,5 | 2 | 97,00  |
| 306632.0060.005.010 | • 0,6        | 0,05       | 1   | 4     | 0,58 | 48 | 0,5 | 2 | 97,00  |
| 306632.0060.005.020 | • 0,6        | 0,05       | 2   | 4     | 0,58 | 48 | 0,5 | 2 | 97,00  |
| 306632.0060.005.030 | • 0,6        | 0,05       | 3   | 4     | 0,58 | 48 | 0,5 | 2 | 107,00 |
| 306632.0060.005.040 | • 0,6        | 0,05       | 4   | 4     | 0,58 | 48 | 0,5 | 2 | 107,00 |
| 306632.0060.005.060 | • 0,6        | 0,05       | 6   | 4     | 0,58 | 48 | 0,5 | 2 | 107,00 |
| 306632.0080.008.01  | • 0,8        | 0,08       | 1   | 6     | 0,77 | 50 | 0,8 | 2 | 87,00  |
| 306632.0080.008.02  | • 0,8        | 0,08       | 2   | 6     | 0,77 | 50 | 0,8 | 2 | 87,00  |
| 306632.0080.008.03  | • 0,8        | 0,08       | 3   | 6     | 0,77 | 50 | 0,8 | 2 | 87,00  |
| 306632.0080.010     | • 0,8        | 0,10       | -   | 4     | 0,77 | 48 | 0,6 | 2 | 84,00  |
| 306632.0080.010.020 | • 0,8        | 0,10       | 2   | 4     | 0,77 | 48 | 0,6 | 2 | 84,00  |
| 306632.0080.010.040 | • 0,8        | 0,10       | 4   | 4     | 0,77 | 48 | 0,6 | 2 | 87,00  |
| 306632.0080.010.060 | • 0,8        | 0,10       | 6   | 4     | 0,77 | 48 | 0,6 | 2 | 87,00  |
| 306632.0080.020     | • 0,8        | 0,20       | -   | 4     | 0,77 | 48 | 0,6 | 2 | 87,00  |
| 306632.0080.020.020 | • 0,8        | 0,20       | 2   | 4     | 0,77 | 48 | 0,6 | 2 | 87,00  |
| 306632.0080.020.040 | • 0,8        | 0,20       | 4   | 4     | 0,77 | 48 | 0,6 | 2 | 87,00  |
| 306632.0080.020.060 | • 0,8        | 0,20       | 6   | 4     | 0,77 | 48 | 0,6 | 2 | 87,00  |
| 306632.0100.010     | • 1,0        | 0,10       | -   | 4     | 0,95 | 48 | 0,7 | 2 | 87,00  |
| 306632.0100.010.01  | • 1,0        | 0,10       | 1   | 6     | 0,95 | 50 | 1,0 | 2 | 87,00  |
| 306632.0100.010.02  | • 1,0        | 0,10       | 2   | 6     | 0,95 | 50 | 1,0 | 2 | 87,00  |
| 306632.0100.010.020 | • 1,0        | 0,10       | 2   | 4     | 0,95 | 48 | 0,7 | 2 | 87,00  |
| 306632.0100.010.03  | • 1,0        | 0,10       | 3   | 6     | 0,95 | 50 | 1,0 | 2 | 87,00  |
| 306632.0100.010.04  | • 1,0        | 0,10       | 4   | 6     | 0,95 | 50 | 1,0 | 2 | 87,00  |
| 306632.0100.010.040 | • 1,0        | 0,10       | 4   | 4     | 0,95 | 48 | 0,7 | 2 | 87,00  |
| 306632.0100.010.05  | • 1,0        | 0,10       | 5   | 6     | 0,95 | 50 | 1,0 | 2 | 87,00  |
| 306632.0100.010.06  | • 1,0        | 0,10       | 6   | 6     | 0,95 | 50 | 1,0 | 2 | 87,00  |
| 306632.0100.010.060 | • 1,0        | 0,10       | 6   | 4     | 0,95 | 48 | 0,7 | 2 | 87,00  |
| 306632.0100.010.080 | • 1,0        | 0,10       | 8   | 4     | 0,95 | 48 | 0,7 | 2 | 87,00  |
| 306632.0100.010.100 | • 1,0        | 0,10       | 10  | 4     | 0,95 | 48 | 0,7 | 2 | 87,00  |
| 306632.0120.010     | • 1,2        | 0,10       | -   | 4     | 1,15 | 48 | 0,7 | 2 | 94,00  |
| 306632.0120.010.020 | • 1,2        | 0,10       | 2   | 4     | 1,15 | 48 | 0,7 | 2 | 94,00  |
| 306632.0120.010.040 | • 1,2        | 0,10       | 4   | 4     | 1,15 | 48 | 0,7 | 2 | 94,00  |
| 306632.0120.010.060 | • 1,2        | 0,10       | 6   | 4     | 1,15 | 48 | 0,7 | 2 | 94,00  |
| 306632.0120.010.080 | • 1,2        | 0,10       | 8   | 4     | 1,15 | 48 | 0,7 | 2 | 94,00  |
| 306632.0120.010.100 | • 1,2        | 0,10       | 10  | 4     | 1,15 | 48 | 0,7 | 2 | 94,00  |
| 306632.0120.012.02  | • 1,2        | 0,12       | 2   | 6     | 1,15 | 50 | 1,2 | 2 | 94,00  |
| 306632.0120.012.03  | • 1,2        | 0,12       | 3   | 6     | 1,15 | 50 | 1,2 | 2 | 94,00  |
| 306632.0120.012.04  | • 1,2        | 0,12       | 4   | 6     | 1,15 | 50 | 1,2 | 2 | 94,00  |
| 306632.0120.012.05  | • 1,2        | 0,12       | 5   | 6     | 1,15 | 50 | 1,2 | 2 | 94,00  |
| 306632.0120.012.06  | • 1,2        | 0,12       | 6   | 6     | 1,15 | 50 | 1,2 | 2 | 94,00  |

CBN  
MICRO-GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

30°

Schnittdaten  
Cutting data



i S. 296

| Art.                | d1 +0/- 0,01 | rp ± 0,004 | l3 | d2 h5 | d3   | l1 | l2  | Z | €      |
|---------------------|--------------|------------|----|-------|------|----|-----|---|--------|
| 306632.0150.015.02  | • 1,5        | 0,15       | 2  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.015.03  | • 1,5        | 0,15       | 3  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.015.04  | • 1,5        | 0,15       | 4  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.015.05  | • 1,5        | 0,15       | 5  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.015.06  | • 1,5        | 0,15       | 6  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.015.07  | • 1,5        | 0,15       | 7  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.015.08  | • 1,5        | 0,15       | 8  | 6     | 1,45 | 50 | 1,5 | 2 | 94,00  |
| 306632.0150.020     | • 1,5        | 0,20       | -  | 4     | 1,44 | 48 | 0,8 | 2 | 94,00  |
| 306632.0150.020.020 | • 1,5        | 0,20       | 2  | 4     | 1,44 | 48 | 0,8 | 2 | 94,00  |
| 306632.0150.020.040 | • 1,5        | 0,20       | 4  | 4     | 1,44 | 48 | 0,8 | 2 | 94,00  |
| 306632.0150.020.060 | • 1,5        | 0,20       | 6  | 4     | 1,44 | 48 | 0,8 | 2 | 94,00  |
| 306632.0150.020.080 | • 1,5        | 0,20       | 8  | 4     | 1,44 | 48 | 0,8 | 2 | 94,00  |
| 306632.0150.020.110 | • 1,5        | 0,20       | 11 | 4     | 1,44 | 48 | 0,8 | 2 | 94,00  |
| 306632.0200.020     | • 2,0        | 0,20       | -  | 4     | 1,92 | 50 | 0,9 | 2 | 101,00 |
| 306632.0200.020.02  | • 2,0        | 0,20       | 2  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.020 | • 2,0        | 0,20       | 2  | 4     | 1,92 | 50 | 0,9 | 2 | 101,00 |
| 306632.0200.020.03  | • 2,0        | 0,20       | 3  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.04  | • 2,0        | 0,20       | 4  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.040 | • 2,0        | 0,20       | 4  | 4     | 1,92 | 50 | 0,9 | 2 | 101,00 |
| 306632.0200.020.05  | • 2,0        | 0,20       | 5  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.06  | • 2,0        | 0,20       | 6  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.060 | • 2,0        | 0,20       | 6  | 4     | 1,92 | 50 | 0,9 | 2 | 101,00 |
| 306632.0200.020.07  | • 2,0        | 0,20       | 7  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.08  | • 2,0        | 0,20       | 8  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.080 | • 2,0        | 0,20       | 8  | 4     | 1,92 | 50 | 0,9 | 2 | 101,00 |
| 306632.0200.020.09  | • 2,0        | 0,20       | 9  | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.10  | • 2,0        | 0,20       | 10 | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0200.020.100 | • 2,0        | 0,20       | 10 | 4     | 1,92 | 50 | 0,9 | 2 | 101,00 |
| 306632.0200.020.12  | • 2,0        | 0,20       | 12 | 6     | 1,95 | 50 | 2,0 | 2 | 101,00 |
| 306632.0300.030.060 | • 3,0        | 0,30       | 6  | 6     | 2,90 | 66 | 1,2 | 2 | 163,00 |
| 306632.0300.030.100 | • 3,0        | 0,30       | 10 | 6     | 2,90 | 66 | 1,2 | 2 | 163,00 |
| 306632.0300.030.160 | • 3,0        | 0,30       | 16 | 6     | 2,90 | 66 | 1,2 | 2 | 163,00 |
| 306632.0300.030.200 | • 3,0        | 0,30       | 20 | 6     | 2,90 | 66 | 1,2 | 2 | 163,00 |
| 306632.0400.050.060 | • 4,0        | 0,50       | 6  | 6     | 3,90 | 66 | 1,5 | 2 | 188,00 |
| 306632.0400.050.100 | • 4,0        | 0,50       | 10 | 6     | 3,90 | 66 | 1,5 | 2 | 188,00 |
| 306632.0400.050.160 | • 4,0        | 0,50       | 16 | 6     | 3,90 | 66 | 1,5 | 2 | 188,00 |
| 306632.0600.050     | • 6,0        | 0,50       | -  | 6     | 5,90 | 83 | 3,0 | 2 | 291,00 |
| 306632.0600.050.150 | • 6,0        | 0,50       | 15 | 6     | 5,90 | 83 | 3,0 | 2 | 291,00 |

Neu in spiralisierter Ausführung / New in spiralled design

# Hochleistung bis ins kleinste Detail.

KARNASCH **Micro-Tools** für den Formenbau

High performance in minuscule detail.  
KARNASCH **Micro-Tools** for mould construction





Art. **30.6633** **PROFESSIONAL** CBN High-end MICRO Schaftfräser < 10 x D Schnitttiefe, Schaft 4 mm / 6 mm

VANADIS 4  
Extra  
Superclean

PULVER-  
METALLE  
über  
> 60 HRC

HRC  
< 72

HRC  
< 65

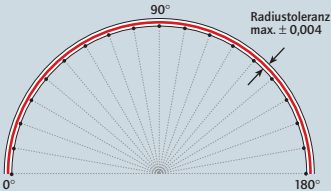
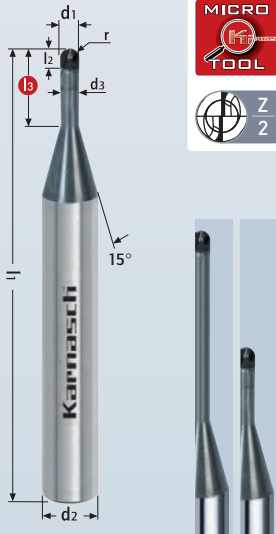
HRC  
< 60

NI-CO  
ALLOYS  
> 900 N/mm

GJL

GJS

GTW  
GTS



CBN High-end MICRO end mill < 10 x D cutting depth, shank 4 mm / 6 mm

Microfresa de mango de CBN, de gama alta, profundidad de corte  
< 10 x D, vástago 4 mm / 6 mm

Профессиональная концевая микрофреза CBN,  
рабочая глубина < 10 x D, хвостовик 4 мм / 6 мм

| Art.            | d1 +0/- 0,01 | rp ± 0,004 | l3  | d2 h5 | d3   | l1 | l2  | €      |
|-----------------|--------------|------------|-----|-------|------|----|-----|--------|
| 306633.0020.002 | • 0,2        | 0,10       | -   | 4     | 0,18 | 48 | 0,2 | 97,00  |
| 306633.0020.005 | • 0,2        | 0,10       | -   | 4     | 0,18 | 48 | 0,5 | 107,00 |
| 306633.0020.006 | • 0,2        | 0,10       | 0,6 | 6     | 0,18 | 50 | 0,2 | 100,00 |
| 306633.0020.012 | • 0,2        | 0,10       | 1,2 | 6     | 0,18 | 50 | 0,2 | 100,00 |
| 306633.0030.003 | • 0,3        | 0,15       | -   | 4     | 0,28 | 48 | 0,3 | 93,00  |
| 306633.0030.005 | • 0,3        | 0,15       | -   | 4     | 0,28 | 48 | 0,5 | 103,00 |
| 306633.0030.01  | • 0,3        | 0,15       | 1   | 6     | 0,28 | 50 | 0,3 | 100,00 |
| 306633.0030.010 | • 0,3        | 0,15       | -   | 4     | 0,28 | 48 | 1,0 | 113,00 |
| 306633.0030.02  | • 0,3        | 0,15       | 2   | 6     | 0,28 | 50 | 0,3 | 100,00 |
| 306633.0040.003 | • 0,4        | 0,20       | -   | 4     | 0,38 | 48 | 0,3 | 91,00  |
| 306633.0040.01  | • 0,4        | 0,20       | 1   | 6     | 0,38 | 50 | 0,5 | 91,00  |
| 306633.0040.010 | • 0,4        | 0,20       | 1   | 4     | 0,38 | 48 | 0,3 | 91,00  |
| 306633.0040.015 | • 0,4        | 0,20       | 1,5 | 4     | 0,38 | 48 | 0,3 | 91,00  |
| 306633.0040.02  | • 0,4        | 0,20       | 2   | 6     | 0,38 | 50 | 0,5 | 91,00  |
| 306633.0040.020 | • 0,4        | 0,20       | 2   | 4     | 0,38 | 48 | 0,3 | 91,00  |
| 306633.0040.03  | • 0,4        | 0,20       | 3   | 6     | 0,38 | 50 | 0,5 | 100,00 |
| 306633.0040.030 | • 0,4        | 0,20       | 3   | 4     | 0,38 | 48 | 0,3 | 100,00 |
| 306633.0040.04  | • 0,4        | 0,20       | 4   | 6     | 0,38 | 50 | 0,5 | 100,00 |
| 306633.0040.040 | • 0,4        | 0,20       | 4   | 4     | 0,38 | 48 | 0,3 | 100,00 |
| 306633.0040.050 | • 0,4        | 0,20       | 5   | 4     | 0,38 | 48 | 0,3 | 100,00 |
| 306633.0040.060 | • 0,4        | 0,20       | 6   | 4     | 0,38 | 48 | 0,3 | 100,00 |
| 306633.0050.004 | • 0,5        | 0,25       | -   | 4     | 0,48 | 48 | 0,4 | 88,00  |
| 306633.0050.01  | • 0,5        | 0,25       | 1   | 6     | 0,48 | 50 | 0,5 | 88,00  |
| 306633.0050.010 | • 0,5        | 0,25       | 1   | 4     | 0,48 | 48 | 0,4 | 88,00  |
| 306633.0050.015 | • 0,5        | 0,25       | 1,5 | 4     | 0,48 | 48 | 0,4 | 88,00  |
| 306633.0050.02  | • 0,5        | 0,25       | 2   | 6     | 0,48 | 50 | 0,5 | 88,00  |
| 306633.0050.020 | • 0,5        | 0,25       | 2   | 4     | 0,48 | 48 | 0,4 | 88,00  |
| 306633.0050.03  | • 0,5        | 0,25       | 3   | 6     | 0,48 | 50 | 0,5 | 98,00  |
| 306633.0050.030 | • 0,5        | 0,25       | 3   | 4     | 0,48 | 48 | 0,4 | 98,00  |
| 306633.0050.04  | • 0,5        | 0,25       | 4   | 6     | 0,48 | 50 | 0,5 | 98,00  |
| 306633.0050.040 | • 0,5        | 0,25       | 4   | 4     | 0,48 | 48 | 0,4 | 98,00  |
| 306633.0050.05  | • 0,5        | 0,25       | 5   | 6     | 0,48 | 50 | 0,5 | 98,00  |
| 306633.0050.050 | • 0,5        | 0,25       | 5   | 4     | 0,48 | 48 | 0,4 | 98,00  |
| 306633.0050.060 | • 0,5        | 0,25       | 6   | 4     | 0,48 | 48 | 0,4 | 98,00  |
| 306633.0050.080 | • 0,5        | 0,25       | 8   | 4     | 0,48 | 48 | 0,4 | 98,00  |
| 306633.0060.005 | • 0,6        | 0,30       | -   | 4     | 0,58 | 48 | 0,5 | 88,00  |
| 306633.0060.01  | • 0,6        | 0,30       | 1   | 6     | 0,58 | 50 | 0,6 | 88,00  |
| 306633.0060.010 | • 0,6        | 0,30       | 1   | 4     | 0,58 | 48 | 0,5 | 88,00  |
| 306633.0060.015 | • 0,6        | 0,30       | 1,5 | 4     | 0,58 | 48 | 0,5 | 88,00  |
| 306633.0060.02  | • 0,6        | 0,30       | 2   | 6     | 0,58 | 50 | 0,6 | 88,00  |
| 306633.0060.020 | • 0,6        | 0,30       | 2   | 4     | 0,58 | 48 | 0,5 | 88,00  |
| 306633.0060.030 | • 0,6        | 0,30       | 3   | 4     | 0,58 | 48 | 0,5 | 98,00  |
| 306633.0060.04  | • 0,6        | 0,30       | 4   | 6     | 0,58 | 50 | 0,6 | 98,00  |
| 306633.0060.040 | • 0,6        | 0,30       | 4   | 4     | 0,58 | 48 | 0,5 | 98,00  |
| 306633.0060.05  | • 0,6        | 0,30       | 5   | 6     | 0,58 | 50 | 0,6 | 98,00  |
| 306633.0060.050 | • 0,6        | 0,30       | 5   | 4     | 0,58 | 48 | 0,5 | 98,00  |
| 306633.0060.06  | • 0,6        | 0,30       | 6   | 6     | 0,58 | 50 | 0,6 | 98,00  |
| 306633.0060.060 | • 0,6        | 0,30       | 6   | 4     | 0,58 | 48 | 0,5 | 98,00  |
| 306633.0060.080 | • 0,6        | 0,30       | 8   | 4     | 0,58 | 48 | 0,5 | 98,00  |
| 306633.0060.100 | • 0,6        | 0,30       | 10  | 4     | 0,58 | 48 | 0,5 | 98,00  |
| 306633.0080.006 | • 0,8        | 0,40       | -   | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0080.01  | • 0,8        | 0,40       | 1   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.015 | • 0,8        | 0,40       | 1,5 | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0080.02  | • 0,8        | 0,40       | 2   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.020 | • 0,8        | 0,40       | 2   | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0080.03  | • 0,8        | 0,40       | 3   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.04  | • 0,8        | 0,40       | 4   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.040 | • 0,8        | 0,40       | 4   | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0080.05  | • 0,8        | 0,40       | 5   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.06  | • 0,8        | 0,40       | 6   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.060 | • 0,8        | 0,40       | 6   | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0080.07  | • 0,8        | 0,40       | 7   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.08  | • 0,8        | 0,40       | 8   | 6     | 0,77 | 50 | 0,8 | 87,00  |
| 306633.0080.080 | • 0,8        | 0,40       | 8   | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0080.100 | • 0,8        | 0,40       | 10  | 4     | 0,77 | 48 | 0,6 | 87,00  |
| 306633.0100.007 | • 1,0        | 0,50       | -   | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.015 | • 1,0        | 0,50       | 1,5 | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.02  | • 1,0        | 0,50       | 2   | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.020 | • 1,0        | 0,50       | 2   | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.030 | • 1,0        | 0,50       | 3   | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.040 | • 1,0        | 0,50       | 4   | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.05  | • 1,0        | 0,50       | 5   | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.050 | • 1,0        | 0,50       | 5   | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.06  | • 1,0        | 0,50       | 6   | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.060 | • 1,0        | 0,50       | 6   | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.07  | • 1,0        | 0,50       | 7   | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.08  | • 1,0        | 0,50       | 8   | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.080 | • 1,0        | 0,50       | 8   | 4     | 0,95 | 48 | 0,7 | 87,00  |

CBN  
MICRO-GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



Schnittdaten  
Cutting data



i S. 297

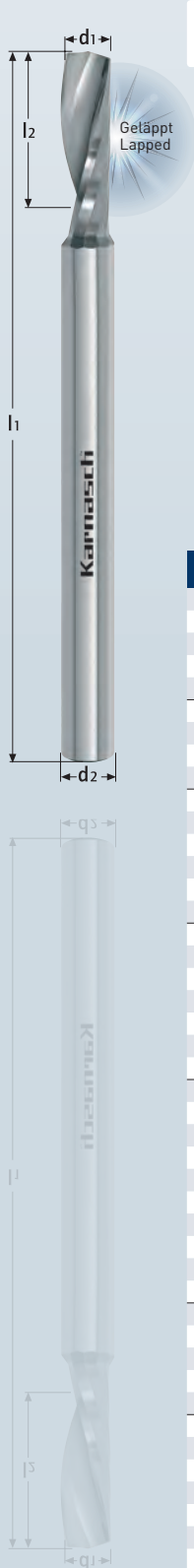


| Art.            | d1 +0/- 0,01 | rp ± 0,004 | l3  | d2 h5 | d3   | l1 | l2  | €      |
|-----------------|--------------|------------|-----|-------|------|----|-----|--------|
| 306633.0100.09  | • 1,0        | 0,50       | 9   | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.10  | • 1,0        | 0,50       | 10  | 6     | 0,95 | 50 | 1,0 | 87,00  |
| 306633.0100.100 | • 1,0        | 0,50       | 10  | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.120 | • 1,0        | 0,50       | 12  | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0100.160 | • 1,0        | 0,50       | 16  | 4     | 0,95 | 48 | 0,7 | 87,00  |
| 306633.0120.008 | • 1,2        | 0,60       | -   | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.015 | • 1,2        | 0,60       | 1,5 | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.02  | • 1,2        | 0,60       | 2   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.020 | • 1,2        | 0,60       | 2   | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.03  | • 1,2        | 0,60       | 3   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.030 | • 1,2        | 0,60       | 3   | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.04  | • 1,2        | 0,60       | 4   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.040 | • 1,2        | 0,60       | 4   | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.05  | • 1,2        | 0,60       | 5   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.06  | • 1,2        | 0,60       | 6   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.060 | • 1,2        | 0,60       | 6   | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.07  | • 1,2        | 0,60       | 7   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.08  | • 1,2        | 0,60       | 8   | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.080 | • 1,2        | 0,60       | 8   | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.10  | • 1,2        | 0,60       | 10  | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.100 | • 1,2        | 0,60       | 10  | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.12  | • 1,2        | 0,60       | 12  | 6     | 1,15 | 50 | 1,2 | 94,00  |
| 306633.0120.120 | • 1,2        | 0,60       | 12  | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0120.160 | • 1,2        | 0,60       | 16  | 4     | 1,15 | 48 | 0,8 | 94,00  |
| 306633.0150.010 | • 1,5        | 0,75       | -   | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.02  | • 1,5        | 0,75       | 2   | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.020 | • 1,5        | 0,75       | 2   | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.03  | • 1,5        | 0,75       | 3   | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.04  | • 1,5        | 0,75       | 4   | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.040 | • 1,5        | 0,75       | 4   | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.05  | • 1,5        | 0,75       | 5   | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.060 | • 1,5        | 0,75       | 6   | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.07  | • 1,5        | 0,75       | 7   | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.08  | • 1,5        | 0,75       | 8   | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.080 | • 1,5        | 0,75       | 8   | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.10  | • 1,5        | 0,75       | 10  | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.100 | • 1,5        | 0,75       | 10  | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.12  | • 1,5        | 0,75       | 12  | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.120 | • 1,5        | 0,75       | 12  | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.140 | • 1,5        | 0,75       | 14  | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.15  | • 1,5        | 0,75       | 15  | 6     | 1,45 | 50 | 1,5 | 94,00  |
| 306633.0150.160 | • 1,5        | 0,75       | 16  | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0150.180 | • 1,5        | 0,75       | 18  | 4     | 1,44 | 48 | 1,0 | 94,00  |
| 306633.0200.012 | • 2,0        | 1,00       | -   | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.02  | • 2,0        | 1,00       | 2   | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.020 | • 2,0        | 1,00       | 2   | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.03  | • 2,0        | 1,00       | 3   | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.04  | • 2,0        | 1,00       | 4   | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.040 | • 2,0        | 1,00       | 4   | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.05  | • 2,0        | 1,00       | 5   | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.06  | • 2,0        | 1,00       | 6   | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.060 | • 2,0        | 1,00       | 6   | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.08  | • 2,0        | 1,00       | 8   | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.080 | • 2,0        | 1,00       | 8   | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.10  | • 2,0        | 1,00       | 10  | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.100 | • 2,0        | 1,00       | 10  | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.12  | • 2,0        | 1,00       | 12  | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.120 | • 2,0        | 1,00       | 12  | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.140 | • 2,0        | 1,00       | 14  | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.15  | • 2,0        | 1,00       | 15  | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.160 | • 2,0        | 1,00       | 16  | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.18  | • 2,0        | 1,00       | 18  | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0200.180 | • 2,0        | 1,00       | 18  | 4     | 1,92 | 50 | 1,2 | 101,00 |
| 306633.0200.20  | • 2,0        | 1,00       | 20  | 6     | 1,95 | 50 | 2,0 | 101,00 |
| 306633.0300.018 | • 3,0        | 1,50       | -   | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.030 | • 3,0        | 1,50       | 3   | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.040 | • 3,0        | 1,50       | 4   | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.05  | • 3,0        | 1,50       | 5   | 6     | 2,95 | 60 | 3,0 | 163,00 |
| 306633.0300.060 | • 3,0        | 1,50       | 6   | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.08  | • 3,0        | 1,50       | 8   | 6     | 2,95 | 60 | 3,0 | 163,00 |
| 306633.0300.080 | • 3,0        | 1,50       | 8   | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.10  | • 3,0        | 1,50       | 10  | 6     | 2,95 | 60 | 3,0 | 163,00 |
| 306633.0300.100 | • 3,0        | 1,50       | 10  | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.120 | • 3,0        | 1,50       | 12  | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.15  | • 3,0        | 1,50       | 15  | 6     | 2,95 | 60 | 3,0 | 163,00 |
| 306633.0300.160 | • 3,0        | 1,50       | 16  | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0300.20  | • 3,0        | 1,50       | 20  | 6     | 2,95 | 60 | 3,0 | 163,00 |
| 306633.0300.200 | • 3,0        | 1,50       | 20  | 6     | 2,90 | 66 | 1,8 | 163,00 |
| 306633.0400.024 | • 4,0        | 2,00       | -   | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.040 | • 4,0        | 2,00       | 4   | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.060 | • 4,0        | 2,00       | 6   | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.080 | • 4,0        | 2,00       | 8   | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.100 | • 4,0        | 2,00       | 10  | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.120 | • 4,0        | 2,00       | 12  | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.160 | • 4,0        | 2,00       | 16  | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0400.200 | • 4,0        | 2,00       | 20  | 6     | 3,90 | 66 | 2,4 | 188,00 |
| 306633.0600.035 | • 6,0        | 3,00       | -   | 6     | 5,90 | 83 | 3,5 | 291,00 |
| 306633.0600.100 | • 6,0        | 3,00       | 10  | 6     | 5,90 | 83 | 3,5 | 291,00 |
| 306633.0600.200 | • 6,0        | 3,00       | 20  | 6     | 5,90 | 83 | 3,5 | 291,00 |

\* Neu in spiralisierter Ausführung / New in spiralled design

Art. 29.1652 Vollhartmetall Einzahnfräser, rechtsspirale – rechtsschneidend

- Acryl
- PMMA  
GS
- PE  
PP
- PA
- PS
- ABS
- PC  
PET  
PPE
- PMMA  
XT
- MAKROLON
- Wachs  
Wax



Solid carbide one-tooth end mill, right spiral - right cutting

Fresa MD a codolo ad un dente, elica destra - taglio destro

Твердосплавная однозубая концевая фреза  
Правосторонняя спираль -правозаходная

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

30°

HSC  
High-Speed-  
Cutting

GELÄPPT  
LAPPED

Air

Schnittdaten  
Cutting data



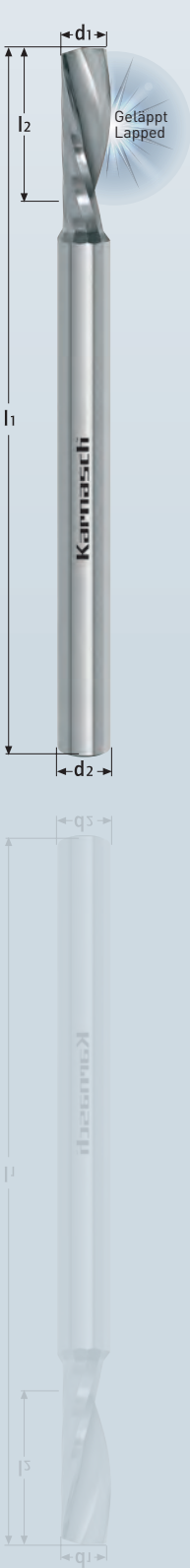
i S. 333

| Art.                   | d1 h10  | l2   | d2 h6 | l1  | Z | €     |
|------------------------|---------|------|-------|-----|---|-------|
| 291652.0010.003.03.030 | • 0,10  | 0,3  | 3     | 30  | 1 | 35,00 |
| 291652.0020.006.03.030 | • 0,20  | 0,6  | 3     | 30  | 1 | 26,00 |
| 291652.0030.010.03.030 | • 0,30  | 1,0  | 3     | 30  | 1 | 23,00 |
| 291652.0040.010.03.030 | • 0,40  | 1,0  | 3     | 30  | 1 | 23,00 |
| 291652.0050.015.03.030 | • 0,50  | 1,5  | 3     | 30  | 1 | 21,00 |
| 291652.0060.030.03.030 | • 0,60  | 3,0  | 3     | 30  | 1 | 21,00 |
| 291652.0080.050.03.030 | • 0,80  | 5,0  | 3     | 30  | 1 | 21,00 |
| 291652.0100.040.03.030 | • 1,00  | 4,0  | 3     | 30  | 1 | 21,00 |
| 291652.0120.050.03.038 | ▲ 1,20  | 5,0  | 3     | 38  | 1 | 21,00 |
| 291652.0150.060.03.030 | • 1,50  | 6,0  | 3     | 30  | 1 | 21,00 |
| 291652.0200.060.03.030 | • 2,00  | 6,0  | 3     | 30  | 1 | 21,00 |
| 291652.0200.060.04.050 | • 2,00  | 6,0  | 4     | 50  | 1 | 26,00 |
| 291652.0200.060.06.050 | • 2,00  | 6,0  | 6     | 50  | 1 | 30,00 |
| 291652.0200.080.03.030 | • 2,00  | 8,0  | 3     | 30  | 1 | 21,00 |
| 291652.0200.110.03.038 | • 2,00  | 11,0 | 3     | 38  | 1 | 26,00 |
| 291652.0300.060.03.030 | • 3,00  | 6,0  | 3     | 30  | 1 | 21,00 |
| 291652.0300.060.06.050 | • 3,00  | 6,0  | 6     | 50  | 1 | 29,00 |
| 291652.0300.110.03.038 | • 3,00  | 11,0 | 3     | 38  | 1 | 26,00 |
| 291652.0300.110.04.050 | • 3,00  | 11,0 | 4     | 50  | 1 | 33,00 |
| 291652.0300.110.06.050 | • 3,00  | 11,0 | 6     | 50  | 1 | 36,00 |
| 291652.0300.220.03.050 | • 3,00  | 22,0 | 3     | 50  | 1 | 29,00 |
| 291652.0300.220.06.060 | • 3,00  | 22,0 | 6     | 60  | 1 | 38,00 |
| 291652.0400.080.04.050 | • 4,00  | 8,0  | 4     | 50  | 1 | 27,00 |
| 291652.0400.080.06.050 | • 4,00  | 8,0  | 6     | 50  | 1 | 32,00 |
| 291652.0400.120.04.050 | • 4,00  | 12,0 | 4     | 50  | 1 | 27,00 |
| 291652.0400.120.06.050 | • 4,00  | 12,0 | 6     | 50  | 1 | 32,00 |
| 291652.0400.140.04.050 | • 4,00  | 14,0 | 4     | 50  | 1 | 27,00 |
| 291652.0400.140.06.050 | • 4,00  | 14,0 | 6     | 50  | 1 | 33,00 |
| 291652.0400.220.04.050 | • 4,00  | 22,0 | 4     | 50  | 1 | 30,00 |
| 291652.0400.220.06.050 | • 4,00  | 22,0 | 6     | 50  | 1 | 35,00 |
| 291652.0400.230.04.060 | ▲ 4,00  | 23,0 | 4     | 60  | 1 | 27,00 |
| 291652.0400.320.04.064 | • 4,00  | 32,0 | 4     | 64  | 1 | 31,00 |
| 291652.0500.120.06.050 | • 5,00  | 12,0 | 6     | 50  | 1 | 34,00 |
| 291652.0500.160.05.050 | ▲ 5,00  | 16,0 | 5     | 50  | 1 | 28,00 |
| 291652.0500.160.06.050 | • 5,00  | 16,0 | 6     | 50  | 1 | 34,00 |
| 291652.0500.220.06.050 | • 5,00  | 22,0 | 6     | 50  | 1 | 34,00 |
| 291652.0500.230.05.060 | ▲ 5,00  | 23,0 | 5     | 60  | 1 | 28,00 |
| 291652.0600.120.06.050 | • 6,00  | 12,0 | 6     | 50  | 1 | 33,00 |
| 291652.0600.160.06.050 | ▲ 6,00  | 16,0 | 6     | 50  | 1 | 28,00 |
| 291652.0600.220.06.050 | • 6,00  | 22,0 | 6     | 50  | 1 | 34,00 |
| 291652.0600.220.06.058 | • 6,00  | 22,0 | 6     | 58  | 1 | 35,00 |
| 291652.0600.230.06.075 | ▲ 6,00  | 23,0 | 6     | 75  | 1 | 41,00 |
| 291652.0600.320.06.064 | • 6,00  | 32,0 | 6     | 64  | 1 | 38,00 |
| 291652.0600.420.06.075 | • 6,00  | 42,0 | 6     | 75  | 1 | 44,00 |
| 291652.0600.320.06.100 | • 6,00  | 32,0 | 6     | 100 | 1 | 45,00 |
| 291652.0800.220.08.064 | • 8,00  | 22,0 | 8     | 64  | 1 | 40,00 |
| 291652.0800.230.08.050 | ▲ 8,00  | 23,0 | 8     | 50  | 1 | 41,00 |
| 291652.0800.320.08.075 | ▲ 8,00  | 32,0 | 8     | 75  | 1 | 41,00 |
| 291652.0800.320.08.064 | • 8,00  | 32,0 | 8     | 64  | 1 | 45,00 |
| 291652.0800.420.08.075 | • 8,00  | 42,0 | 8     | 75  | 1 | 51,00 |
| 291652.0800.420.08.100 | • 8,00  | 42,0 | 8     | 100 | 1 | 57,00 |
| 291652.0800.550.08.100 | • 8,00  | 55,0 | 8     | 100 | 1 | 60,00 |
| 291652.1000.220.10.064 | • 10,00 | 22,0 | 10    | 64  | 1 | 64,00 |
| 291652.1000.320.10.075 | • 10,00 | 32,0 | 10    | 75  | 1 | 70,00 |
| 291652.1000.550.10.100 | • 10,00 | 55,0 | 10    | 100 | 1 | 82,00 |
| 291652.1000.750.10.120 | • 10,00 | 75,0 | 10    | 120 | 1 | 93,00 |
| 291652.1200.320.12.100 | ▲ 12,00 | 32,0 | 12    | 100 | 1 | 89,00 |

Vollhartmetall Einzahnfräser, linksspirale – rechtsschneidend

Art. 29.1654

- Acryl
- PMMA GS
- PE PP
- PA
- PS
- ABS
- PC PET PPE
- PMMA XT
- MAKROLON
- Wachs Wax



- Solid carbide one-tooth end mill, left spiral - right cutting
- Fresa de mango de punta única de metal duro y macizo  
Espiral a izquierdas - con corte a derechas
- Твердосплавная однозубая концевая фреза  
Левосторонняя спираль - правозаходная

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

30°

HSC High-Speed-Cutting

GELÄPPT LAPPED

Air

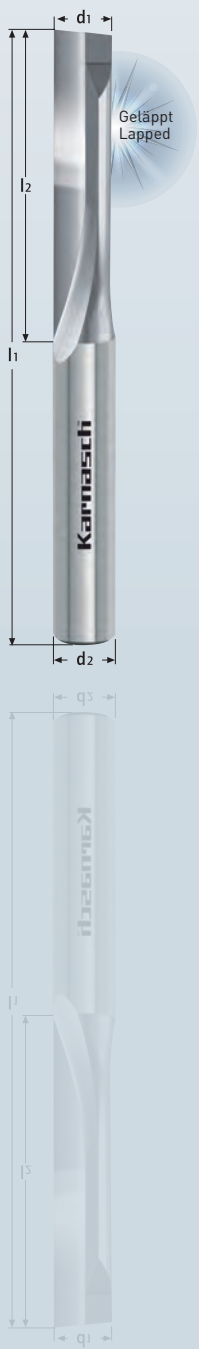
Schnittdaten  
Cutting data

i S. 333

| Art.                  | Ø d1 h10 | l2 | d2 h6 | l3 | l1  | Z | €     |
|-----------------------|----------|----|-------|----|-----|---|-------|
| 291654.0100.04.03.040 | • 1,0    | 4  | 3     | –  | 40  | 1 | 27,00 |
| 291654.0150.06.03.040 | • 1,5    | 6  | 3     | –  | 40  | 1 | 27,00 |
| 291654.0200.03.03.050 | • 2,0    | 3  | 3     | –  | 50  | 1 | 28,00 |
| 291654.0200.06.06.050 | • 2,0    | 6  | 6     | –  | 50  | 1 | 33,00 |
| 291654.0200.08.03.040 | • 2,0    | 8  | 3     | –  | 40  | 1 | 29,00 |
| 291654.0300.04.03.050 | • 3,0    | 4  | 3     | –  | 50  | 1 | 29,00 |
| 291654.0300.06.03.050 | • 3,0    | 6  | 3     | –  | 50  | 1 | 30,00 |
| 291654.0300.10.03.060 | • 3,0    | 10 | 3     | –  | 30  | 1 | 29,00 |
| 291654.0300.10.03.030 | • 3,0    | 10 | 3     | –  | 60  | 1 | 31,00 |
| 291654.0300.12.06.050 | • 3,0    | 12 | 6     | –  | 50  | 1 | 35,00 |
| 291654.0300.15.08.075 | • 3,0    | 15 | 8     | –  | 75  | 1 | 44,00 |
| 291654.0300.18.08.100 | • 3,0    | 18 | 8     | –  | 100 | 1 | 50,00 |
| 291654.0400.05.04.050 | • 4,0    | 5  | 4     | –  | 50  | 1 | 32,00 |
| 291654.0400.08.04.040 | • 4,0    | 8  | 4     | –  | 40  | 1 | 32,00 |
| 291654.0400.14.06.050 | • 4,0    | 14 | 6     | –  | 50  | 1 | 37,00 |
| 291654.0400.18.08.075 | • 4,0    | 18 | 8     | –  | 75  | 1 | 46,00 |
| 291654.0400.20.04.060 | • 4,0    | 20 | 4     | –  | 60  | 1 | 33,00 |
| 291654.0400.22.08.100 | • 4,0    | 22 | 8     | –  | 100 | 1 | 52,00 |
| 291654.0500.06.06.050 | • 5,0    | 6  | 6     | –  | 50  | 1 | 37,00 |
| 291654.0500.10.06.040 | • 5,0    | 10 | 6     | –  | 40  | 1 | 36,00 |
| 291654.0500.16.06.050 | • 5,0    | 16 | 6     | –  | 50  | 1 | 37,00 |
| 291654.0500.22.06.060 | • 5,0    | 22 | 6     | –  | 60  | 1 | 38,00 |
| 291654.0500.23        | ▲ 5,0    | 23 | 6     | –  | 75  | 1 | 48,00 |
| 291654.0500.25.08.075 | • 5,0    | 25 | 8     | –  | 75  | 1 | 47,00 |
| 291654.0500.25.08.100 | • 5,0    | 25 | 8     | –  | 100 | 1 | 57,00 |
| 291654.0500.30.06.070 | • 5,0    | 30 | 6     | –  | 70  | 1 | 38,00 |
| 291654.0600.07.06.050 | • 6,0    | 7  | 6     | –  | 50  | 1 | 32,00 |
| 291654.0600.18.06.050 | • 6,0    | 18 | 6     | –  | 50  | 1 | 33,00 |
| 291654.0600.20.06.060 | • 6,0    | 20 | 6     | –  | 60  | 1 | 34,00 |
| 291654.0600.20.06.100 | • 6,0    | 20 | 6     | 40 | 100 | 1 | 37,00 |
| 291654.0600.25.06.065 | • 6,0    | 25 | 6     | –  | 65  | 1 | 35,00 |
| 291654.0600.25.08.075 | • 6,0    | 25 | 8     | –  | 75  | 1 | 46,00 |
| 291654.0600.40.06.080 | • 6,0    | 40 | 6     | –  | 80  | 1 | 52,00 |
| 291654.0600.30.08.100 | • 6,0    | 30 | 8     | –  | 100 | 1 | 36,00 |
| 291654.0800.10.08.050 | • 8,0    | 10 | 8     | –  | 50  | 1 | 46,00 |
| 291654.0800.20.08.050 | • 8,0    | 20 | 8     | –  | 50  | 1 | 48,00 |
| 291654.0800.20.08.060 | • 8,0    | 20 | 8     | –  | 60  | 1 | 49,00 |
| 291654.0800.20.08.100 | • 8,0    | 20 | 8     | 40 | 100 | 1 | 57,00 |
| 291654.0800.32        | ▲ 8,0    | 32 | 8     | –  | 75  | 1 | 55,00 |
| 291654.0800.35.08.100 | • 8,0    | 35 | 8     | –  | 100 | 1 | 61,00 |
| 291654.1000.25.10.070 | • 10,0   | 25 | 10    | –  | 70  | 1 | 63,00 |
| 291654.1000.25.10.120 | • 10,0   | 25 | 10    | 50 | 120 | 1 | 85,00 |
| 291654.1000.32        | ▲ 10,0   | 32 | 10    | –  | 75  | 1 | 77,00 |
| 291654.1000.35.10.090 | • 10,0   | 35 | 10    | –  | 90  | 1 | 70,00 |

Art. 29.1661 Vollhartmetall Einzahnfräser, gerade genutet, rechtsschneidend

- Acryl
- PMMA  
GS
- PE  
PP
- PA
- PS
- ABS
- PC  
PET  
PPE
- PMMA  
XT
- MAKROLON
- Wachs  
Wax



- Solid carbide one-tooth end mill, straight fluted - right cutting
- Fresa de mango de punta única de metal duro y macizo, espiral a recto – con corte a derechas
- Однозубая фреза из твердосплавного металла с прямыми стружечными канавками

| Art.               | d1 h10 | l2 | d2 h6 | l1  | €     |
|--------------------|--------|----|-------|-----|-------|
| 291661.0100.04.040 | • 1,0  | 4  | 3     | 40  | 22,00 |
| 291661.0150.06.040 | • 1,5  | 6  | 3     | 40  | 22,00 |
| 291661.0200.03.050 | • 2,0  | 3  | 3     | 50  | 22,00 |
| 291661.0200.06.050 | • 2,0  | 6  | 6     | 50  | 30,00 |
| 291661.0200.08.040 | • 2,0  | 8  | 3     | 40  | 22,00 |
| 291661.0250.09.040 | • 2,5  | 9  | 3     | 40  | 22,00 |
| 291661.0300.06.040 | • 3,0  | 6  | 3     | 40  | 22,00 |
| 291661.0300.10.030 | • 3,0  | 10 | 3     | 30  | 21,00 |
| 291661.0300.10.060 | • 3,0  | 10 | 3     | 60  | 22,00 |
| 291661.0300.12.050 | • 3,0  | 12 | 6     | 50  | 30,00 |
| 291661.0300.15.075 | • 3,0  | 15 | 8     | 75  | 39,00 |
| 291661.0300.18.100 | • 3,0  | 18 | 8     | 100 | 45,00 |
| 291661.0400.05.050 | • 4,0  | 5  | 4     | 50  | 27,00 |
| 291661.0400.08.040 | • 4,0  | 8  | 4     | 40  | 26,00 |
| 291661.0400.14.050 | • 4,0  | 14 | 6     | 50  | 33,00 |
| 291661.0400.18.075 | • 4,0  | 18 | 8     | 75  | 39,00 |
| 291661.0400.20.060 | • 4,0  | 20 | 4     | 60  | 27,00 |
| 291661.0400.22.100 | • 4,0  | 22 | 8     | 100 | 45,00 |
| 291661.0400.30.070 | • 4,0  | 30 | 4     | 70  | 28,00 |
| 291661.0500.06.050 | • 5,0  | 6  | 5     | 50  | 32,00 |
| 291661.0500.10.040 | • 5,0  | 10 | 5     | 40  | 31,00 |
| 291661.0500.16.050 | • 5,0  | 16 | 6     | 50  | 33,00 |
| 291661.0500.22.060 | • 5,0  | 22 | 5     | 60  | 33,00 |
| 291661.0500.25.075 | • 5,0  | 25 | 8     | 75  | 39,00 |
| 291661.0500.25.100 | • 5,0  | 25 | 8     | 100 | 45,00 |
| 291661.0500.30.070 | • 5,0  | 30 | 5     | 70  | 34,00 |
| 291661.0600.07.050 | • 6,0  | 7  | 6     | 50  | 33,00 |
| 291661.0600.18.050 | • 6,0  | 18 | 6     | 50  | 34,00 |
| 291661.0600.20.060 | • 6,0  | 20 | 6     | 60  | 35,00 |
| 291661.0600.25.065 | • 6,0  | 25 | 6     | 65  | 36,00 |
| 291661.0600.25.075 | • 6,0  | 25 | 8     | 75  | 39,00 |
| 291661.0600.30.100 | • 6,0  | 30 | 8     | 100 | 45,00 |
| 291661.0600.40.080 | • 6,0  | 40 | 6     | 80  | 38,00 |
| 291661.0800.09.050 | • 8,0  | 9  | 8     | 50  | 39,00 |
| 291661.0800.20.050 | • 8,0  | 20 | 8     | 50  | 39,00 |
| 291661.0800.20.060 | • 8,0  | 20 | 8     | 60  | 40,00 |
| 291661.0800.30.075 | • 8,0  | 30 | 8     | 75  | 44,00 |
| 291661.0800.35.100 | • 8,0  | 35 | 8     | 100 | 49,00 |
| 291661.1000.25.070 | • 10,0 | 25 | 10    | 70  | 70,00 |
| 291661.1000.35.090 | • 10,0 | 35 | 10    | 90  | 75,00 |

MICRO GRAINKARNASCH NORM

SPEZIALDIN 6535 Form HA

0°

HSCHigh-Speed-Cutting

GELÄPPTLAPPED

Air

Schnittdaten  
Cutting data





Vollhartmetall Einzahnfräser mit Radius, rechtsspirale – rechtsschneidend, Hochglanz-finish

Art. **29.1658**

PMMA  
GS

PMMA  
XT

MAKROLON

Wachs  
Wax

PMMA

PMMA



🇺🇸 Solid carbide one-tooth end mill with corner radius, right spiral - right cutting, mirror finish

🇪🇸 Fresa metal duro con 1 labio con radio con espiral a derecha, cortante a la derecha, con acabado brillo intenso

🇷🇺 Твердосплавная однозубая фреза с радиусом Правосторонняя спираль – правозаходная зеркальная шлифовка

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HSC  
High-Speed-  
Cutting



GELÄPPT  
LAPPED



Schnittdaten  
Cutting data



i S. 333

| Art.           | d1   | r   | l2 | d2 h5 | l1 | €     |
|----------------|------|-----|----|-------|----|-------|
| 291658.0200.06 | • 2  | 1,0 | 6  | 6     | 60 | 49,00 |
| 291658.0300.09 | • 3  | 1,5 | 9  | 6     | 60 | 49,00 |
| 291658.0400.12 | • 4  | 2,0 | 12 | 6     | 60 | 47,00 |
| 291658.0500.15 | • 5  | 2,5 | 15 | 6     | 60 | 55,00 |
| 291658.0600.18 | • 6  | 3,0 | 18 | 6     | 70 | 53,00 |
| 291658.0800.24 | • 8  | 4,0 | 24 | 8     | 80 | 61,00 |
| 291658.1000.30 | • 10 | 5,0 | 30 | 10    | 80 | 70,00 |

Technik: Keine Schartigkeit bei 50-facher Vergrößerung (< Rz 0,5)

Art. **30.7425** Für Inox / For Inox

MAXIMALE STABILITÄT  
DURCH 3-FASEN-SCHLIFF

Maximum stability through  
triple-bevel grinding

SEHR GLATTE OBERFLÄCHE  
DURCH NEU ENTWICKELTE  
BESCHICHTUNG Tcx<sup>3</sup>

Extremely smooth surface  
through our new developed  
Tcx<sup>3</sup>-coating

UNGLEICHTEILUNG  
FÜR HOHE LAUFRIHE

Unequal pitch for a smooth  
cutting

Art. 30.7415 Vollhartmetall HPC Schaftfräser für exotisches Material

INOX  
stainless steel  
< 900 N/mm  
ferritic

TITAN

INOX  
stainless steel  
> 900 N/mm  
martensitic

kurz-  
spanend  
short chip

INOX  
stainless steel  
< 900 N/mm  
austenitic

lang-  
spanend  
long chip

NI-ALLOYS  
< 900 N/mm

Schruppen  
roughing  
▼

NI-CO  
ALLOYS  
> 900 N/mm

Schrupp-  
schlicht  
semifinishing  
▼▼

TITAN  
< 1100  
N/mm

Schlichten  
finishing  
▼▼▼

HARDOX

INCONEL

MONEL

NIMONIC



- Solid carbide end mills for exotic materials
- Fresa metal duro para material exótico
- Твердосплавная концевая фреза для экзотического материала

MICRO  
GRAIN

DIN  
6527 K

SPEZIAL

DIN 6535  
Form HA

45°

f 45°

HPC

INOX F²

OIL Emul  
MMKS

Schnittdaten  
Cutting data

i S. 285

| Art.           | d1 e8 | l3 | l2 | d2 h5 | d3   | l1  | Z | €      |
|----------------|-------|----|----|-------|------|-----|---|--------|
| 307415.0300.15 | • 3   | 15 | 8  | 6     | 2,8  | 57  | 3 | 42,00  |
| 307415.0400.15 | • 4   | 15 | 11 | 6     | 3,8  | 57  | 3 | 42,00  |
| 307415.0500.20 | • 5   | 20 | 12 | 6     | 4,8  | 57  | 3 | 42,00  |
| 307415.0600.20 | • 6   | 20 | 12 | 6     | 5,8  | 57  | 3 | 42,00  |
| 307415.0800.27 | • 8   | 27 | 20 | 8     | 7,8  | 63  | 3 | 55,00  |
| 307415.1000.32 | • 10  | 32 | 22 | 10    | 9,8  | 72  | 3 | 85,00  |
| 307415.1200.38 | • 12  | 38 | 26 | 12    | 11,8 | 83  | 3 | 107,00 |
| 307415.1600.45 | • 16  | 45 | 32 | 16    | 15,7 | 92  | 3 | 165,00 |
| 307415.2000.55 | • 20  | 55 | 38 | 20    | 19,7 | 104 | 3 | 292,00 |

Art. 30.7421 Vollhartmetall Schaftfräser mit Eckenradius für exotisches Material

INOX  
stainless steel  
< 900 N/mm  
ferritic

TITAN

INOX  
stainless steel  
> 900 N/mm  
martensitic

kurz-  
spanend  
short chip

INOX  
stainless steel  
< 900 N/mm  
austenitic

lang-  
spanend  
long chip

NI-ALLOYS  
< 900 N/mm

Schruppen  
roughing  
▼

NI-CO  
ALLOYS  
> 900 N/mm

Schrupp-  
schlicht  
semifinishing  
▼▼

TITAN  
< 1100  
N/mm

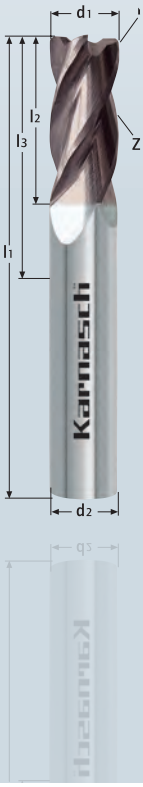
Schlichten  
finishing  
▼▼▼

HARDOX

INCONEL

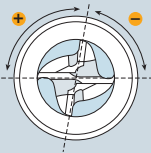
MONEL

NIMONIC



- Solid carbide end mills with corner radius for exotic materials
- Fresa metal duro de mango con radio angular para material exótico
- Твердосплавная концевая фреза для экзотического материала геометрией режущих кромок

A Ungleiche Teilung  
unequal pitch



B Wellenschliff  
wave-cut



MICRO  
GRAIN

DIN  
6527 L

SPEZIAL

DIN 6535  
Form HA

DIFF.

EXOTIC

HXP-7

OIL Emul  
MMKS

Schnittdaten  
Cutting data

i S. 295

| Art.           | d1 e8 | r ± 0,003 | l3 | l2 | d2 h6 | d3   | l1  | Z | €      |
|----------------|-------|-----------|----|----|-------|------|-----|---|--------|
| 307421.0600.10 | ▲ 6   | 1,0       | 21 | 16 | 6     | 5,8  | 57  | 4 | 74,00  |
| 307421.0800.10 | ▲ 8   | 1,0       | 29 | 22 | 8     | 7,8  | 70  | 4 | 91,00  |
| 307421.1200.10 | ▲ 12  | 1,0       | 38 | 28 | 12    | 11,8 | 83  | 4 | 125,00 |
| 307421.1200.30 | ▲ 12  | 3,0       | 38 | 28 | 12    | 11,8 | 83  | 4 | 125,00 |
| 307421.1400.10 | ▲ 14  | 1,0       | 42 | 30 | 14    | 13,8 | 83  | 4 | 146,00 |
| 307421.1400.30 | ▲ 14  | 3,0       | 42 | 30 | 14    | 13,8 | 83  | 4 | 146,00 |
| 307421.1600.10 | ▲ 16  | 1,0       | 45 | 35 | 16    | 15,8 | 93  | 4 | 167,00 |
| 307421.1800.10 | ▲ 18  | 1,0       | 45 | 35 | 18    | 17,8 | 93  | 4 | 189,00 |
| 307421.1800.30 | ▲ 18  | 3,0       | 45 | 35 | 18    | 17,8 | 93  | 4 | 189,00 |
| 307421.2000.10 | ▲ 20  | 1,0       | 50 | 40 | 20    | 19,8 | 105 | 4 | 207,00 |

Nachfolgewerkzeug / Replacement article 30.7425

VHM-Schaftfräser „GOLDWIN“ mit Eckenradius für **INOX** 2.1 – 2.2 – 2.3 – 2.4 – 4.1 – 4.2 – 4.3 – 5.1 – 5.2 – 5.3

Art. **30.7425**

**INOX**  
stainless steel  
< 900 N/mm  
ferritic

**INOX**  
stainless steel  
> 900 N/mm  
martensitic

**INOX**  
stainless steel  
< 900 N/mm  
austenitic

**NI-CO  
ALLOYS**  
> 900 N/mm

**NI-ALLOYS**  
< 900 N/mm

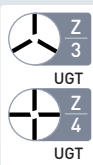
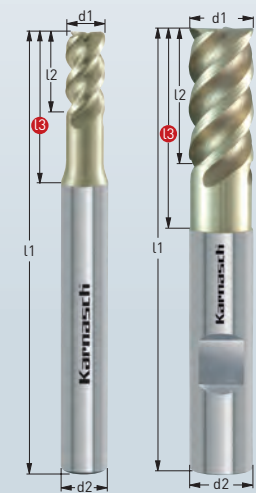
**kurz-  
spanend**  
short chip

**lang-  
spanend**  
long chip

**Schruppen**  
roughing  
▼

**Schrupp-  
schlicht**  
semifinishing  
▼▼

**Schlichten**  
finishing  
▼▼▼



- 🇧🇪 Solid carbide mills „GOLDWIN“ with corner radius
- 🇪🇸 Fresa de mango VHM “GOLDWIN” con radio angular
- 🇷🇺 Фреза концевая твердосплавная монолитная «GOLDWIN» с радиусом закругления

| Art.               | d1 h9 | rp  | l2 | l3 | d2 h5 | d3   | l1  | Z | €      |
|--------------------|-------|-----|----|----|-------|------|-----|---|--------|
| 307425.0200.020.04 | • 2   | 0,2 | 4  | 9  | 6     | 1,8  | 57  | 3 | 60,00  |
| 307425.0300.030.06 | • 3   | 0,3 | 6  | 12 | 6     | 2,8  | 57  | 3 | 59,00  |
| 307425.0400.050.08 | • 4   | 0,5 | 8  | 16 | 6     | 3,8  | 57  | 3 | 57,00  |
| 307425.0500.050.10 | • 5   | 0,5 | 10 | 16 | 6     | 4,8  | 57  | 3 | 57,00  |
| 307425.0600.050.12 | • 6   | 0,5 | 12 | 21 | 6     | 5,8  | 57  | 4 | 55,00  |
| 307425.0800.050.16 | • 8   | 0,5 | 16 | 27 | 8     | 7,7  | 63  | 4 | 61,00  |
| 307425.0800.100.16 | • 8   | 1,0 | 16 | 27 | 8     | 7,7  | 63  | 4 | 61,00  |
| 307425.0800.200.16 | • 8   | 2,0 | 16 | 27 | 8     | 7,7  | 63  | 4 | 61,00  |
| 307425.1000.050.20 | • 10  | 0,5 | 20 | 32 | 10    | 9,6  | 72  | 4 | 81,00  |
| 307425.1000.100.20 | • 10  | 1,0 | 20 | 32 | 10    | 9,6  | 72  | 4 | 81,00  |
| 307425.1000.200.20 | • 10  | 2,0 | 20 | 32 | 10    | 9,6  | 72  | 4 | 81,00  |
| 307425.1200.050.24 | • 12  | 0,5 | 24 | 36 | 12    | 11,5 | 83  | 4 | 102,00 |
| 307425.1200.100.24 | • 12  | 1,0 | 24 | 36 | 12    | 11,5 | 83  | 4 | 102,00 |
| 307425.1200.200.24 | • 12  | 2,0 | 24 | 36 | 12    | 11,5 | 83  | 4 | 102,00 |
| 307425.1200.300.24 | • 12  | 3,0 | 24 | 36 | 12    | 11,5 | 83  | 4 | 102,00 |
| 307425.1600.050.32 | • 16  | 0,5 | 32 | 44 | 16    | 15,4 | 92  | 4 | 194,00 |
| 307425.1600.100.32 | • 16  | 1,0 | 32 | 44 | 16    | 15,4 | 92  | 4 | 194,00 |
| 307425.1600.200.32 | • 16  | 2,0 | 32 | 44 | 16    | 15,4 | 92  | 4 | 194,00 |
| 307425.1600.300.32 | • 16  | 3,0 | 32 | 44 | 16    | 15,4 | 92  | 4 | 194,00 |
| 307425.2000.050.40 | • 20  | 0,5 | 40 | 54 | 20    | 19,3 | 104 | 4 | 259,00 |
| 307425.2000.100.40 | • 20  | 1,0 | 40 | 54 | 20    | 19,3 | 104 | 4 | 259,00 |
| 307425.2000.200.40 | • 20  | 2,0 | 40 | 54 | 20    | 19,3 | 104 | 4 | 259,00 |
| 307425.2000.300.40 | • 20  | 3,0 | 40 | 54 | 20    | 19,3 | 104 | 4 | 259,00 |

Schaft < Ø 10 = HA / Schaft > Ø 12 = HB

**MICRO  
GRAIN  
CLEAN**

**DIN  
6527 L**

**SPEZIAL**

DIN 6535/Form HA  
DIN 6535/Form HB



**HSC  
HPC**

**Tcx<sup>3</sup>**



**Schnittdaten  
Cutting data**



i S. 286-289

High-Performance VHM-Schaftfräser, für **TITAN** 4.1 – 4.2 – 4.3 – 5.1 – 5.2 – 5.3

Art. **30.7428**

**TITAN**  
TITAN < 1200 N/mm

**TITAN  
GRADE 1**

**TITAN  
GRADE 2**

**TITAN  
GRADE 3**

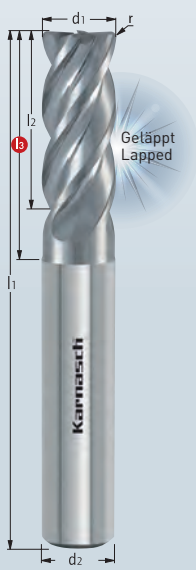
**TITAN  
GRADE 4**

**TITAN  
GRADE 5**

**TITAN  
GRADE 12**

**Schruppen**  
roughing  
▼

**Schlichten**  
finishing  
▼▼▼



- 🇧🇪 High performance solid carbide end mills for titanium
- 🇪🇸 Metal duro fresadora de rendimiento alto titanio
- 🇷🇺 Высококачественная твердосплавная концевая фреза для обработки титана

| Art.              | d1 h10 | r   | l2 | l3 | l1  | d2 | Z | €      |
|-------------------|--------|-----|----|----|-----|----|---|--------|
| 307428.0600.01.13 | • 6,0  | 0,1 | 13 | 20 | 57  | 6  | 4 | 43,00  |
| 307428.0600.05.13 | • 6,0  | 0,5 | 13 | 20 | 57  | 6  | 4 | 43,00  |
| 307428.0600.10.13 | • 6,0  | 1,0 | 13 | 20 | 57  | 6  | 4 | 43,00  |
| 307428.0800.02.21 | • 8,0  | 0,2 | 21 | 25 | 63  | 8  | 4 | 49,00  |
| 307428.0800.05.21 | • 8,0  | 0,5 | 21 | 25 | 63  | 8  | 4 | 49,00  |
| 307428.0800.10.21 | • 8,0  | 1,0 | 21 | 25 | 63  | 8  | 4 | 49,00  |
| 307428.1000.02.22 | • 10,0 | 0,2 | 22 | 30 | 72  | 10 | 4 | 72,00  |
| 307428.1000.05.22 | • 10,0 | 0,5 | 22 | 30 | 72  | 10 | 4 | 72,00  |
| 307428.1000.10.22 | • 10,0 | 1,0 | 22 | 30 | 72  | 10 | 4 | 72,00  |
| 307428.1200.02.26 | • 12,0 | 0,2 | 26 | 36 | 83  | 12 | 4 | 98,00  |
| 307428.1200.05.26 | • 12,0 | 0,5 | 26 | 36 | 83  | 12 | 4 | 98,00  |
| 307428.1200.10.26 | • 12,0 | 1,0 | 26 | 36 | 83  | 12 | 4 | 98,00  |
| 307428.1600.05.36 | • 16,0 | 0,5 | 36 | 42 | 92  | 16 | 4 | 175,00 |
| 307428.1600.10.36 | • 16,0 | 1,0 | 36 | 42 | 92  | 16 | 4 | 175,00 |
| 307428.1600.20.36 | • 16,0 | 2,0 | 36 | 42 | 92  | 16 | 4 | 175,00 |
| 307428.2000.05.41 | • 20,0 | 0,5 | 41 | 55 | 104 | 20 | 4 | 251,00 |
| 307428.2000.10.41 | • 20,0 | 1,0 | 41 | 55 | 104 | 20 | 4 | 251,00 |
| 307428.2000.20.41 | • 20,0 | 2,0 | 41 | 55 | 104 | 20 | 4 | 251,00 |

**MICRO  
GRAIN  
CLEAN**

**DIN  
6527 L**

**SPEZIAL**

DIN 6535  
Form HA



**HSC  
HPC**

**GELÄPPT  
LAPPED**



**Schnittdaten  
Cutting data**



i S. 305

Art. 30.7431 Vollhartmetall Innenschruppfräser für exotisches Material

INOX  
stainless steel  
< 900 N/mm  
ferritic

Nickel  
< 500  
N/mm<sup>2</sup>

INOX  
stainless steel  
> 900 N/mm  
martensitic

kurz-  
spanend  
short chip

INOX  
stainless steel  
< 900 N/mm  
austenitic

lang-  
spanend  
long chip

NI-ALLOYS  
< 900 N/mm

NI-CO  
ALLOYS  
> 900 N/mm

HARDOX

INCONEL

HASTELLOY

MONEL

NIMONIC



- Solid carbide roughing end mills for exotic materials, patented cutting geometry
- Fresa metal duro de desbastar para material exótico, geometría de corte patentada
- Твердосплавная концевая фреза для экзотического материала геометрией режущих кромок



Patentierte Schneidengeometrie  
Patented cutting geometry

| Art.           | d1 tol. d11 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|----------------|-------------|----|-------|------|-----|----|---|--------|
| 307431.0400.13 | • 4         | 13 | 6     | 3,9  | 57  | 8  | 4 | 73,00  |
| 307431.0500.15 | • 5         | 15 | 6     | 4,9  | 57  | 10 | 4 | 81,00  |
| 307431.0600.17 | • 6         | 17 | 6     | 5,9  | 57  | 12 | 4 | 79,00  |
| 307431.0800.21 | • 8         | 21 | 8     | 7,5  | 65  | 16 | 4 | 90,00  |
| 307431.1000.25 | • 10        | 25 | 10    | 9,5  | 72  | 20 | 4 | 98,00  |
| 307431.1200.30 | • 12        | 30 | 12    | 11,5 | 85  | 24 | 4 | 115,00 |
| 307431.1600.36 | • 16        | 36 | 16    | 15,5 | 92  | 32 | 5 | 196,00 |
| 307431.2000.45 | • 20        | 45 | 20    | 19,5 | 104 | 40 | 6 | 298,00 |
| 307431.2500.55 | • 25        | 55 | 25    | 24,0 | 150 | 50 | 6 | 540,00 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

Schnittdaten  
Cutting data



Art. 30.7432 Vollhartmetall Innen- und Außenschruppfräser für exotisches Material

INOX  
stainless steel  
< 900 N/mm  
ferritic

TITAN

INOX  
stainless steel  
> 900 N/mm  
martensitic

Nickel  
< 500  
N/mm<sup>2</sup>

INOX  
stainless steel  
< 900 N/mm  
austenitic

kurz-  
spanend  
short chip

NI-ALLOYS  
< 900 N/mm

lang-  
spanend  
long chip

NI-CO  
ALLOYS  
> 900 N/mm

Schruppen  
roughing

TITAN  
< 1100  
N/mm

INCONEL

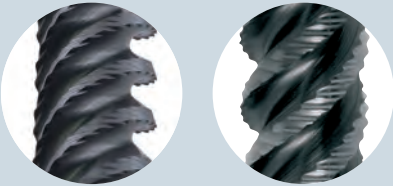
HASTELLOY

MONEL

NIMONIC



- Solid carbide roughing end mills for exotic materials, patented cutting geometry
- Fresa metal duro de desbastar para material exótico, geometría de corte patentada
- Твердосплавная концевая фреза для экзотического материала геометрией режущих кромок



Innen- und Außenschrupp  
Inside and outside roughing profil

| Art.           | d1 d10 | l3 | d2 h6 | d3   | l1  | l2 | Z | €      |
|----------------|--------|----|-------|------|-----|----|---|--------|
| 307432.0600.21 | • 6    | 21 | 6     | 5,8  | 57  | 16 | 4 | 79,00  |
| 307432.0800.27 | • 8    | 27 | 8     | 7,7  | 70  | 22 | 4 | 90,00  |
| 307432.1000.30 | • 10   | 30 | 10    | 9,7  | 72  | 25 | 4 | 100,00 |
| 307432.1200.38 | • 12   | 38 | 12    | 11,5 | 85  | 28 | 4 | 122,00 |
| 307432.1600.45 | • 16   | 45 | 16    | 15,5 | 92  | 35 | 5 | 233,00 |
| 307432.2000.55 | • 20   | 55 | 20    | 19,5 | 104 | 40 | 5 | 347,00 |
| 307432.2500.65 | • 25   | 65 | 25    | 24,0 | 125 | 50 | 5 | 586,00 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

Schnittdaten  
Cutting data





VHM-3D-Radiusfräser Z=2 Cobalt-Chrom Titan-Titanlegierungen

Art. **31.6840**

INOX  
stainless steel  
< 900 N/mm  
ferritic

TITAN

INOX  
stainless steel  
> 900 N/mm  
martensitic

kurz-  
spanend  
short chip

INOX  
stainless steel  
< 900 N/mm  
austenitic

lang-  
spanend  
long chip

NI-ALLOYS  
< 900 N/mm

Schruppen  
roughing  
▼

NI-CO  
ALLOYS  
> 900 N/mm

Schrupp-  
schicht  
semifinishing  
▼▼

TITAN  
< 1100  
N/mm

Schlichten  
finishing  
▼▼▼

HARDOX

INCONEL

MONEL

NIMONIC



- Solid carbide 3D, 2 teeth ball nose end mills, cobalt-chromium-titanium-titanium alloys
- Fresa metal duro de 2 labios – Punta rada y esférica, cobalto cromo titanio, aleación de titanio
- Твердосплавная радиусная фреза 3D, зубы = 2 Кобальд-Хром Титан-Титансплав

| Art.              | d1 -0,01 | r ±0,005 | l3 | d2 h5 | d3   | l1 | l2  | Z | €     |
|-------------------|----------|----------|----|-------|------|----|-----|---|-------|
| 316840.0100.08.03 | • 1,0    | 0,5      | 8  | 3     | 0,95 | 45 | 1,0 | 2 | 43,00 |
| 316840.0100.08.04 | • 1,0    | 0,5      | 8  | 4     | 0,95 | 45 | 1,0 | 2 | 44,00 |
| 316840.0100.08.06 | • 1,0    | 0,5      | 8  | 6     | 0,95 | 45 | 1,0 | 2 | 48,00 |
| 316840.0200.12.03 | • 2,0    | 1,0      | 12 | 3     | 1,92 | 45 | 2,0 | 2 | 43,00 |
| 316840.0200.12.04 | • 2,0    | 1,0      | 12 | 4     | 1,92 | 45 | 2,0 | 2 | 44,00 |
| 316840.0200.12.06 | • 2,0    | 1,0      | 12 | 6     | 1,92 | 45 | 2,0 | 2 | 48,00 |
| 316840.0300.14.03 | • 3,0    | 1,5      | 14 | 3     | 2,90 | 45 | 3,0 | 2 | 43,00 |
| 316840.0300.14.04 | • 3,0    | 1,5      | 14 | 4     | 2,90 | 45 | 3,0 | 2 | 44,00 |
| 316840.0300.14.06 | • 3,0    | 1,5      | 14 | 6     | 2,90 | 45 | 3,0 | 2 | 48,00 |

| Werkstoffgruppe<br>Material group | Schruppen<br>roughing<br>Ø 3,0 | Schruppen<br>roughing<br>Ø 2,0 | Schlichten<br>finishing<br>Ø 1,0 |
|-----------------------------------|--------------------------------|--------------------------------|----------------------------------|
| Cobalt-Chrom                      | Vc 200                         | Vc 200                         | Vc 100                           |
| Titan                             | Vf 1.650                       | Vf 1.870                       | Vf 1.250                         |
| Titanlegierung                    | n 20.800                       | n 31.200                       | n 31.200                         |
| Titanium alloy                    | fz 0,04                        | fz 0,03                        | fz 0,02                          |
|                                   | ap 0,06                        | ap 0,06                        | ap 0,06                          |
|                                   | ae 1,50                        | ae 1,00                        | ae 0,50                          |

MICRO  
GRAIN  
CLEAN-34

KARNASCH  
NORM

SPEZIAL

Form HA

30°

HSC  
HHC

Tcx<sup>3</sup>

Schnittdaten  
Cutting data



i S. 111

VHM-3D-Radiusfräser, 4-Schneiden-Zentrumschnitt, Cobalt-Chrom Titan-Titanlegierungen

Art. **31.6868**

INOX  
stainless steel  
< 900 N/mm  
ferritic

TITAN

INOX  
stainless steel  
> 900 N/mm  
martensitic

kurz-  
spanend  
short chip

INOX  
stainless steel  
< 900 N/mm  
austenitic

lang-  
spanend  
long chip

NI-ALLOYS  
< 900 N/mm

Schruppen  
roughing  
▼

NI-CO  
ALLOYS  
> 900 N/mm

Schrupp-  
schicht  
semifinishing  
▼▼

TITAN  
< 1100  
N/mm

Schlichten  
finishing  
▼▼▼

HARDOX

INCONEL

MONEL

NIMONIC



- Solid carbide 3D, 4 teeth ball nose end mills, cobalt-chromium-titanium-titanium alloys
- Fresa metal duro de 4 labios – Punta rada y esférica, cobalto cromo titanio, aleación de titanio
- Твердосплавная радиусная фреза 3D, зубы = 2 Кобальд-Хром Титан-Титансплав

| Art.              | d1 -0,01 | r ±0,005 | l3 | d2 h5 | d3   | l1 | l2  | Z | €     |
|-------------------|----------|----------|----|-------|------|----|-----|---|-------|
| 316868.0100.08.03 | • 1,0    | 0,5      | 8  | 3     | 0,95 | 45 | 1,5 | 4 | 36,00 |
| 316868.0100.08.04 | • 1,0    | 0,5      | 8  | 4     | 0,95 | 45 | 1,5 | 4 | 37,00 |
| 316868.0100.08.06 | • 1,0    | 0,5      | 8  | 6     | 0,95 | 45 | 1,5 | 4 | 39,00 |
| 316868.0200.12.03 | • 2,0    | 1,0      | 12 | 3     | 1,92 | 45 | 3,0 | 4 | 34,00 |
| 316868.0200.12.04 | • 2,0    | 1,0      | 12 | 4     | 1,92 | 45 | 3,0 | 4 | 36,00 |
| 316868.0200.12.06 | • 2,0    | 1,0      | 12 | 6     | 1,92 | 45 | 3,0 | 4 | 38,00 |
| 316868.0300.14.03 | • 3,0    | 1,5      | 14 | 3     | 2,90 | 45 | 4,0 | 4 | 34,00 |
| 316868.0300.14.04 | • 3,0    | 1,5      | 14 | 4     | 2,90 | 45 | 4,0 | 4 | 36,00 |
| 316868.0300.14.06 | • 3,0    | 1,5      | 14 | 6     | 2,90 | 45 | 4,0 | 4 | 38,00 |
| 316868.0400.08.06 | • 4,0    | 2,0      | 8  | 6     | 3,90 | 45 | 5,0 | 4 | 40,00 |

| Werkstoffgruppe<br>Material group | Schruppen<br>roughing<br>Ø 3,0 | Schruppen<br>roughing<br>Ø 2,0 | Schlichten<br>finishing<br>Ø 1,0 |
|-----------------------------------|--------------------------------|--------------------------------|----------------------------------|
| Cobalt-Chrom                      | Vc 200                         | Vc 200                         | Vc 100                           |
| Titan                             | Vf 3.300                       | Vf 3.750                       | Vf 2.500                         |
| Titanlegierung                    | n 20.800                       | n 31.200                       | n 31.200                         |
| Titanium alloy                    | fz 0,04                        | fz 0,03                        | fz 0,02                          |
|                                   | ap 0,06                        | ap 0,06                        | ap 0,06                          |
|                                   | ae 1,50                        | ae 1,00                        | ae 0,50                          |

MICRO  
GRAIN  
CLEAN-34

KARNASCH  
NORM

SPEZIAL

Form HA

30°

HSC  
HHC

Tcx<sup>3</sup>

Schnittdaten  
Cutting data



i S. 111

Art. 30.7485

EXPERT

Vollhartmetall 3D-Radiusfräser FOURWIN, 4 Schneiden-Zentrumschnitt, für TITAN 4.1 - 4.2 - 4.3 - 5.1 - 5.2 - 5.3

TITAN

TITAN < 1200 N/mm

INCONEL HASTELLOY TITAN

NIMONIC 105

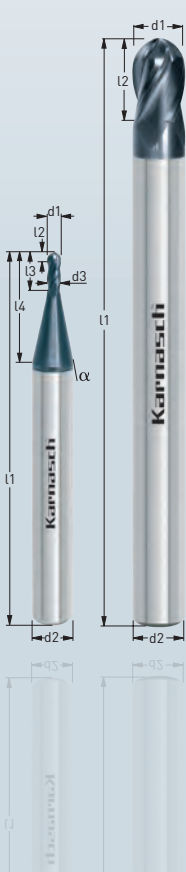
Monel 400

HASTELLOY C22

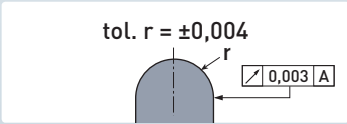
INCONEL 718

Schruppen roughing

Schlichten finishing



- Solid carbide 3D ball nose end mills, for titanium, 4 cutting edges - centre cutting
- Fresadora metal duro de radio de 3D, per titanio, 4 cortar - corte de centro
- Твердосплавная радиусная фреза 3D, четыре зуба - резка к центру



|     |                  |                     |
|-----|------------------|---------------------|
| d1* | = Ø 0,1 - Ø 2,0  | tol -0,002 / -0,010 |
| d1* | = Ø 1,5 - Ø 3,0  | tol -0,006 / -0,020 |
| d1* | = Ø 4,0 - Ø 6,0  | tol -0,010 / -0,028 |
| d1* | = Ø 8,0 - Ø 10,0 | tol -0,013 / -0,035 |
| d1* | = Ø 12,0         | tol -0,016 / -0,043 |

| Art.              | d1 f8  | r ± 0,004 | l3   | L4 | d2 h5 | d3  | l1  | l2   | α  | Z | €      |
|-------------------|--------|-----------|------|----|-------|-----|-----|------|----|---|--------|
| 307485.0150.08.55 | • 1,5  | 0,75      | 8,0  | 20 | 6     | 1,4 | 55  | 2,5  | 12 | 4 | 46,00  |
| 307485.0200.055   | • 2,0  | 1,0       | -    | -  | 6     | -   | 55  | 4    | 12 | 4 | 45,00  |
| 307485.0200.08.55 | • 2,0  | 1,0       | 8,0  | 20 | 6     | 1,8 | 55  | 3,0  | 12 | 4 | 46,00  |
| 307485.0200.080   | • 2,0  | 1,0       | -    | -  | 6     | -   | 80  | 4    | 12 | 4 | 62,00  |
| 307485.0250.10.55 | • 2,5  | 1,25      | 10,0 | 20 | 6     | 2,3 | 55  | 3,25 | 12 | 4 | 46,00  |
| 307485.0300.055   | • 3,0  | 1,5       | -    | -  | 6     | -   | 55  | 5    | 12 | 4 | 45,00  |
| 307485.0300.10.55 | • 3,0  | 1,5       | 10,0 | 20 | 6     | 2,8 | 55  | 3,5  | 12 | 4 | 46,00  |
| 307485.0300.14.55 | • 3,0  | 1,5       | 14,0 | 20 | 6     | 2,8 | 55  | 3,5  | 12 | 4 | 46,00  |
| 307485.0300.18.55 | • 3,0  | 1,5       | 18,0 | 20 | 6     | 2,8 | 55  | 3,5  | 12 | 4 | 47,00  |
| 307485.0300.080   | • 3,0  | 1,5       | -    | -  | 6     | -   | 80  | 5    | 12 | 4 | 62,00  |
| 307485.0400.12.55 | • 4,0  | 2,0       | 12,0 | 20 | 6     | 3,8 | 55  | 4    | 12 | 4 | 46,00  |
| 307485.0400.16.55 | • 4,0  | 2,0       | 16,0 | 20 | 6     | 3,8 | 55  | 4    | 12 | 4 | 46,00  |
| 307485.0400.055   | • 4,0  | 2,0       | -    | -  | 6     | -   | 55  | 8    | 12 | 4 | 45,00  |
| 307485.0400.080   | • 4,0  | 2,0       | -    | -  | 6     | -   | 80  | 8    | 12 | 4 | 62,00  |
| 307485.0500.055   | • 5,0  | 2,5       | -    | -  | 6     | -   | 55  | 9    | 12 | 4 | 45,00  |
| 307485.0500.080   | • 5,0  | 2,5       | -    | -  | 6     | -   | 80  | 9    | 12 | 4 | 62,00  |
| 307485.0600.055   | • 6,0  | 3,0       | -    | -  | 6     | -   | 55  | 10   | -  | 4 | 44,00  |
| 307485.0600.100   | • 6,0  | 3,0       | -    | -  | 6     | -   | 100 | 10   | -  | 4 | 60,00  |
| 307485.0800.060   | • 8,0  | 4,0       | -    | -  | 8     | -   | 60  | 12   | -  | 4 | 55,00  |
| 307485.0800.100   | • 8,0  | 4,0       | -    | -  | 8     | -   | 100 | 12   | -  | 4 | 75,00  |
| 307485.1000.068   | • 10,0 | 5,0       | -    | -  | 10    | -   | 68  | 14   | -  | 4 | 72,00  |
| 307485.1000.100   | • 10,0 | 5,0       | -    | -  | 10    | -   | 100 | 14   | -  | 4 | 94,00  |
| 307485.1200.075   | • 12,0 | 6,0       | -    | -  | 12    | -   | 75  | 16   | -  | 4 | 97,00  |
| 307485.1200.100   | • 12,0 | 6,0       | -    | -  | 12    | -   | 100 | 16   | -  | 4 | 122,00 |

MICRO GRAIN

KARNASCH NORM

N/M

DIN 6535 Form HA



HSC HPC



TI-X2



Schnittdaten Cutting data



i S. 298-299

Art. 30.7486

EXPERT

Vollhartmetall 3D-Radiusfräser für exotisches Material

INOX stainless steel < 900 N/mm ferritic

TITAN

INOX stainless steel > 900 N/mm martensitic

Nickel < 500 N/mm²

INOX stainless steel < 900 N/mm austenitic

kurz-spanend short chip

NI-ALLOYS < 900 N/mm

lang-spanend long chip

NI-CO ALLOYS > 900 N/mm

Schruppen roughing

TITAN < 1100 N/mm

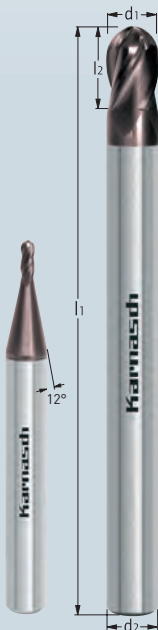
Schlichten finishing

INCONEL

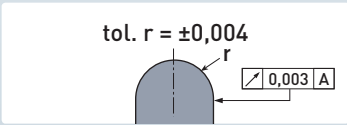
HASTELLOY

MONEL

NIMONIC



- Solid carbide 3D ball nose end mills, exotic materials
- Fresadora metal duro de radio de 3D, para material exotico
- Твердосплавная радиусная фреза 3D



|     |                  |                     |
|-----|------------------|---------------------|
| d1* | = Ø 0,1 - Ø 2,0  | tol -0,002 / -0,010 |
| d1* | = Ø 1,5 - Ø 3,0  | tol -0,006 / -0,020 |
| d1* | = Ø 4,0 - Ø 6,0  | tol -0,010 / -0,028 |
| d1* | = Ø 8,0 - Ø 10,0 | tol -0,013 / -0,035 |
| d1* | = Ø 12,0         | tol -0,016 / -0,043 |

| Art.            | d1 f8  | r ± 0,004 | l1  | l2 | d2 h5 | α  | Z | €      |
|-----------------|--------|-----------|-----|----|-------|----|---|--------|
| 307486.0200.055 | ▲ 2,0  | 1,0       | 55  | 4  | 6     | 12 | 4 | 43,00  |
| 307486.0200.080 | ▲ 2,0  | 1,0       | 80  | 4  | 6     | 12 | 4 | 61,00  |
| 307486.0300.080 | ▲ 3,0  | 1,5       | 80  | 5  | 6     | 12 | 4 | 60,00  |
| 307486.0400.080 | ▲ 4,0  | 2,0       | 80  | 8  | 6     | 12 | 4 | 59,00  |
| 307486.0500.100 | ▲ 5,0  | 2,5       | 100 | 9  | 6     | 12 | 4 | 58,00  |
| 307486.0600.055 | ▲ 6,0  | 3,0       | 55  | 10 | 6     | -  | 4 | 42,00  |
| 307486.0600.100 | ▲ 6,0  | 3,0       | 100 | 10 | 6     | -  | 4 | 65,00  |
| 307486.0800.100 | ▲ 8,0  | 4,0       | 100 | 12 | 8     | -  | 4 | 73,00  |
| 307486.1000.068 | ▲ 10,0 | 5,0       | 68  | 14 | 10    | -  | 4 | 70,00  |
| 307486.1000.100 | ▲ 10,0 | 5,0       | 100 | 14 | 10    | -  | 4 | 93,00  |
| 307486.1200.075 | ▲ 12,0 | 6,0       | 75  | 16 | 12    | -  | 4 | 95,00  |
| 307486.1200.100 | ▲ 12,0 | 6,0       | 100 | 16 | 12    | -  | 4 | 120,00 |

Nachfolgewerkzeug / Replacement article  
30.7485 = TITAN, Z4 NEU/NEW  
30.7487 = VA, Z4 NEU/NEW

MICRO GRAIN

KARNASCH NORM

N/M

DIN 6535 Form HA



HSC HPC



INOX F2



Schnittdaten Cutting data



i S. 295

Vollhartmetall 3D-Radiusfräser FOURWIN 4 Schneiden-Zentrumschnitt, für **INOX** 2.1 – 2.2 – 2.3 – 2.4

EXPERT  
★ ★ ★

Art. **30.7487**

**INOX**

**INOX**  
stainless steel  
> 900 N/mm  
martensitic

**INOX**  
stainless steel  
< 900 N/mm  
ferritic

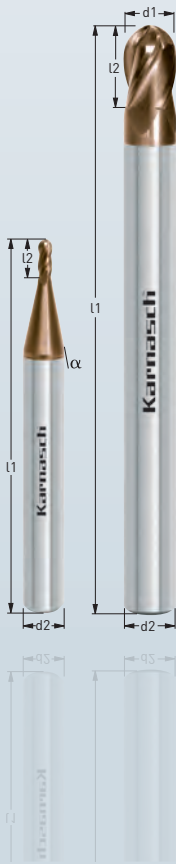
**INOX**  
stainless steel  
< 900 N/mm  
austenitic

**NI-ALLOYS**  
< 900 N/mm

**STAHL**  
steel  
< 1100 N/mm

**Schruppen**  
roughing  
▼

**Schlichten**  
finishing  
▼▼▼

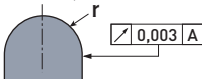


Solid carbide 3D ball nose end mills for Inox, 4 cutting edges - centre cutting

Fresadora metal duro de radio de 3D por Inox, 4 cortar - corte de centro

Твердосплавная радиусная фреза 3D, четыре зуба - резка к центру

tol. r = ±0,004



d1\* = Ø 0,1 - Ø 2,0 tol -0,002 / -0,010

d1\* = Ø 1,5 - Ø 3,0 tol -0,006 / -0,020

d1\* = Ø 4,0 - Ø 6,0 tol -0,010 / -0,028

d1\* = Ø 8,0 - Ø 10,0 tol -0,013 / -0,035

d1\* = Ø 12,0 tol -0,016 / -0,043

| Art.            | d1 f8  | r ± 0,004 | l1  | l2 | d2 h5 | α  | Z | €      |
|-----------------|--------|-----------|-----|----|-------|----|---|--------|
| 307487.0200.055 | • 2,0  | 1,0       | 55  | 4  | 6     | 12 | 4 | 45,00  |
| 307487.0200.080 | • 2,0  | 1,0       | 80  | 4  | 6     | 12 | 4 | 64,00  |
| 307487.0300.055 | • 3,0  | 1,5       | 55  | 5  | 6     | 12 | 4 | 45,00  |
| 307487.0300.080 | • 3,0  | 1,5       | 80  | 5  | 6     | 12 | 4 | 62,00  |
| 307487.0400.055 | • 4,0  | 2,0       | 55  | 8  | 6     | 12 | 4 | 45,00  |
| 307487.0400.080 | • 4,0  | 2,0       | 80  | 8  | 6     | 12 | 4 | 61,00  |
| 307487.0500.055 | • 5,0  | 2,5       | 55  | 9  | 6     | 12 | 4 | 45,00  |
| 307487.0500.080 | • 5,0  | 2,5       | 80  | 9  | 6     | 12 | 4 | 60,00  |
| 307487.0600.055 | • 6,0  | 3,0       | 55  | 10 | 6     | -  | 4 | 45,00  |
| 307487.0600.100 | • 6,0  | 3,0       | 100 | 10 | 6     | -  | 4 | 59,00  |
| 307487.0800.060 | • 8,0  | 4,0       | 60  | 12 | 8     | -  | 4 | 55,00  |
| 307487.0800.100 | • 8,0  | 4,0       | 100 | 12 | 8     | -  | 4 | 74,00  |
| 307487.1000.068 | • 10,0 | 5,0       | 68  | 14 | 10    | -  | 4 | 73,00  |
| 307487.1000.100 | • 10,0 | 5,0       | 100 | 14 | 10    | -  | 4 | 96,00  |
| 307487.1200.075 | • 12,0 | 6,0       | 75  | 16 | 12    | -  | 4 | 98,00  |
| 307487.1200.100 | • 12,0 | 6,0       | 100 | 16 | 12    | -  | 4 | 121,00 |

**MICRO  
GRAIN**

**KARNASCH  
NORM**

**N/M**

**DIN 6535  
Form HA**



**HSC  
HPC**



**INOX  
HP**



Schnittdaten  
Cutting data



i s. 300-301







 Zähnezahl- Tabelle für Vollhartmetall- Kreissägeblätter ähnlich DIN 1837 A

Art. **5.6000A**

 Number of teeth - table for solid carbide circular saw blades similar DIN 1837 A

| Ø mm/±0,1                         | 15                                  | 20 | 25 | 30  | 40  | 50  | 63  | 80  | 100 | 125 | 150 | 160 | 200 |
|-----------------------------------|-------------------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Bohrung/Bore H7                   | 5                                   | 5  | 8  | 8   | 10  | 13  | 16  | 22  | 22  | 22  | 32  | 32  | 32  |
| Blattstärke/Blade thickness ±0,01 | Anzahl der Zähne<br>Number of teeth |    |    |     |     |     |     |     |     |     |     |     |     |
| • 0,10                            | 64                                  | 80 | 80 | 100 | 128 |     |     |     |     |     |     |     |     |
| • 0,15                            | 64                                  | 80 | 80 | 100 | 128 |     |     |     |     |     |     |     |     |
| • 0,20                            | 64                                  | 80 | 80 | 100 | 128 | 128 | 160 |     |     |     |     |     |     |
| • 0,25                            | 64                                  | 64 | 80 | 100 | 100 | 128 | 128 |     |     |     |     |     |     |
| • 0,30                            | 64                                  | 64 | 80 | 80  | 100 | 128 | 128 | 160 |     |     |     |     |     |
| • 0,35                            | 64                                  | 64 | 64 | 80  | 100 | 100 | 128 | 160 |     |     |     |     |     |
| • 0,40                            | 64                                  | 64 | 64 | 80  | 100 | 100 | 128 | 160 |     |     |     |     |     |
| • 0,45                            | 48                                  | 48 | 64 | 80  | 80  | 100 | 128 | 128 |     |     |     |     |     |
| • 0,50                            | 48                                  | 48 | 64 | 80  | 80  | 100 | 128 | 128 | 160 |     |     |     |     |
| • 0,60                            | 48                                  | 48 | 64 | 64  | 80  | 100 | 100 | 128 | 160 | 160 |     |     |     |
| • 0,70                            | 48                                  | 48 | 48 | 64  | 80  | 80  | 100 | 128 | 128 | 160 |     |     |     |
| • 0,80                            | 40                                  | 40 | 48 | 64  | 80  | 80  | 100 | 128 | 128 | 160 |     |     |     |
| • 0,90                            | 40                                  | 40 | 48 | 64  | 64  | 80  | 100 | 100 | 128 | 160 |     |     |     |
| • 1,00                            | 40                                  | 40 | 48 | 64  | 64  | 80  | 100 | 100 | 128 | 160 | 150 | 160 |     |
| • 1,10                            | 40                                  | 40 | 48 | 48  | 64  | 80  | 80  | 100 | 128 | 128 |     |     |     |
| • 1,20                            | 40                                  | 40 | 48 | 48  | 64  | 80  | 80  | 100 | 128 | 128 | 150 | 160 | 200 |
| • 1,30                            | 40                                  | 40 | 40 | 48  | 64  | 64  | 80  | 100 | 100 |     |     |     |     |
| • 1,40                            | 40                                  | 40 | 40 | 48  | 64  | 64  | 80  | 100 | 100 | 128 |     |     |     |
| • 1,50                            | 40                                  | 40 | 40 | 48  | 64  | 64  | 80  | 100 | 100 | 128 | 150 | 160 | 160 |
| • 1,60                            | 40                                  | 40 | 40 | 48  | 64  | 64  | 80  | 100 | 100 | 128 | 150 | 160 | 160 |
| • 1,70                            | 40                                  | 32 | 40 | 48  | 48  | 64  | 80  | 80  | 100 |     |     |     |     |
| • 1,80                            | 40                                  | 32 | 40 | 48  | 48  | 64  | 80  | 80  | 100 | 128 | 128 | 128 | 160 |
| • 1,90                            | 40                                  | 32 | 40 | 48  | 48  | 64  | 80  | 80  | 100 |     |     |     |     |
| • 2,00                            | 40                                  | 32 | 40 | 48  | 48  | 64  | 80  | 80  | 100 | 128 | 128 | 128 | 160 |
| • 2,50                            | 40                                  | 32 | 40 | 40  | 48  | 64  | 64  | 80  | 100 | 100 | 128 | 128 | 160 |
| • 3,00                            | 40                                  | 32 | 32 | 40  | 48  | 48  | 64  | 80  | 80  | 100 | 128 | 128 | 128 |
| • 3,50                            | 24                                  | 24 | 32 | 40  | 40  | 48  | 64  | 64  | 80  | 100 |     |     |     |
| • 4,00                            | 24                                  | 24 | 32 | 40  | 40  | 48  | 64  | 64  | 80  | 100 | 100 | 100 | 128 |
| • 5,00                            | 24                                  | 24 | 32 | 32  | 40  | 48  | 48  | 64  | 80  | 100 |     |     |     |
| • 6,00                            | 24                                  | 24 | 24 | 32  | 40  | 40  | 48  | 64  | 64  | 100 |     |     |     |

 Zähnezahl- Tabelle für Vollhartmetall- Kreissägeblätter ähnlich DIN 1838 B

Art. **5.6001B**

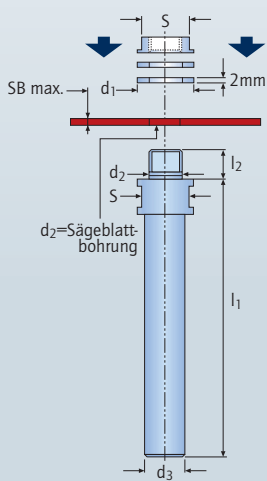
 Number of teeth - table for solid carbide circular saw blades similar DIN 1838 B

| Ø mm/±0,1                         | 15                                  | 20 | 25 | 30 | 40 | 50 | 63 | 80 | 100 | 125 |  |  |  |
|-----------------------------------|-------------------------------------|----|----|----|----|----|----|----|-----|-----|--|--|--|
| Bohrung/Bore H7                   | 5                                   | 5  | 8  | 8  | 10 | 13 | 16 | 22 | 22  | 22  |  |  |  |
| Blattstärke/Blade thickness ±0,01 | Anzahl der Zähne<br>Number of teeth |    |    |    |    |    |    |    |     |     |  |  |  |
| • 0,20                            | 20                                  | 20 | 20 | 30 | 40 |    |    |    |     |     |  |  |  |
| • 0,25                            | 20                                  | 20 | 20 | 30 | 40 |    |    |    |     |     |  |  |  |
| • 0,30                            | 20                                  | 20 | 20 | 30 | 40 |    |    |    |     |     |  |  |  |
| • 0,40                            | 20                                  | 20 | 20 | 30 | 40 | 48 | 64 |    |     |     |  |  |  |
| • 0,50                            | 20                                  | 20 | 20 | 30 | 40 | 48 | 64 |    |     |     |  |  |  |
| • 0,60                            | 20                                  | 20 | 20 | 30 | 40 | 48 | 48 | 64 | 80  |     |  |  |  |
| • 0,70                            | 20                                  | 20 | 20 | 30 | 40 | 40 | 48 | 64 | 64  |     |  |  |  |
| • 0,80                            | 20                                  | 20 | 20 | 24 | 32 | 40 | 48 | 64 | 64  | 80  |  |  |  |
| • 0,90                            | 20                                  | 20 | 20 | 24 | 32 | 40 | 48 | 48 | 64  | 80  |  |  |  |
| • 1,00                            | 20                                  | 20 | 20 | 24 | 32 | 40 | 48 | 48 | 64  | 80  |  |  |  |
| • 1,20                            | 20                                  | 20 | 20 | 24 | 32 | 40 | 40 | 48 | 64  | 64  |  |  |  |
| • 1,50                            | 20                                  | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 48  | 64  |  |  |  |
| • 1,60                            | 20                                  | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 48  | 64  |  |  |  |
| • 1,80                            | 20                                  | 20 | 20 | 24 | 24 | 32 | 40 | 40 | 48  | 64  |  |  |  |
| • 2,00                            | 20                                  | 20 | 20 | 24 | 24 | 32 | 40 | 40 | 48  | 64  |  |  |  |
| • 2,50                            | 20                                  | 20 | 20 | 24 | 24 | 32 | 32 | 40 | 48  | 48  |  |  |  |
| • 3,00                            | 20                                  | 20 | 20 | 24 | 24 | 24 | 32 | 40 | 40  | 48  |  |  |  |
| • 4,00                            | 20                                  | 20 | 20 | 24 | 20 | 24 | 32 | 32 | 40  | 48  |  |  |  |
| • 5,00                            | 20                                  | 20 | 20 | 24 | 20 | 24 | 24 | 32 | 40  | 40  |  |  |  |
| • 6,00                            | 20                                  | 20 | 20 | 24 | 20 | 20 | 24 | 32 | 32  | 40  |  |  |  |

Art. 5.6100

Kreissägeblätter Aufnahmehalter – "Vorderseitige Aufspannung"

HSS

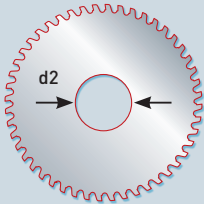


- Circular saw blade retainer – front side securing
- Soporte de hojas de sierra circular –Fijación frontal
- Крепежный держатель пильных полотен – передняя затяжка

d2 = Sägeblattbohrung / Saw blade bore  
d1 = Flanschdurchmesser / Flange diameter  
d3 = Schaftdurchmesser / Shank diameter

Preise siehe Hauptkatalog  
Industrial Tools Division  
For prices refer to  
maincatalogue Industrial  
Tools Division

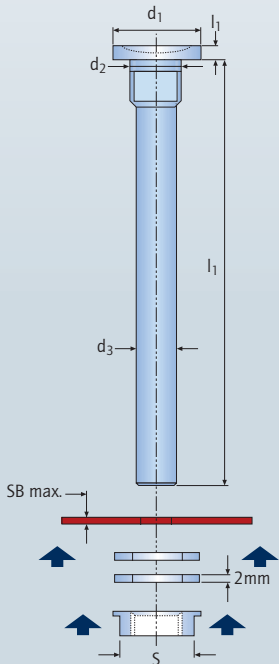
| Art.            | d2 h6 | d3 h6 | d1  | l1  | l2   | SB max. | S  | € |
|-----------------|-------|-------|-----|-----|------|---------|----|---|
| 56100.03.05     | • 3   | 5     | 5   | 60  | 8,0  | 3       | 4  |   |
| 56100.05.06     | • 5   | 6     | 10  | 70  | 10,0 | 6       | 8  |   |
| 56100.05.06.075 | • 5   | 6     | 7,5 | 70  | 7,0  | 3       | 6  |   |
| 56100.05.10     | • 5   | 10    | 10  | 80  | 10,0 | 6       | 8  |   |
| 56100.06.10     | • 6   | 10    | 12  | 80  | 10,5 | 6       | 10 |   |
| 56100.08.10     | • 8   | 10    | 15  | 90  | 10,0 | 6       | 13 |   |
| 56100.08.12     | • 8   | 12    | 15  | 90  | 11,0 | 6       | 13 |   |
| 56100.10.06     | • 10  | 6     | 18  | 80  | 10,5 | 6       | 15 |   |
| 56100.10.10     | • 10  | 10    | 18  | 90  | 10,5 | 6       | 15 |   |
| 56100.10.16     | • 10  | 16    | 18  | 100 | 11,5 | 6       | 15 |   |
| 56100.13.16     | • 13  | 16    | 22  | 110 | 12,0 | 6       | 19 |   |
| 56100.16.10     | • 16  | 10    | 22  | 80  | 8,0  | 3       | 19 |   |
| 56100.16.20     | • 16  | 20    | 26  | 120 | 13,0 | 6       | 22 |   |
| 56100.22.16     | • 22  | 16    | 32  | 130 | 13,0 | 6       | 27 |   |
| 56100.22.25     | • 22  | 25    | 32  | 150 | 4,0  | 6       | 8  |   |



Art. 5.6101

Kreissägeblätter Aufnahmehalter – "Rückseitige Aufspannung"

HSS

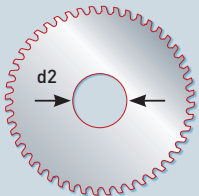


- Circular saw blades retainer – rear side securing
- Soporte de hojas de sierra circular –Fijación posterior
- Крепежный держатель пильных полотен – задняя затяжка

d2 = Sägeblattbohrung / Saw blade bore  
d1 = Flanschdurchmesser / Flange diameter  
d3 = Schaftdurchmesser / Shank diameter

Preise siehe Hauptkatalog  
Industrial Tools Division  
For prices refer to  
maincatalogue Industrial  
Tools Division

| Art.        | d2 h6 | d3 h6 | d1 | l1  | l2  | SB max. | S  | € |
|-------------|-------|-------|----|-----|-----|---------|----|---|
| 56101.05.04 | • 5   | 4     | 10 | 50  | 3,0 | 6       | 8  |   |
| 56101.06.05 | • 6   | 5     | 12 | 60  | 3,0 | 6       | 10 |   |
| 56101.08.06 | • 8   | 6     | 15 | 70  | 3,0 | 6       | 13 |   |
| 56101.08.07 | • 8   | 7     | 15 | 80  | 3,0 | 6       | 13 |   |
| 56101.10.06 | • 10  | 6     | 18 | 70  | 3,5 | 6       | 15 |   |
| 56101.10.08 | • 10  | 8     | 18 | 90  | 3,5 | 6       | 15 |   |
| 56101.13.10 | • 13  | 10    | 22 | 110 | 3,5 | 6       | 19 |   |
| 56101.16.12 | • 16  | 12    | 26 | 120 | 3,5 | 6       | 22 |   |



TECHNISCHE INFORMATION zu VHM-Kreissägeblätter  
TECHNICAL INFORMATION on slitting saws solid carbide

Art. **5.6000 A** | Art. **5.6001 B**

Kühlung:

Wir empfehlen beim Einsatz von Vollhartmetallwerkzeugen eine besonders kräftige Kühlung. Unzureichend oder unregelmäßig arbeitende Kühlung begünstigt das Entstehen von Rissen im Werkzeug oder kann zum Bruch führen. Im Zweifelsfalle mit fetter Emulsion oder mit Schneidöl arbeiten.  
**Keine Regel ohne Ausnahme:** Grauguß wird normalerweise trocken zerspant, ebenfalls wird Kunststoff trocken gesägt. Gelegentlich wird Preßluft oder Wasser verwendet. Bei Magnesiumlegierungen ist Vorsicht geboten. In Verbindung mit Wasser besteht Explosionsgefahr. Aus diesem Grund wird hier trocken gesägt.

Vorschub:

Der allgemeine Richtwert für den Vorschub je Zahn liegt zwischen 0,005 mm für sehr harte Werkstoffe und 0,05 mm für weiche NE-Metalle. Bei durchschnittlich hartem Material wird man mit ca. 0,01 mm pro Zahn beginnen – also wesentlich langsamer als bei HSS – und je nach Ergebnis den Vorschub etwas reduzieren oder erhöhen. Die Wahl des Vorschubes wird von vielen nicht berechenbaren Faktoren beeinflusst. Die Zerspanbarkeit des Werkstoffes spielt ebenso eine Rolle, wie Drehzahl, Vorschubart, Werkstückspannung und Maschinenzustand. Die Anzahl der Zähne im Eingriff, Sägendurchmesser und Breite sind weitere Einfluß-faktoren. Aus diesen Gründen können wir Ihnen nur allgemeine Richtwerte angeben. Je nach Einsatzbedingungen können diese Werte sowohl höher als auch niedriger liegen. Speziell bei Karnasch Vollhartmetallwerkzeugen bringt ein kleiner Vorschub und eine feine Zahnteilung eine besonders feine Schnittfläche. Bei den verschiedenen Werkstoffen kann man von den in der Tabelle aufgeführten Vorschubwerten pro Zahn ausgehen. Multipliziert mit der Zähnezahl des verwendeten Sägeblatts und der Drehzahl ergibt sich dann der auf der Maschine einzustellende Vorschub in mm/min.

Für NE-Metalle kann, sofern auf der Maschine vorhanden, auch Sprühöl-Schmierung verwendet werden: oder **Art.: 60.1150** (Mecutspray).

Cooling:

We recommend using highly effective cooling when cutting with solid carbide tools. If the cooling is not sufficient or is irregular in nature, this can cause fractures in the tools or even result in complete failure. When in doubt, use water-oil emulsions or cutting oil.  
*Exception: Grey cast iron is usually machined while dry and plastics are also cut dry. Occasionally, compressed air or water may be used. Exercise caution with magnesium alloys. Magnesium may explode if it comes into contact with water. Therefore, always cut magnesium alloys while they are dry.*

Feed rates:

As a guideline, use a feed rate per saw tooth of 0.005 mm for very hard materials and 0.05 mm for softer non-ferrous metals. For a metal of typical hardness, start with approx. 0.01 mm per tooth – i.e., much slower than with high speed steel. Depending on the results you achieve, you can reduce or increase the feed rate slightly. Your choice of feed rate is affected by many unpredictable factors. The machinability of the material plays a role as does the speed, feed type, workpiece clamping and the state of your machines and tools. Additional factors include the number of saw teeth that are engaged at any given moment, the saw diameter and saw width. Therefore it is only possible to provide approximate values. Depending on the machining conditions, you may have to increase or decrease this value. When using Karnasch solid carbide tools in particular, lower feed rates and finer tooth pitches will result in improved cutting surfaces. Depending on the material being processed, start with the feed rate given in the table below. Multiplying the number of teeth with the speed gives the feed rate to be set on your machine in mm/min.

For non-ferrous metals, you can also use spray oil lubrication if this is available on the machine being used: or type: 60.1150 (Mecut spray).

| Werkstoffe<br>Material                                                                                               | Kühl-/Schmierstoffe<br>Coolant/lubricant                          | Schnittgeschwindigkeit<br>Cutting speed | Richtwerte/Vorschub Sz (mm / Zahn)<br>Suggested feed rate Sz (mm / tooth) |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------|
| Stähle bis 600 N/mm <sup>2</sup> (Automatenstahl)<br>Steels with up to 600 N/mm <sup>2</sup> (free-cutting steel)    | Emulsion / Mischverhältnis 1:20<br>Emulsion / Mixture ratio 1:20  | 150 m/min.                              | 0,010 – 0,030 mm                                                          |
| Stähle von 600 bis 1000 N/mm <sup>2</sup> (Baustahl)<br>Steels from 600 to 1000 N/mm <sup>2</sup> (structural steel) | Emulsion / Mischverhältnis 1:15<br>Emulsion / Mixture ratio 1:15  | 120 m/min.                              | 0,005 – 0,020 mm                                                          |
| Nichtrostende Stähle<br>Stainless steel                                                                              | Emulsion / Mischverhältnis 1:10<br>Emulsion / Mixture ratio 1:10  | 80 m/min.                               | 0,005 – 0,015 mm                                                          |
| Hochlegierte Stähle<br>High-alloyed steel                                                                            | Emulsion / Mischverhältnis: 1:10<br>Emulsion / Mixture ratio 1:10 | 70 m/min.                               | 0,005 – 0,010 mm                                                          |
| Titan<br>Titanium                                                                                                    | Schneidöl<br>Cutting oil                                          | 60 m/min.                               | 0,003 – 0,005 mm                                                          |
| Grauguß über 220 HB<br>Grey cast iron harder than 220 HB                                                             | Trocken<br>Dry                                                    | 100 m/min.                              | 0,005 – 0,010 mm                                                          |
| Kupferlegierungen<br>Copper alloys                                                                                   | Emulsion<br>Emulsion                                              | 300 m/min.                              | 0,020 – 0,040 mm                                                          |
| Messinglegierungen<br>Brass alloys                                                                                   | Sprühölkühlung / Emulsion<br>Spray oil cooling / Emulsion         | 500 m/min.                              | 0,010 – 0,040 mm                                                          |
| Aluminium<br>Aluminium                                                                                               | Sprühölkühlung / Emulsion<br>Spray oil cooling / Emulsion         | 1000 – 2000 m/min.                      | 0,010 – 0,040 mm                                                          |

Vorschub pro Zahn: Sz (mm / Zahn)  
Feed per tooth: Sz (mm / tooth)

$$S_z = \frac{S}{Z \cdot n}$$

S = Vorschub (mm / min.)  
S = feed (mm / min.)

Z = Zähnezahl  
Z = number of teeth

n = Drehzahl (1 / min.)  
n = speed (rpm)

Vorschub: S (mm / min)  
Feed rate: S (mm / min)

$$S = S_z \cdot Z \cdot n$$

Sz = Vorschub pro Zahn (mm / Zahn)  
Sz = feed per tooth (mm / tooth)

Z = Zähnezahl  
Z = number of teeth

n = Drehzahl (1 / min.)  
n = speed (rpm)

Alle angegebenen Werte sind nur als Richtwerte zu betrachten.  
All of the given values are only intended as a guideline.



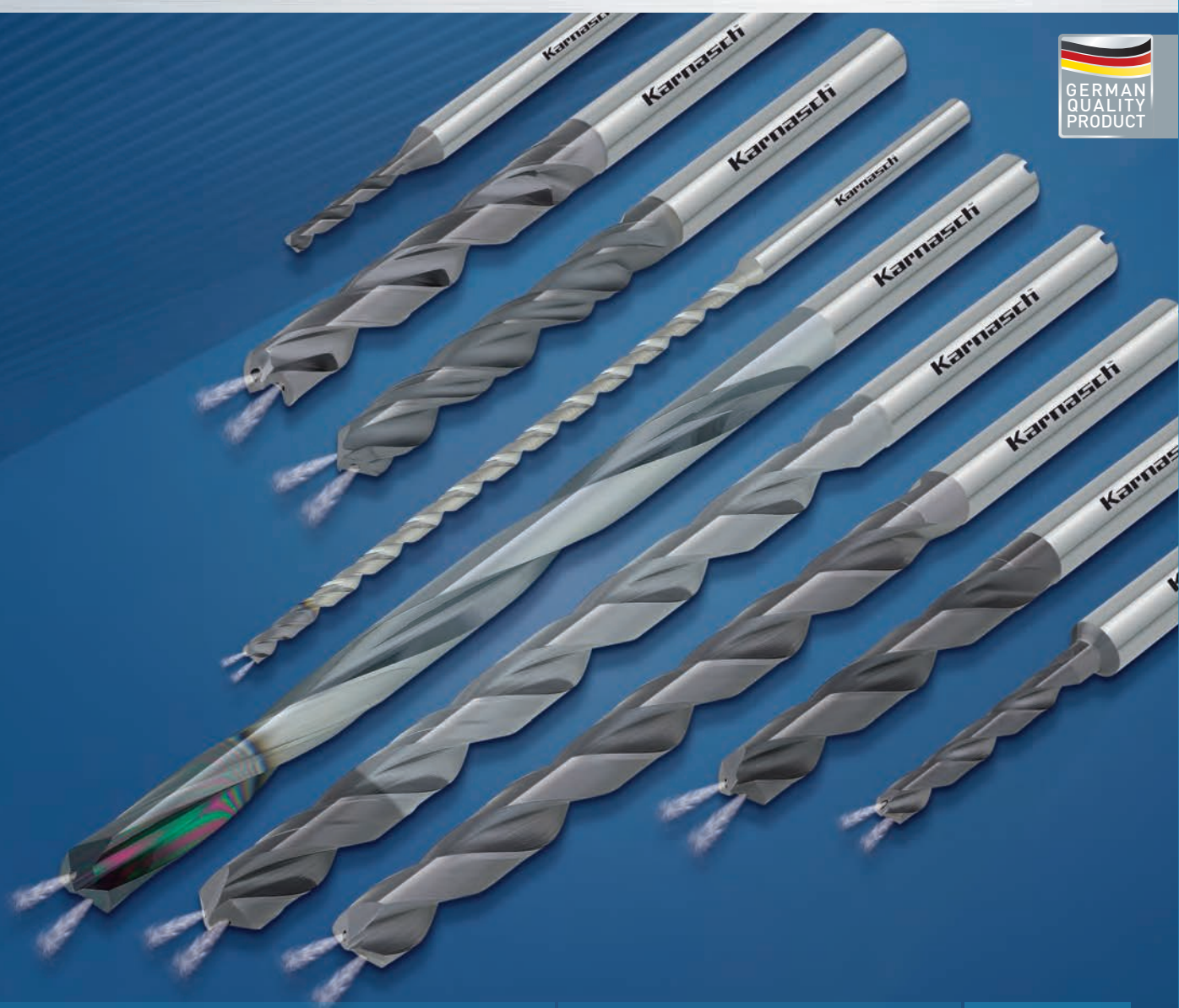


VOLLHARTMETALL HOCHLEISTUNGSBOHRER / MICROBOHRER

SOLID CARBIDE HIGH PERFORMANCE TWIST DRILL / MICRO TWIST DRILL

MICROBROCAS DE ALTO RENDIMIENTO DE METAL DURO

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**P R O F E S S I O N A L   T O O L S**

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| Art.                                   | Vollhartmetallbohrer / Solid carbide drills |                                                                                     |                                                                                   | Material    |  | HSC<br>high-speed<br>cutting | HRC<br>< 52 | HRC<br>50-70 | STAHL<br>steel |
| 22.0321                                | Ø 0,8 - 2,95                                |    |  | MICRO GRAIN | 124                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0322                                | Ø 0,8 - 2,95 < 30xD                         |    |  | MICRO GRAIN | 126                                                                                 | ✓                            |             |              | ✓              |
| 22.0341                                | Ø 0,15 - 3,0 < 6xD                          |    |  | MICRO GRAIN | 128                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0360                                | Ø 0,5 - 3,0 < 10xD                          |    |  | MICRO GRAIN | 129                                                                                 | ✓                            |             |              |                |
| 22.0390                                | Ø 3,0 - 12,0 < 50xD                         |    |                                                                                   | MICRO GRAIN | 132                                                                                 | ✓                            |             |              | ✓              |
| 22.0392                                | Ø 2,0 - 12,0 < 40xD                         |    |                                                                                   | MICRO GRAIN | 134                                                                                 | ✓                            |             |              |                |
| 22.0402                                | Ø 3,0 - 20,0 < 5xD                          |    |                                                                                   | MICRO GRAIN | 138                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0403                                | Ø 3,0 - 12,0 H7 < 5xD                       |    |                                                                                   | MICRO GRAIN | 140                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0404                                | Ø 3,0 - 12,0 < 5xD                          |    |                                                                                   | MICRO GRAIN | 141                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0405                                | Ø 3,0 - 20,0 < 8xD                          |    |                                                                                   | MICRO GRAIN | 143                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0406                                | Ø 3,0 - 18,0 < 12xD                         |    |                                                                                   | MICRO GRAIN | 146                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0409                                | Ø 3,0 - 16,0 < 8xD                          |  |                                                                                   | MICRO GRAIN | 148                                                                                 | ✓                            |             |              |                |
| 22.0410                                | Ø 3,0 - 16,0 < 5xD                          |  |                                                                                   | MICRO GRAIN | 150                                                                                 | ✓                            |             |              |                |
| 22.0412                                | Ø 3,0 - 16,0 < 5xD                          |  |                                                                                   | MICRO GRAIN | 151                                                                                 | ✓                            |             |              |                |
| 22.0419                                | Ø 3,0 - 12,0 H7 < 5xD                       |  |                                                                                   | MICRO GRAIN | 153                                                                                 | ✓                            |             |              | ✓              |
| 22.0424                                | Ø 2,98 - 12,0 H7 < 5xD                      |  |                                                                                   | MICRO GRAIN | 154                                                                                 | ✓                            | ✓           |              | ✓              |
| 22.0425                                | Ø 3,0 - 20,0 H7 < 8xD                       |  |                                                                                   | MICRO GRAIN | 153                                                                                 | ✓                            |             |              | ✓              |
| 22.0468                                | Ø 0,3 - 14,0                                |  |                                                                                   | MICRO GRAIN | 155                                                                                 |                              |             | ✓            | ✓              |
| 22.0530                                | Ø 3,0 - 12,0 < 5xD                          |  |                                                                                   | MICRO GRAIN | 160                                                                                 | ✓                            |             |              |                |

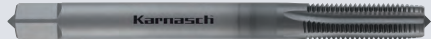
Vollhartmetall Pilot-Stufenbohrer / Solid carbide pilot step drill

|         |                  |                                                                                     |  |             |     |   |   |  |   |
|---------|------------------|-------------------------------------------------------------------------------------|--|-------------|-----|---|---|--|---|
| 22.0389 | Ø 3,0 - 12,0 3xD |  |  | MICRO GRAIN | 130 | ✓ | ✓ |  | ✓ |
|---------|------------------|-------------------------------------------------------------------------------------|--|-------------|-----|---|---|--|---|

Vollhartmetallbohrer- Hochleistungs- Mehrfasen- Stufenbohrer für HSC-Bearbeitung / Solid carbide high capacity subland twist drill

|         |          |                                                                                     |  |             |     |   |   |  |   |
|---------|----------|-------------------------------------------------------------------------------------|--|-------------|-----|---|---|--|---|
| 22.0471 | M3 - M16 |  |  | MICRO GRAIN | 156 | ✓ | ✓ |  | ✓ |
| 22.0473 | M4 - M16 |  |  | MICRO GRAIN | 156 | ✓ | ✓ |  | ✓ |

| INOX<br>stainless<br>steel | INCONEL<br>HASTELLOY<br>TITAN | GJL | GJS | GTW<br>GTS | NE<br>non-ferrous | GRAPHIT<br>graphite | COMPO-<br>SITES | kurz-<br>spanend<br>short chip | lang-<br>spanend<br>long chip | MIT INNEN-<br>KÜHLUNG<br>with interior<br>cooling | OHNE INNEN-<br>KÜHLUNG<br>without interior<br>cooling | DIN 6535<br>Form HA | DIN 6535<br>Form HE | DIN 6535<br>Form HAK | DIN 6535<br>Form HEK |
|----------------------------|-------------------------------|-----|-----|------------|-------------------|---------------------|-----------------|--------------------------------|-------------------------------|---------------------------------------------------|-------------------------------------------------------|---------------------|---------------------|----------------------|----------------------|
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
| ✓                          | ✓                             | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
| ✓                          | ✓                             | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|                            |                               |     |     |            | ✓                 |                     | ✓               |                                | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
|                            |                               |     |     |            | ✓                 |                     | ✓               |                                | ✓                             | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     |                     | ✓                   |                      |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     |                      | ✓                    |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
| ✓                          | ✓                             |     |     |            | ✓                 |                     |                 |                                | ✓                             | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
|                            | ✓                             |     |     |            |                   |                     |                 |                                | ✓                             | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
|                            | ✓                             |     |     |            |                   |                     |                 |                                | ✓                             | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
| ✓                          |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
|                            |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|                            |                               |     |     |            | ✓                 |                     |                 |                                | ✓                             | ✓                                                 |                                                       |                     |                     | ✓                    |                      |
|                            |                               |     |     |            |                   |                     |                 |                                |                               |                                                   |                                                       |                     |                     |                      |                      |
|                            |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|                            |                               |     |     |            |                   |                     |                 |                                |                               |                                                   |                                                       |                     |                     |                      |                      |
| ✓                          | ✓                             | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
| ✓                          | ✓                             | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     | ✓                    |                      |

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| Art.                                                                                                       | Vollhartmetallbohrer / Solid carbide drills |         |                                                                                     |                     | Material |  | HSC<br>high-speed<br>cutting | HRC<br>< 52 | HRC<br>50-70 | STAHL<br>steel |
| Vollhartmetallbohrer- Hochleistungsbohrer und Aufbohrer / Solid carbide twist drill / cordrill             |                                             |         |                                                                                     |                     |          |                                                                                     |                              |             |              |                |
| 22.0520                                                                                                    | Ø 3,0 - 12,0                                | < 10xD  |    | MICRO<br>GRAIN      | 157      |                                                                                     | ✓                            | ✓           |              | ✓              |
| 22.0525                                                                                                    | Ø 4,0 - 12,0                                | < 10xD  |    | MICRO<br>GRAIN      | 157      |                                                                                     | ✓                            | ✓           |              | ✓              |
| Vollhartmetallbohrer Diamantbeschichtet / Solid carbide twist drill with diamant coating                   |                                             |         |                                                                                     |                     |          |                                                                                     |                              |             |              |                |
| 22.0415                                                                                                    | Ø 3,3 - 10,3                                | < 5xD   |    | DIAMANT<br>DCC 0312 | 164      |                                                                                     | ✓                            |             |              |                |
| Vollhartmetall Gewindefräser Diamantbeschichtet / Solid carbide thread milling cutter with diamant coating |                                             |         |                                                                                     |                     |          |                                                                                     |                              |             |              |                |
| 23.2005                                                                                                    | M4 – M12                                    | 2,5 x D |    | DCC<br>0318         | 165      |                                                                                     | ✓                            |             |              |                |
| 23.2006                                                                                                    | M4 – M12                                    | 2,0 x D |    | DCC<br>0318         | 165      |                                                                                     | ✓                            |             |              |                |
| Hartgewindebohrer / High-hard maschine taps                                                                |                                             |         |                                                                                     |                     |          |                                                                                     |                              |             |              |                |
| 22.2025                                                                                                    | M3 – M12                                    |         |    | MICRO<br>GRAIN      | 162      |                                                                                     |                              |             | ✓            |                |
| 22.2215                                                                                                    | MF8 – MF12                                  |         |    | MICRO<br>GRAIN      | 162      |                                                                                     |                              |             | ✓            |                |
| 22.2239                                                                                                    | G1/8 – G1/4                                 |         |  | MICRO<br>GRAIN      | 163      |                                                                                     |                              |             | ✓            |                |
| PKD-Hochleistungsbohrer / PCD drill                                                                        |                                             |         |                                                                                     |                     |          |                                                                                     |                              |             |              |                |
| 29.0060                                                                                                    | Ø 0,5 - 2,5                                 | < 11xD  |  | PKD                 | 164      |                                                                                     | ✓                            |             |              |                |
| 22.0526                                                                                                    | Ø 8,0 - 12,0                                | < 11xD  |  | PKD                 | 158      |                                                                                     | ✓                            |             |              |                |
| Vollhartmetallbohrer für Composites / Solid carbide drills for composites                                  |                                             |         |                                                                                     |                     |          |                                                                                     |                              |             |              |                |
| 29.0080A                                                                                                   | Ø 3,0 - 12,0                                | < 4xD   |  | DIAMANT<br>DCA-06   | 166      |                                                                                     | ✓                            |             |              |                |
| 29.0080B                                                                                                   | Ø 3,0 - 12,0                                | < 4xD   |  | MICRO<br>GRAIN      | 166      |                                                                                     | ✓                            |             |              |                |
| 29.0120                                                                                                    | Ø 0,5 - 12,0                                |         |  | DCC<br>0318         | 168      |                                                                                     | ✓                            |             |              |                |
| 29.0121                                                                                                    | Ø 2,8 - 5,9                                 |         |  | DCC<br>0318         | 170      |                                                                                     | ✓                            |             |              |                |
| 29.0122                                                                                                    | Ø 6,0 - 12,0                                |         |  | DCC<br>0318         | 171      |                                                                                     | ✓                            |             |              |                |



|  | INOX<br>stainless<br>steel | INCONEL<br>HASTELLOY<br>TITAN | GJL | GJS | GTW<br>GTS | NE<br>non-ferrous | GRAPHIT<br>graphite | COMPO-<br>SITES | kurz-<br>spanend<br>short chip | lang-<br>spanend<br>long chip | MIT INNEN-<br>KÜHLUNG<br>with interior<br>cooling | OHNE INNEN-<br>KÜHLUNG<br>without interior<br>cooling | DIN 6535<br>Form HA | DIN 6535<br>Form HE | DIN 6535<br>Form HAK | DIN 6535<br>Form HEK |
|--|----------------------------|-------------------------------|-----|-----|------------|-------------------|---------------------|-----------------|--------------------------------|-------------------------------|---------------------------------------------------|-------------------------------------------------------|---------------------|---------------------|----------------------|----------------------|
|  |                            |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               | ✓                                                 |                                                       |                     |                     |                      | ✓                    |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             | ✓                                                 |                                                       |                     |                     |                      | ✓                    |
|  |                            |                               |     |     |            | ✓                 | ✓                   | ✓               | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               |     |     |            | ✓                 | ✓                   | ✓               | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     |                     |                     |                      |                      |
|  |                            |                               | ✓   | ✓   | ✓          |                   |                     |                 | ✓                              |                               |                                                   | ✓                                                     |                     |                     |                      |                      |
|  |                            |                               |     |     |            | ✓                 | ✓                   | ✓               | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               |     |     |            | ✓                 | ✓                   | ✓               | ✓                              |                               | ✓                                                 |                                                       |                     |                     |                      | ✓                    |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             | ✓                                                 |                                                       |                     |                     |                      | ✓                    |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|  |                            |                               |     |     |            |                   | ✓                   | ✓               | ✓                              | ✓                             | ✓                                                 |                                                       |                     |                     |                      | ✓                    |

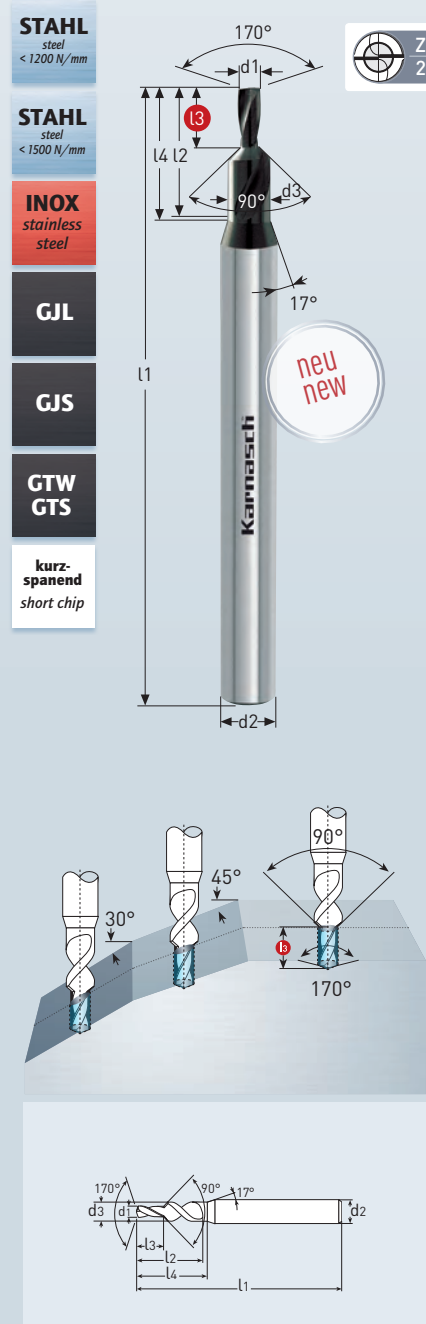
- Stock/Lagerware  
stock-tools

○ Keine Lagerware, Lieferzeit und Preis auf Anfrage  
No stock-tool. Price and delivery on request
- ☐ Lieferzeit kurzfristig da Rohlinglager vorhanden

▲ Lieferbar solange Vorrat oder auf Anfrage  
Article be discontinued. Delivery possible until sold out. After sold out delivery possible on request.
- △ Lieferbar solange Vorrat.  
Nachfolgewerkzeug vorhanden  
Be discontinued. Replacement article available.

Art. 22.0321

Vollhartmetall-Micro-Pilot-Stufenbohrer 170°/90°  
abgestimmt auf Micro-Tieflochbohrer 22.0322



- Solid-carbide Micro pilot step drill 170°/90°.  
Designed for Micro deep-cut drill 22.0322
- Broca guía de niveles de metal duro 170°/90°, adecuado a broca de  
taladrado profundo 22.0322
- Монолитное твердосплавное центровочное сверло 170°/90°  
Согласовано со сверлами для глубокого сверления арт. 22.0322

| Bohrungstoleranz<br>hole tolerance |                  |
|------------------------------------|------------------|
| ≤ 3                                | +0,002<br>+0,012 |

| Art.        | d1 m7  | l3   | l2   | l4   | l1   | d3  | d2 h6 | €     |
|-------------|--------|------|------|------|------|-----|-------|-------|
| 220321.0080 | • 0,80 | 2,00 | 4,7  | 5,2  | 50,0 | 1,7 | 4,0   | 64,00 |
| 220321.0085 | • 0,85 | 2,12 | 4,8  | 5,3  | 50,0 | 1,7 | 4,0   | 64,00 |
| 220321.0090 | • 0,90 | 2,25 | 4,9  | 5,4  | 50,0 | 1,7 | 4,0   | 64,00 |
| 220321.0095 | • 0,95 | 2,37 | 5,0  | 5,5  | 50,0 | 1,7 | 4,0   | 64,00 |
| 220321.0100 | • 1,00 | 2,50 | 5,6  | 6,1  | 55,0 | 2,0 | 4,0   | 64,00 |
| 220321.0105 | • 1,05 | 2,62 | 5,7  | 6,2  | 55,0 | 2,0 | 4,0   | 64,00 |
| 220321.0110 | • 1,10 | 2,75 | 5,9  | 6,4  | 55,0 | 2,0 | 4,0   | 64,00 |
| 220321.0115 | • 1,15 | 2,87 | 6,0  | 6,5  | 55,0 | 2,0 | 4,0   | 64,00 |
| 220321.0120 | • 1,20 | 3,00 | 6,1  | 6,6  | 55,0 | 2,0 | 4,0   | 64,00 |
| 220321.0125 | • 1,25 | 3,12 | 7,1  | 7,6  | 55,0 | 2,5 | 4,0   | 64,00 |
| 220321.0130 | • 1,30 | 3,25 | 7,2  | 7,7  | 55,0 | 2,5 | 4,0   | 64,00 |
| 220321.0135 | • 1,35 | 3,37 | 7,3  | 7,8  | 55,0 | 2,5 | 4,0   | 64,00 |
| 220321.0140 | • 1,40 | 3,50 | 7,4  | 7,9  | 55,0 | 2,5 | 4,0   | 64,00 |
| 220321.0145 | • 1,45 | 3,62 | 7,5  | 8,0  | 55,0 | 2,5 | 4,0   | 64,00 |
| 220321.0150 | • 1,50 | 3,75 | 8,6  | 9,1  | 55,0 | 3,0 | 4,0   | 64,00 |
| 220321.0155 | • 1,55 | 3,87 | 8,7  | 9,2  | 55,0 | 3,0 | 4,0   | 64,00 |
| 220321.0160 | • 1,60 | 4,00 | 8,8  | 9,3  | 55,0 | 3,0 | 4,0   | 64,00 |
| 220321.0165 | • 1,65 | 4,12 | 8,9  | 9,4  | 55,0 | 3,0 | 4,0   | 64,00 |
| 220321.0170 | • 1,70 | 4,25 | 9,1  | 9,6  | 55,0 | 3,0 | 4,0   | 64,00 |
| 220321.0175 | • 1,75 | 4,37 | 9,2  | 9,7  | 55,0 | 3,0 | 4,0   | 64,00 |
| 220321.0180 | • 1,80 | 4,50 | 10,1 | 10,6 | 55,0 | 3,5 | 4,0   | 64,00 |
| 220321.0185 | • 1,85 | 4,62 | 10,3 | 10,8 | 55,0 | 3,5 | 4,0   | 64,00 |
| 220321.0190 | • 1,90 | 4,75 | 10,4 | 10,9 | 55,0 | 3,5 | 4,0   | 64,00 |
| 220321.0195 | • 1,95 | 4,87 | 10,5 | 11,0 | 55,0 | 3,5 | 4,0   | 64,00 |
| 220321.0200 | • 2,00 | 5,00 | 10,6 | 11,1 | 65,0 | 3,5 | 6,0   | 67,00 |
| 220321.0205 | • 2,05 | 5,12 | 10,7 | 11,2 | 65,0 | 3,5 | 6,0   | 67,00 |
| 220321.0210 | • 2,10 | 5,25 | 10,8 | 11,3 | 65,0 | 3,5 | 6,0   | 67,00 |
| 220321.0215 | • 2,15 | 5,37 | 10,9 | 11,4 | 65,0 | 3,5 | 6,0   | 67,00 |
| 220321.0220 | • 2,20 | 5,50 | 12,8 | 13,3 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0225 | • 2,25 | 5,62 | 12,9 | 13,4 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0230 | • 2,30 | 5,75 | 13,0 | 13,5 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0235 | • 2,35 | 5,87 | 13,1 | 13,6 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0240 | • 2,40 | 6,00 | 13,2 | 13,7 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0245 | • 2,45 | 6,12 | 13,4 | 13,9 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0250 | • 2,50 | 6,25 | 13,5 | 14,0 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0255 | • 2,55 | 6,37 | 13,6 | 14,1 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0260 | • 2,60 | 6,50 | 13,7 | 14,2 | 65,0 | 4,5 | 6,0   | 67,00 |
| 220321.0265 | • 2,65 | 6,62 | 14,7 | 15,2 | 65,0 | 5,0 | 6,0   | 67,00 |
| 220321.0270 | • 2,70 | 6,75 | 14,8 | 15,3 | 65,0 | 5,0 | 6,0   | 67,00 |
| 220321.0275 | • 2,75 | 6,87 | 14,9 | 15,4 | 65,0 | 5,0 | 6,0   | 67,00 |
| 220321.0280 | • 2,80 | 7,00 | 15,0 | 15,5 | 65,0 | 5,0 | 6,0   | 67,00 |
| 220321.0285 | • 2,85 | 7,12 | 15,1 | 15,6 | 65,0 | 5,0 | 6,0   | 67,00 |
| 220321.0290 | • 2,90 | 7,25 | 15,2 | 15,7 | 65,0 | 5,0 | 6,0   | 67,00 |
| 220321.0295 | • 2,95 | 7,37 | 15,4 | 15,9 | 65,0 | 5,0 | 6,0   | 67,00 |

MICRO GRAIN  
KARNASCH NORM

SPEZIAL  
DIN 6535 Form HA

30°  
 170°

HSC HPC

DVC-X2

Schnittdaten  
Cutting data



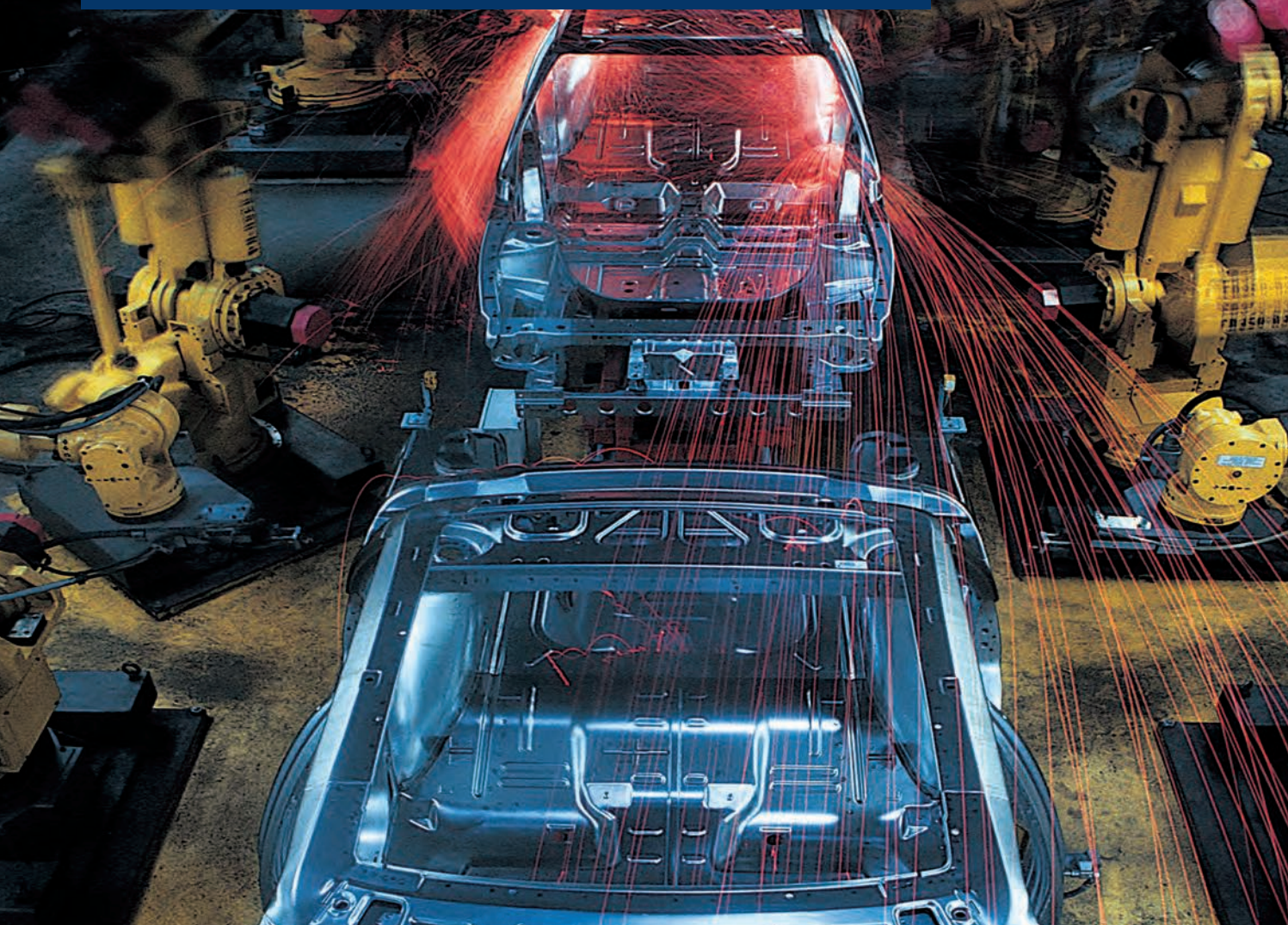
Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer ohne Innenkühlung  
Recommended cutting data for solid carbide twist drill, without interior cooling supply

| Werkstoffe<br>Work Material                                        | Werkstoffgruppe<br>Material Group | Bohrer Ø<br>Festigkeit in<br>N/mm² | Ø 0.80-0.85   |                       | Ø 0.86-0.99   |                     | Ø 1.0-2.95    |                     |
|--------------------------------------------------------------------|-----------------------------------|------------------------------------|---------------|-----------------------|---------------|---------------------|---------------|---------------------|
|                                                                    |                                   |                                    | Vc<br>m/min   | f<br>mm/Umdr.         | Vc<br>m/min   | f<br>mm/Umdr.       | Vc<br>m/min   | f<br>mm/Umdr.       |
| Baustahl<br>Mild Steel                                             | 1.1                               | ≤ 600                              | 50<br>(40-60) | 0.02<br>(0.01-0.03)   | 50<br>(40-60) | 0.03<br>(0.02-0.05) | 50<br>(40-60) | 0.08<br>(0.04-0.12) |
| Kohlenstoffstahl<br>Legierter Stahl<br>Carbon Steel<br>Alloy Steel | 1.2-2.1-2.2<br>2.2-2.3-2.5-2.6    | 600-950                            | 50<br>(40-60) | 0.02<br>(0.01-0.03)   | 50<br>(40-60) | 0.03<br>(0.02-0.05) | 50<br>(40-60) | 0.08<br>(0.04-0.12) |
|                                                                    |                                   | 950-1200                           | 50<br>(40-60) | 0.02<br>(0.01-0.03)   | 50<br>(40-60) | 0.03<br>(0.02-0.05) | 50<br>(40-60) | 0.08<br>(0.04-0.12) |
| Edelstahl<br>Stainless Steel                                       | 3.1                               | 680                                | 30<br>(20-40) | 0.015<br>(0.008-0.02) | 30<br>(20-40) | 0.02<br>(0.01-0.03) | 30<br>(20-40) | 0.05<br>(0.02-0.10) |
| Guss<br>Cast Iron                                                  | 7.1-7.2                           | ≤ 105 HB                           | 50<br>(40-60) | 0.02<br>(0.01-0.03)   | 50<br>(40-60) | 0.04<br>(0.02-0.06) | 50<br>(40-60) | 0.08<br>(0.04-0.12) |
| Kugelgraphitguss<br>Ductile Cast Iron                              | 7.4                               | ≤ 133 HB                           | 30<br>(20-40) | 0.02<br>(0.01-0.03)   | 30<br>(20-40) | 0.03<br>(0.02-0.05) | 30<br>(20-40) | 0.06<br>(0.02-0.10) |



# Eine große Vision braucht einen zuverlässigen Partner.

Karnasch Werkzeuge für die Automobilindustrie – Made for Professionals



IHR PARTNER FÜR: Metallindustrie Automobilindustrie Flugzeugindustrie Schiffbau Schienenbau Formenbau Forschung und Entwicklung

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Art. 22.0322 Mini- Vollhartmetall-Hochleistungsbohrer < 30xD

STAHL  
steel  
< 1200 N/mm

STAHL  
steel  
< 1500 N/mm

INOX  
stainless  
steel

INCONEL  
HASTELLOY  
TITAN

GJL

GJS

GTW  
GTS

kurz-  
spanend  
short chip

MICRO  
TOOL

Mini solid carbide twist drill < 30xD

MINI taladro de gran potencia de metal duro y macizo < 30xD

Высокопроизводительное сверло сквозной закалки  
MINI < 30xD

Pilotbohrer Art. 22.0321 auf S. 124.  
Pilot drill art. 22.0321 on page 124.

|       | Bohrertoleranz<br>Drill tolerance |
|-------|-----------------------------------|
| ≤ 3,0 | + 0,000<br>- 0,010                |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HAK

30°

140°

HSC  
HPC

DVC-X2<sup>2</sup>  
Nano-  
finish

Schnittdaten  
Cutting data



Schnittdaten  
Cutting data



i S. 307

| Art.            | d1 h7  | l3   | l2 | l4 | l1 | d2 h6 | €      |
|-----------------|--------|------|----|----|----|-------|--------|
| 220322.0080.050 | • 0,80 | 5    | 6  | 7  | 50 | 3     | 99,00  |
| 220322.0080.105 | • 0,80 | 10,5 | 11 | 12 | 50 | 3     | 107,00 |
| 220322.0085.055 | • 0,85 | 5,5  | 7  | 8  | 50 | 3     | 99,00  |
| 220322.0085.105 | • 0,85 | 10,5 | 12 | 13 | 50 | 3     | 107,00 |
| 220322.0090.055 | • 0,90 | 5,5  | 7  | 8  | 50 | 3     | 99,00  |
| 220322.0090.115 | • 0,90 | 11,5 | 13 | 14 | 50 | 3     | 107,00 |
| 220322.0095.060 | • 0,95 | 6    | 7  | 8  | 50 | 3     | 99,00  |
| 220322.0095.115 | • 0,95 | 11,5 | 13 | 14 | 50 | 3     | 107,00 |
| 220322.0100.060 | • 1,00 | 6    | 7  | 8  | 60 | 3     | 88,00  |
| 220322.0100.120 | • 1,00 | 12   | 13 | 14 | 65 | 3     | 102,00 |
| 220322.0100.180 | • 1,00 | 18   | 20 | 21 | 65 | 3     | 112,00 |
| 220322.0105.070 | • 1,05 | 7    | 8  | 10 | 60 | 3     | 88,00  |
| 220322.0105.130 | • 1,05 | 13   | 14 | 16 | 65 | 3     | 102,00 |
| 220322.0105.190 | • 1,05 | 19   | 21 | 22 | 65 | 3     | 112,00 |
| 220322.0110.070 | • 1,10 | 7    | 9  | 10 | 60 | 3     | 88,00  |
| 220322.0110.140 | • 1,10 | 14   | 16 | 17 | 65 | 3     | 102,00 |
| 220322.0110.200 | • 1,10 | 20   | 22 | 23 | 65 | 3     | 112,00 |
| 220322.0115.070 | • 1,15 | 7    | 9  | 10 | 60 | 3     | 88,00  |
| 220322.0115.140 | • 1,15 | 14   | 16 | 17 | 65 | 3     | 102,00 |
| 220322.0115.210 | • 1,15 | 21   | 23 | 24 | 65 | 3     | 112,00 |
| 220322.0120.080 | • 1,20 | 8    | 10 | 11 | 60 | 3     | 88,00  |
| 220322.0120.150 | • 1,20 | 15   | 17 | 18 | 65 | 3     | 102,00 |
| 220322.0120.220 | • 1,20 | 22   | 24 | 25 | 65 | 3     | 112,00 |
| 220322.0125.080 | • 1,25 | 8    | 10 | 11 | 60 | 3     | 88,00  |
| 220322.0125.150 | • 1,25 | 15   | 17 | 18 | 65 | 3     | 102,00 |
| 220322.0125.230 | • 1,25 | 23   | 25 | 26 | 65 | 3     | 112,00 |
| 220322.0130.080 | • 1,30 | 8    | 10 | 11 | 60 | 3     | 88,00  |
| 220322.0130.160 | • 1,30 | 16   | 18 | 19 | 65 | 3     | 102,00 |
| 220322.0130.240 | • 1,30 | 24   | 26 | 27 | 65 | 3     | 112,00 |
| 220322.0135.090 | • 1,35 | 9    | 11 | 12 | 60 | 3     | 88,00  |
| 220322.0135.170 | • 1,35 | 17   | 19 | 20 | 65 | 3     | 102,00 |
| 220322.0135.250 | • 1,35 | 25   | 27 | 28 | 65 | 3     | 112,00 |
| 220322.0140.090 | • 1,40 | 9    | 11 | 12 | 60 | 3     | 88,00  |
| 220322.0140.170 | • 1,40 | 17   | 19 | 20 | 65 | 3     | 102,00 |
| 220322.0140.260 | • 1,40 | 26   | 28 | 29 | 65 | 3     | 112,00 |
| 220322.0145.090 | • 1,45 | 9    | 12 | 13 | 60 | 3     | 88,00  |
| 220322.0145.180 | • 1,45 | 18   | 20 | 21 | 65 | 3     | 102,00 |
| 220322.0145.270 | • 1,45 | 27   | 30 | 31 | 65 | 3     | 112,00 |
| 220322.0150.090 | • 1,50 | 9    | 11 | 12 | 60 | 3     | 88,00  |
| 220322.0150.180 | • 1,50 | 18   | 20 | 21 | 65 | 3     | 102,00 |
| 220322.0150.270 | • 1,50 | 27   | 30 | 31 | 65 | 3     | 112,00 |
| 220322.0155.100 | • 1,55 | 10   | 12 | 13 | 60 | 3     | 88,00  |
| 220322.0155.190 | • 1,55 | 19   | 21 | 22 | 65 | 3     | 102,00 |
| 220322.0155.280 | • 1,55 | 28   | 31 | 32 | 65 | 3     | 112,00 |

| Art.            | d1 h7  | l3 | l2 | l4 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|----|-----|-------|--------|
| 220322.0160.100 | • 1,60 | 10 | 13 | 14 | 60  | 3     | 88,00  |
| 220322.0160.200 | • 1,60 | 20 | 22 | 23 | 65  | 3     | 102,00 |
| 220322.0160.300 | • 1,60 | 30 | 32 | 33 | 65  | 3     | 112,00 |
| 220322.0165.100 | • 1,65 | 10 | 13 | 14 | 60  | 3     | 88,00  |
| 220322.0165.200 | • 1,65 | 20 | 22 | 23 | 65  | 3     | 102,00 |
| 220322.0165.300 | • 1,65 | 30 | 32 | 33 | 65  | 3     | 112,00 |
| 220322.0170.110 | • 1,70 | 11 | 14 | 15 | 60  | 3     | 88,00  |
| 220322.0170.210 | • 1,70 | 21 | 23 | 24 | 65  | 3     | 102,00 |
| 220322.0170.310 | • 1,70 | 31 | 34 | 35 | 70  | 3     | 112,00 |
| 220322.0175.110 | • 1,75 | 11 | 14 | 15 | 60  | 3     | 88,00  |
| 220322.0175.210 | • 1,75 | 21 | 23 | 24 | 65  | 3     | 102,00 |
| 220322.0175.320 | • 1,75 | 32 | 35 | 36 | 70  | 3     | 112,00 |
| 220322.0180.110 | • 1,80 | 11 | 14 | 15 | 60  | 3     | 88,00  |
| 220322.0180.220 | • 1,80 | 22 | 25 | 26 | 70  | 3     | 102,00 |
| 220322.0180.330 | • 1,80 | 33 | 36 | 37 | 70  | 3     | 112,00 |
| 220322.0185.120 | • 1,85 | 12 | 15 | 16 | 60  | 3     | 88,00  |
| 220322.0185.230 | • 1,85 | 23 | 26 | 27 | 70  | 3     | 102,00 |
| 220322.0185.340 | • 1,85 | 34 | 37 | 38 | 70  | 3     | 112,00 |
| 220322.0190.120 | • 1,90 | 12 | 15 | 16 | 60  | 3     | 88,00  |
| 220322.0190.230 | • 1,90 | 23 | 26 | 27 | 70  | 3     | 102,00 |
| 220322.0190.350 | • 1,90 | 35 | 37 | 38 | 70  | 3     | 112,00 |
| 220322.0195.120 | • 1,95 | 12 | 15 | 16 | 60  | 3     | 88,00  |
| 220322.0195.240 | • 1,95 | 24 | 27 | 28 | 70  | 3     | 102,00 |
| 220322.0195.360 | • 1,95 | 36 | 39 | 40 | 70  | 3     | 112,00 |
| 220322.0200.120 | • 2,00 | 12 | 15 | 16 | 60  | 3     | 88,00  |
| 220322.0200.240 | • 2,00 | 24 | 26 | 27 | 70  | 3     | 102,00 |
| 220322.0200.360 | • 2,00 | 36 | 37 | 38 | 70  | 3     | 112,00 |
| 220322.0200.520 | • 2,00 | 52 | 55 | 56 | 95  | 3     | 177,00 |
| 220322.0200.620 | • 2,00 | 62 | 65 | 66 | 102 | 3     | 179,00 |
| 220322.0205.130 | • 2,05 | 13 | 16 | 17 | 60  | 3     | 88,00  |
| 220322.0205.250 | • 2,05 | 25 | 28 | 29 | 70  | 3     | 102,00 |
| 220322.0205.370 | • 2,05 | 37 | 40 | 41 | 70  | 3     | 112,00 |
| 220322.0205.520 | • 2,05 | 52 | 55 | 56 | 100 | 3     | 177,00 |
| 220322.0205.630 | • 2,05 | 63 | 66 | 67 | 118 | 3     | 197,00 |
| 220322.0210.130 | • 2,10 | 13 | 16 | 17 | 60  | 3     | 88,00  |
| 220322.0210.260 | • 2,10 | 26 | 29 | 30 | 70  | 3     | 102,00 |
| 220322.0210.380 | • 2,10 | 38 | 42 | 43 | 70  | 3     | 112,00 |
| 220322.0210.530 | • 2,10 | 53 | 56 | 57 | 100 | 3     | 177,00 |
| 220322.0210.650 | • 2,10 | 65 | 68 | 69 | 118 | 3     | 197,00 |
| 220322.0215.130 | • 2,15 | 13 | 16 | 17 | 60  | 3     | 88,00  |
| 220322.0215.260 | • 2,15 | 26 | 29 | 30 | 70  | 3     | 102,00 |
| 220322.0215.390 | • 2,15 | 39 | 43 | 44 | 70  | 3     | 112,00 |
| 220322.0215.530 | • 2,15 | 53 | 56 | 57 | 100 | 3     | 177,00 |
| 220322.0215.660 | • 2,15 | 66 | 69 | 70 | 118 | 3     | 197,00 |



| Art.            | d1 h7  | l3 | l2 | l4 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|----|-----|-------|--------|
| 220322.0220.140 | • 2,20 | 14 | 18 | 19 | 60  | 3     | 88,00  |
| 220322.0220.270 | • 2,20 | 27 | 30 | 31 | 70  | 3     | 102,00 |
| 220322.0220.400 | • 2,20 | 40 | 44 | 45 | 75  | 3     | 112,00 |
| 220322.0220.550 | • 2,20 | 55 | 58 | 59 | 105 | 3     | 184,00 |
| 220322.0220.680 | • 2,20 | 68 | 71 | 72 | 118 | 3     | 197,00 |
| 220322.0225.140 | • 2,25 | 14 | 18 | 19 | 60  | 3     | 88,00  |
| 220322.0225.270 | • 2,25 | 27 | 30 | 31 | 70  | 3     | 102,00 |
| 220322.0225.410 | • 2,25 | 41 | 44 | 45 | 75  | 3     | 112,00 |
| 220322.0225.570 | • 2,25 | 57 | 60 | 61 | 105 | 3     | 184,00 |
| 220322.0225.690 | • 2,25 | 69 | 72 | 73 | 118 | 3     | 197,00 |
| 220322.0230.140 | • 2,30 | 14 | 18 | 19 | 60  | 3     | 88,00  |
| 220322.0230.280 | • 2,30 | 28 | 31 | 32 | 70  | 3     | 102,00 |
| 220322.0230.420 | • 2,30 | 42 | 45 | 46 | 82  | 3     | 112,00 |
| 220322.0230.570 | • 2,30 | 57 | 60 | 61 | 105 | 3     | 184,00 |
| 220322.0230.710 | • 2,30 | 71 | 74 | 75 | 118 | 3     | 197,00 |
| 220322.0235.150 | • 2,35 | 15 | 19 | 20 | 60  | 3     | 88,00  |
| 220322.0235.290 | • 2,35 | 29 | 32 | 33 | 70  | 3     | 102,00 |
| 220322.0235.430 | • 2,35 | 43 | 46 | 48 | 82  | 3     | 112,00 |
| 220322.0235.590 | • 2,35 | 59 | 62 | 63 | 105 | 3     | 184,00 |
| 220322.0235.730 | • 2,35 | 73 | 76 | 77 | 120 | 3     | 197,00 |
| 220322.0240.150 | • 2,40 | 15 | 19 | 20 | 60  | 3     | 88,00  |
| 220322.0240.290 | • 2,40 | 29 | 32 | 33 | 70  | 3     | 102,00 |
| 220322.0240.440 | • 2,40 | 44 | 47 | 48 | 82  | 3     | 112,00 |
| 220322.0240.600 | • 2,40 | 60 | 63 | 64 | 105 | 3     | 184,00 |
| 220322.0240.750 | • 2,40 | 75 | 78 | 79 | 120 | 3     | 197,00 |
| 220322.0245.150 | • 2,45 | 15 | 19 | 20 | 60  | 3     | 88,00  |
| 220322.0245.300 | • 2,45 | 30 | 33 | 34 | 70  | 3     | 102,00 |
| 220322.0245.450 | • 2,45 | 45 | 49 | 50 | 82  | 3     | 112,00 |
| 220322.0245.620 | • 2,45 | 62 | 65 | 66 | 105 | 3     | 184,00 |
| 220322.0245.760 | • 2,45 | 76 | 79 | 80 | 120 | 3     | 197,00 |
| 220322.0250.150 | • 2,50 | 15 | 19 | 20 | 60  | 3     | 88,00  |
| 220322.0250.300 | • 2,50 | 30 | 33 | 34 | 70  | 3     | 102,00 |
| 220322.0250.450 | • 2,50 | 45 | 49 | 50 | 82  | 3     | 112,00 |
| 220322.0250.620 | • 2,50 | 62 | 65 | 66 | 105 | 3     | 184,00 |
| 220322.0250.770 | • 2,50 | 77 | 80 | 81 | 120 | 3     | 197,00 |
| 220322.0255.160 | • 2,55 | 16 | 20 | 21 | 60  | 3     | 88,00  |
| 220322.0255.310 | • 2,55 | 31 | 35 | 36 | 75  | 3     | 102,00 |
| 220322.0255.460 | • 2,55 | 46 | 50 | 53 | 82  | 3     | 112,00 |
| 220322.0255.670 | • 2,55 | 67 | 70 | 71 | 120 | 3     | 191,00 |
| 220322.0255.790 | • 2,55 | 79 | 82 | 83 | 130 | 3     | 205,00 |
| 220322.0260.160 | • 2,60 | 16 | 20 | 21 | 60  | 3     | 88,00  |
| 220322.0260.320 | • 2,60 | 32 | 36 | 37 | 75  | 3     | 102,00 |
| 220322.0260.470 | • 2,60 | 47 | 52 | 53 | 82  | 3     | 112,00 |

| Art.            | d1 h7  | l3 | l2 | l4 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|----|-----|-------|--------|
| 220322.0260.670 | • 2,60 | 67 | 71 | 72 | 120 | 3     | 191,00 |
| 220322.0260.800 | • 2,60 | 80 | 84 | 85 | 130 | 3     | 205,00 |
| 220322.0265.160 | • 2,65 | 16 | 20 | 21 | 60  | 3     | 88,00  |
| 220322.0265.320 | • 2,65 | 32 | 36 | 37 | 75  | 3     | 102,00 |
| 220322.0265.480 | • 2,65 | 48 | 53 | 54 | 82  | 3     | 112,00 |
| 220322.0265.680 | • 2,65 | 68 | 72 | 73 | 120 | 3     | 191,00 |
| 220322.0265.810 | • 2,65 | 81 | 85 | 86 | 130 | 3     | 205,00 |
| 220322.0270.170 | • 2,70 | 17 | 21 | 22 | 60  | 3     | 88,00  |
| 220322.0270.330 | • 2,70 | 33 | 37 | 38 | 75  | 3     | 102,00 |
| 220322.0270.490 | • 2,70 | 49 | 54 | 55 | 90  | 3     | 112,00 |
| 220322.0270.690 | • 2,70 | 69 | 73 | 74 | 120 | 3     | 191,00 |
| 220322.0270.830 | • 2,70 | 83 | 87 | 88 | 130 | 3     | 205,00 |
| 220322.0275.170 | • 2,75 | 17 | 21 | 22 | 60  | 3     | 88,00  |
| 220322.0275.330 | • 2,75 | 33 | 37 | 38 | 75  | 3     | 102,00 |
| 220322.0275.500 | • 2,75 | 50 | 54 | 56 | 90  | 3     | 112,00 |
| 220322.0275.710 | • 2,75 | 71 | 75 | 76 | 120 | 3     | 191,00 |
| 220322.0275.850 | • 2,75 | 85 | 89 | 90 | 130 | 3     | 205,00 |
| 220322.0280.170 | • 2,80 | 17 | 21 | 22 | 60  | 3     | 88,00  |
| 220322.0280.340 | • 2,80 | 34 | 38 | 39 | 75  | 3     | 102,00 |
| 220322.0280.530 | • 2,80 | 53 | 57 | 58 | 90  | 3     | 112,00 |
| 220322.0280.720 | • 2,80 | 72 | 76 | 77 | 120 | 3     | 191,00 |
| 220322.0280.860 | • 2,80 | 86 | 90 | 91 | 130 | 3     | 205,00 |
| 220322.0285.180 | • 2,85 | 18 | 23 | 24 | 60  | 3     | 88,00  |
| 220322.0285.350 | • 2,85 | 35 | 39 | 40 | 75  | 3     | 102,00 |
| 220322.0285.530 | • 2,85 | 53 | 57 | 58 | 90  | 3     | 112,00 |
| 220322.0285.730 | • 2,85 | 73 | 77 | 78 | 120 | 3     | 191,00 |
| 220322.0285.880 | • 2,85 | 88 | 92 | 93 | 130 | 3     | 205,00 |
| 220322.0290.180 | • 2,90 | 18 | 23 | 24 | 60  | 3     | 88,00  |
| 220322.0290.350 | • 2,90 | 35 | 39 | 40 | 75  | 3     | 102,00 |
| 220322.0290.530 | • 2,90 | 53 | 57 | 58 | 90  | 3     | 112,00 |
| 220322.0290.740 | • 2,90 | 74 | 78 | 79 | 120 | 3     | 191,00 |
| 220322.0290.890 | • 2,90 | 89 | 93 | 94 | 130 | 3     | 205,00 |
| 220322.0295.180 | • 2,95 | 18 | 23 | 24 | 60  | 3     | 88,00  |
| 220322.0295.360 | • 2,95 | 36 | 40 | 41 | 75  | 3     | 102,00 |
| 220322.0295.540 | • 2,95 | 54 | 58 | 59 | 90  | 3     | 112,00 |
| 220322.0295.740 | • 2,95 | 74 | 78 | 79 | 120 | 3     | 191,00 |
| 220322.0295.890 | • 2,95 | 89 | 93 | 94 | 130 | 3     | 205,00 |

> Ø 2,95 = Art. 22.0390

HSC- HPC- Vollhartmetall-  
Minibohrer -mit Innenkühlung

Ø 0,8 - 0,95 mm 6xD-12xD  
Ø 1,0 - 1,95 mm 6xD-12xD-18xD  
Ø 2,0 - 2,95 mm 6xD-12xD-18xD-24xD-30xD

HSC - HPC - solid carbide mini drill  
with interior cooling supply

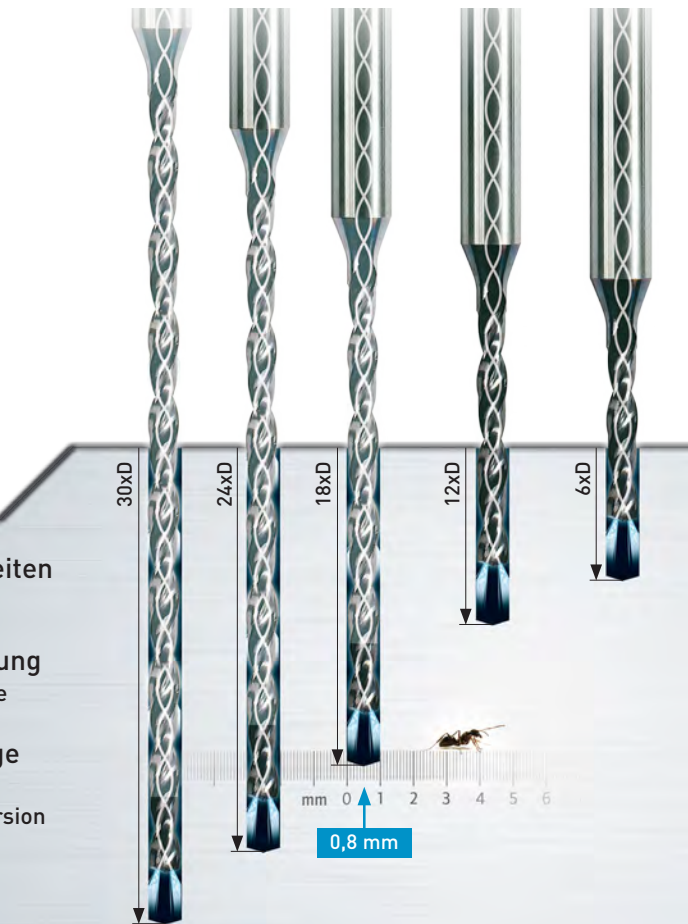
Ø 0,8 - 0,95 mm 6xD-12xD  
Ø 1,0 - 1,95 mm 6xD-12xD-18xD  
Ø 2,0 - 2,95 mm 6xD-12xD-18xD-24xD-30xD

- Neue Perspektive durch  
Innenkühlung ab 0,8 Ø mm  
6xD – 12xD – 18xD –  
24xD – 30xD  
New perspective through interior  
cooling supply from 0,8 Ø mm  
6xD – 12xD – 18xD – 24xD – 30xD

→ Prozesssicher  
Process reliability
- Reduzierte Taktzeiten  
Reduced cycle-times

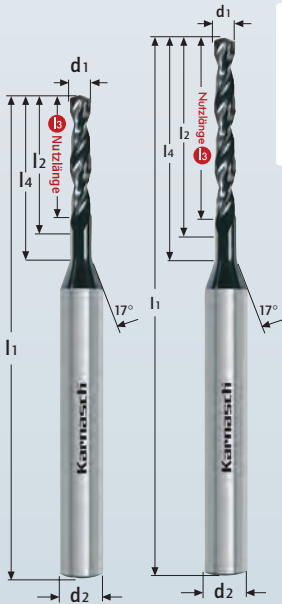
→ Überlegene Leistung  
Superior performance

→ Weltweit einmalige  
Ausführung  
Worldwide unique version



Art. 22.0341 Vollhartmetall-Hochleistungs-Minidrill – HSC/HHC < 6xD

- STAHL  
steel
- INOX  
stainless  
steel
- INCONEL  
HASTELLOY  
TITAN
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



- Solid carbide-micro-twist drill – HSC/HHC < 52 HRC
- Miniberbiqui de gran potencia de metal duro y macizo – HSC/HHC < 52 HRC
- Высокопроизводительное сверло сквозной закалки HSC/HHC < 52 HRC

|       | Bohrertoleranz<br>Drill tolerance |
|-------|-----------------------------------|
| ≅ 3,0 | + 0,004<br>- 0,000                |

Schnittdaten  
Cutting data



i S. 317

MICRO  
GRAIN

KARNASCH  
NORM

N/M

DIN 6535  
Form HA

HSC  
HPC

DVC-X2<sup>2</sup>  
Nano-  
finish

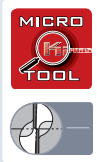
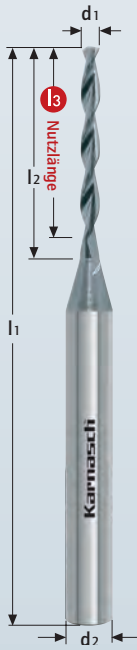
| Art.             | d1 k5  | l3   | l2   | l4   | l1 | d2 h6 | €     |
|------------------|--------|------|------|------|----|-------|-------|
| 220341.0010.005  | • 0,10 | 0,5  | 1,5  | 2,0  | 38 | 3,0   | 41,00 |
| 220341.0015.0075 | • 0,15 | 0,75 | 1,8  | 2,0  | 38 | 3,0   | 41,00 |
| 220341.0020.008  | • 0,20 | 0,8  | 1,8  | 2,3  | 38 | 3,0   | 41,00 |
| 220341.0020.012  | • 0,20 | 1,2  | 2,2  | 2,7  | 38 | 3,0   | 41,00 |
| 220341.0025.010  | • 0,25 | 1,0  | 2,0  | 2,5  | 38 | 3,0   | 41,00 |
| 220341.0025.015  | • 0,25 | 1,5  | 2,5  | 3,0  | 38 | 3,0   | 41,00 |
| 220341.0030.012  | • 0,30 | 1,2  | 2,2  | 2,7  | 38 | 3,0   | 41,00 |
| 220341.0030.018  | • 0,30 | 1,8  | 2,8  | 3,3  | 38 | 3,0   | 41,00 |
| 220341.0035.014  | • 0,35 | 1,4  | 2,4  | 2,9  | 38 | 3,0   | 41,00 |
| 220341.0035.021  | • 0,35 | 2,1  | 3,1  | 3,6  | 38 | 3,0   | 41,00 |
| 220341.0040.016  | • 0,40 | 1,6  | 2,6  | 3,1  | 38 | 3,0   | 36,00 |
| 220341.0040.024  | • 0,40 | 2,4  | 3,4  | 3,9  | 38 | 3,0   | 36,00 |
| 220341.0045.018  | • 0,45 | 1,8  | 2,8  | 3,3  | 38 | 3,0   | 36,00 |
| 220341.0045.027  | • 0,45 | 2,7  | 3,7  | 4,2  | 38 | 3,0   | 36,00 |
| 220341.0050.020  | • 0,50 | 2,0  | 3,0  | 3,5  | 38 | 3,0   | 36,00 |
| 220341.0050.030  | • 0,50 | 3,0  | 4,0  | 4,5  | 38 | 3,0   | 36,00 |
| 220341.0055.022  | • 0,55 | 2,2  | 3,2  | 3,7  | 38 | 3,0   | 36,00 |
| 220341.0055.033  | • 0,55 | 3,3  | 4,3  | 4,8  | 38 | 3,0   | 36,00 |
| 220341.0060.024  | • 0,60 | 2,4  | 3,4  | 3,9  | 38 | 3,0   | 36,00 |
| 220341.0060.036  | • 0,60 | 3,6  | 4,6  | 5,1  | 38 | 3,0   | 36,00 |
| 220341.0065.026  | • 0,65 | 2,6  | 3,6  | 4,1  | 38 | 3,0   | 36,00 |
| 220341.0065.039  | • 0,65 | 3,9  | 4,9  | 5,4  | 38 | 3,0   | 36,00 |
| 220341.0070.028  | • 0,70 | 2,8  | 3,8  | 4,3  | 38 | 3,0   | 36,00 |
| 220341.0070.042  | • 0,70 | 4,2  | 5,2  | 5,7  | 38 | 3,0   | 36,00 |
| 220341.0075.030  | • 0,75 | 3,0  | 4,0  | 4,5  | 38 | 3,0   | 36,00 |
| 220341.0075.045  | • 0,75 | 4,5  | 5,5  | 6,0  | 38 | 3,0   | 36,00 |
| 220341.0080.032  | • 0,80 | 3,2  | 4,8  | 5,3  | 46 | 3,0   | 42,00 |
| 220341.0080.048  | • 0,80 | 4,8  | 5,8  | 6,3  | 54 | 3,0   | 42,00 |
| 220341.0085.034  | • 0,85 | 3,4  | 5,1  | 5,6  | 46 | 3,0   | 42,00 |
| 220341.0085.051  | • 0,85 | 5,1  | 6,1  | 6,6  | 54 | 3,0   | 42,00 |
| 220341.0090.036  | • 0,90 | 3,6  | 5,4  | 5,9  | 46 | 3,0   | 42,00 |
| 220341.0090.054  | • 0,90 | 5,4  | 6,5  | 6,7  | 54 | 3,0   | 42,00 |
| 220341.0095.038  | • 0,95 | 3,8  | 5,7  | 6,2  | 46 | 3,0   | 42,00 |
| 220341.0095.057  | • 0,95 | 5,7  | 6,8  | 7,3  | 54 | 3,0   | 42,00 |
| 220341.0100.040  | • 1,00 | 4,0  | 6,0  | 6,5  | 46 | 3,0   | 42,00 |
| 220341.0100.060  | • 1,00 | 6,0  | 7,2  | 7,7  | 54 | 3,0   | 42,00 |
| 220341.0105.042  | • 1,05 | 4,2  | 6,3  | 6,8  | 46 | 3,0   | 42,00 |
| 220341.0105.063  | • 1,05 | 6,3  | 7,6  | 8,1  | 54 | 3,0   | 42,00 |
| 220341.0110.044  | • 1,10 | 4,4  | 6,6  | 7,1  | 46 | 3,0   | 42,00 |
| 220341.0110.066  | • 1,10 | 6,6  | 7,9  | 8,4  | 54 | 3,0   | 42,00 |
| 220341.0115.046  | • 1,15 | 4,6  | 6,9  | 7,4  | 46 | 3,0   | 42,00 |
| 220341.0115.069  | • 1,15 | 6,9  | 8,3  | 8,8  | 54 | 3,0   | 42,00 |
| 220341.0120.048  | • 1,20 | 4,8  | 7,2  | 7,7  | 46 | 3,0   | 42,00 |
| 220341.0120.072  | • 1,20 | 7,2  | 8,6  | 9,1  | 54 | 3,0   | 42,00 |
| 220341.0125.050  | • 1,25 | 5,0  | 7,5  | 8,0  | 46 | 3,0   | 42,00 |
| 220341.0125.075  | • 1,25 | 7,5  | 8,9  | 9,5  | 54 | 3,0   | 42,00 |
| 220341.0130.052  | • 1,30 | 5,2  | 7,8  | 8,3  | 46 | 3,0   | 42,00 |
| 220341.0130.078  | • 1,30 | 7,8  | 9,4  | 9,9  | 54 | 3,0   | 42,00 |
| 220341.0135.054  | • 1,35 | 5,4  | 8,1  | 8,6  | 46 | 3,0   | 42,00 |
| 220341.0135.081  | • 1,35 | 8,1  | 9,7  | 10,2 | 54 | 3,0   | 42,00 |
| 220341.0140.056  | • 1,40 | 5,6  | 8,4  | 8,9  | 46 | 3,0   | 42,00 |
| 220341.0140.084  | • 1,40 | 8,4  | 10,1 | 10,6 | 54 | 3,0   | 42,00 |
| 220341.0145.058  | • 1,45 | 5,8  | 8,7  | 9,2  | 46 | 3,0   | 42,00 |
| 220341.0145.087  | • 1,45 | 8,7  | 10,4 | 10,9 | 54 | 3,0   | 42,00 |
| 220341.0150.060  | • 1,50 | 6,0  | 9,0  | 9,5  | 46 | 3,0   | 42,00 |
| 220341.0150.090  | • 1,50 | 9,0  | 10,8 | 11,3 | 54 | 3,0   | 42,00 |
| 220341.0155.062  | • 1,55 | 6,2  | 7,4  | 7,9  | 46 | 3,0   | 42,00 |
| 220341.0155.093  | • 1,55 | 9,3  | 11,2 | 11,7 | 54 | 3,0   | 42,00 |

| Art.            | d1 k5  | l3   | l2   | l4   | l1 | d2 h6 | €     |
|-----------------|--------|------|------|------|----|-------|-------|
| 220341.0160.064 | • 1,60 | 6,4  | 7,7  | 8,2  | 46 | 3,0   | 42,00 |
| 220341.0160.096 | • 1,60 | 9,6  | 11,5 | 12,0 | 54 | 3,0   | 42,00 |
| 220341.0165.066 | • 1,65 | 6,6  | 7,9  | 8,4  | 46 | 3,0   | 42,00 |
| 220341.0165.099 | • 1,65 | 9,9  | 11,9 | 12,4 | 54 | 3,0   | 42,00 |
| 220341.0170.068 | • 1,70 | 6,8  | 8,2  | 8,7  | 46 | 3,0   | 42,00 |
| 220341.0170.102 | • 1,70 | 10,2 | 12,2 | 12,7 | 54 | 3,0   | 42,00 |
| 220341.0175.070 | • 1,75 | 7,0  | 8,4  | 8,9  | 46 | 3,0   | 42,00 |
| 220341.0175.105 | • 1,75 | 10,5 | 12,6 | 13,1 | 54 | 3,0   | 42,00 |
| 220341.0180.072 | • 1,80 | 7,2  | 8,6  | 9,1  | 46 | 3,0   | 42,00 |
| 220341.0180.108 | • 1,80 | 10,8 | 13,0 | 13,5 | 54 | 3,0   | 42,00 |
| 220341.0185.074 | • 1,85 | 7,4  | 8,9  | 9,4  | 46 | 3,0   | 42,00 |
| 220341.0185.111 | • 1,85 | 11,1 | 13,3 | 13,8 | 54 | 3,0   | 42,00 |
| 220341.0190.076 | • 1,90 | 7,6  | 9,1  | 9,6  | 46 | 3,0   | 42,00 |
| 220341.0190.114 | • 1,90 | 11,4 | 13,7 | 14,2 | 54 | 3,0   | 42,00 |
| 220341.0195.078 | • 1,95 | 7,8  | 9,4  | 9,9  | 46 | 3,0   | 42,00 |
| 220341.0195.117 | • 1,95 | 11,7 | 14,0 | 14,5 | 54 | 3,0   | 42,00 |
| 220341.0200.080 | • 2,00 | 8,0  | 12,0 | 12,5 | 60 | 4,0   | 42,00 |
| 220341.0200.120 | • 2,00 | 12,0 | 14,4 | 14,9 | 65 | 4,0   | 42,00 |
| 220341.0205.082 | • 2,05 | 8,2  | 12,3 | 12,8 | 60 | 4,0   | 42,00 |
| 220341.0205.123 | • 2,05 | 12,3 | 14,7 | 15,2 | 65 | 4,0   | 42,00 |
| 220341.0210.084 | • 2,10 | 8,4  | 12,6 | 13,1 | 60 | 4,0   | 42,00 |
| 220341.0210.126 | • 2,10 | 12,6 | 15,1 | 15,6 | 65 | 4,0   | 42,00 |
| 220341.0215.086 | • 2,15 | 8,6  | 12,9 | 13,4 | 60 | 4,0   | 42,00 |
| 220341.0215.129 | • 2,15 | 12,9 | 15,5 | 16,0 | 65 | 4,0   | 42,00 |
| 220341.0220.088 | • 2,20 | 8,8  | 13,2 | 13,7 | 60 | 4,0   | 42,00 |
| 220341.0220.132 | • 2,20 | 13,2 | 15,8 | 16,3 | 65 | 4,0   | 42,00 |
| 220341.0225.090 | • 2,25 | 9,0  | 13,5 | 14,0 | 60 | 4,0   | 42,00 |
| 220341.0225.135 | • 2,25 | 13,5 | 16,2 | 16,7 | 65 | 4,0   | 42,00 |
| 220341.0230.092 | • 2,30 | 9,2  | 13,8 | 14,3 | 60 | 4,0   | 42,00 |
| 220341.0230.138 | • 2,30 | 13,8 | 16,6 | 17,1 | 65 | 4,0   | 42,00 |
| 220341.0235.094 | • 2,35 | 9,4  | 14,1 | 14,6 | 60 | 4,0   | 42,00 |
| 220341.0235.141 | • 2,35 | 14,1 | 16,9 | 17,4 | 65 | 4,0   | 42,00 |
| 220341.0240.096 | • 2,40 | 9,6  | 14,4 | 14,9 | 60 | 4,0   | 42,00 |
| 220341.0240.144 | • 2,40 | 14,4 | 17,2 | 17,7 | 65 | 4,0   | 42,00 |
| 220341.0245.098 | • 2,45 | 9,8  | 14,7 | 15,2 | 60 | 4,0   | 42,00 |
| 220341.0245.147 | • 2,45 | 14,7 | 17,6 | 18,1 | 65 | 4,0   | 42,00 |
| 220341.0250.100 | • 2,50 | 10,0 | 15,0 | 15,5 | 60 | 4,0   | 42,00 |
| 220341.0250.150 | • 2,50 | 15,0 | 18,0 | 18,5 | 65 | 4,0   | 42,00 |
| 220341.0255.102 | • 2,55 | 10,2 | 15,3 | 15,7 | 60 | 4,0   | 42,00 |
| 220341.0255.153 | • 2,55 | 15,3 | 18,5 | 19,0 | 65 | 4,0   | 42,00 |
| 220341.0260.104 | • 2,60 | 10,4 | 15,6 | 16,1 | 60 | 4,0   | 42,00 |
| 220341.0260.156 | • 2,60 | 15,6 | 18,7 | 19,2 | 65 | 4,0   | 42,00 |
| 220341.0265.106 | • 2,65 | 10,6 | 15,9 | 16,4 | 60 | 4,0   | 42,00 |
| 220341.0265.159 | • 2,65 | 15,9 | 19,1 | 19,6 | 65 | 4,0   | 42,00 |
| 220341.0270.108 | • 2,70 | 10,8 | 16,2 | 16,7 | 60 | 4,0   | 42,00 |
| 220341.0270.162 | • 2,70 | 16,2 | 19,4 | 19,9 | 65 | 4,0   | 42,00 |
| 220341.0275.110 | • 2,75 | 11,0 | 16,5 | 17,0 | 60 | 4,0   | 42,00 |
| 220341.0275.165 | • 2,75 | 16,5 | 19,8 | 20,3 | 65 | 4,0   | 42,00 |
| 220341.0280.112 | • 2,80 | 11,2 | 16,8 | 17,3 | 60 | 4,0   | 42,00 |
| 220341.0280.168 | • 2,80 | 16,8 | 20,2 | 20,7 | 65 | 4,0   | 42,00 |
| 220341.0285.114 | • 2,85 | 11,4 | 17,1 | 17,6 | 60 | 4,0   | 42,00 |
| 220341.0285.171 | • 2,85 | 17,1 | 20,5 | 21,0 | 65 | 4,0   | 42,00 |
| 220341.0290.116 | • 2,90 | 11,6 | 17,4 | 17,9 | 60 | 4,0   | 42,00 |
| 220341.0290.174 | • 2,90 | 17,4 | 20,9 | 21,4 | 65 | 4,0   | 42,00 |
| 220341.0295.118 | • 2,95 | 11,8 | 17,7 | 18,2 | 60 | 4,0   | 42,00 |
| 220341.0295.177 | • 2,95 | 17,7 | 21,2 | 21,7 | 65 | 4,0   | 42,00 |
| 220341.0300.120 | • 3,00 | 12,0 | 18,0 | 18,5 | 60 | 4,0   | 42,00 |
| 220341.0300.180 | • 3,00 | 18,0 | 21,6 | 22,1 | 65 | 4,0   | 42,00 |

Mini- Vollhartmetall-Hochleistungsbohrer

Art. **22.0360**

- ALU  
aluminium
- ALU  
< 6% Si
- MESSING  
brass
- KUPFER  
copper
- GOLD  
gold
- Kunststoff  
plastic



- Mini solid carbide twist drill
- Mini taladro metal duro
- Высокопроизводительное сверло сквозной закали HSC

|           | Bohrertoleranz<br>Drill tolerance |
|-----------|-----------------------------------|
| $\pm 3,0$ | + 0,000<br>- 0,010                |

Über 6% Si bis 12% Si empfehlen wir unsere NHC-7000-Beschichtung  
Over 6% Si until 12% Si we recommend our NHC-7000-coating

**MICRO GRAIN**  
KARNASCH NORM

**W**  
DIN 6535 Form HA

30°

130°

HSC High-Speed-Cutting

POLIERT POLISHED

ÖL

Schnittdaten  
Cutting data

i S. 319

| Art.                | d1 h7  | l3   | l2   | l1 | d2 h6 | €     |
|---------------------|--------|------|------|----|-------|-------|
| 220360.0050.050     | • 0,50 | 5,0  | 6,5  | 39 | 3     | 18,50 |
| 220360.0055.050     | • 0,55 | 5,0  | 6,5  | 39 | 3     | 18,50 |
| 220360.0060.050     | • 0,60 | 5,0  | 6,5  | 39 | 3     | 18,50 |
| 220360.0065.060     | • 0,65 | 6,0  | 7,5  | 39 | 3     | 18,50 |
| 220360.0070.060     | • 0,70 | 6,0  | 7,5  | 39 | 3     | 18,50 |
| 220360.0075.080     | • 0,75 | 8,0  | 9,5  | 39 | 3     | 18,50 |
| 220360.0080.080     | • 0,80 | 8,0  | 9,5  | 39 | 3     | 18,50 |
| 220360.0085.080     | • 0,85 | 8,0  | 9,5  | 39 | 3     | 18,50 |
| 220360.0090.100     | • 0,90 | 10,0 | 11,5 | 39 | 3     | 18,50 |
| 220360.0095.100     | • 0,95 | 10,0 | 11,5 | 39 | 3     | 18,50 |
| 220360.0100.100     | • 1,00 | 10,0 | 11,5 | 39 | 3     | 18,50 |
| NEU 220360.0105.100 | • 1,05 | 10,0 | 11,5 | 39 | 3     | 18,50 |
| NEU 220360.0110.100 | • 1,10 | 10,0 | 11,5 | 39 | 3     | 18,50 |
| NEU 220360.0115.100 | • 1,15 | 10,0 | 11,5 | 39 | 3     | 18,50 |
| 220360.0120.120     | • 1,20 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| NEU 220360.0125.120 | • 1,25 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0130.120     | • 1,30 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| NEU 220360.0135.120 | • 1,35 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0140.120     | • 1,40 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| NEU 220360.0145.120 | • 1,45 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0150.120     | • 1,50 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0160.120     | • 1,60 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0165.120     | • 1,65 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0170.120     | • 1,70 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0180.120     | • 1,80 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| NEU 220360.0185.120 | • 1,85 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0190.120     | • 1,90 | 12,0 | 14,5 | 39 | 3     | 18,50 |
| 220360.0200.140     | • 2,00 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0205.140 | • 2,05 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0210.140 | • 2,10 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0220.140 | • 2,20 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0230.140 | • 2,30 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0240.140 | • 2,40 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| 220360.0250.140     | • 2,50 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0260.140 | • 2,60 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0270.140 | • 2,70 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0280.140 | • 2,80 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0290.140 | • 2,90 | 14,0 | 16,5 | 39 | 3     | 18,50 |
| NEU 220360.0300.140 | • 3,00 | 14,0 | 16,5 | 39 | 3     | 18,50 |

Art. 22.0389

Vollhartmetall-Pilot-Stufenbohrer 142°/90°  
abgestimmt auf Tieflochbohrer 22.0390

UNI

GJS

STAHL  
steel  
< 1400 N/mm

GTW  
GTS

HRC  
< 52

kurz-  
spanend  
short chip

GJL



Solid-carbide pilot step drill 142°/90°. Designed for deep-cut drill 22.0390

Broca guia de niveles de metal duro, adecuado a broca de taladrado profundo 22.0390

Монолитное твердосплавное центровочное сверло 142°/90°  
Согласовано со сверлами для глубокого сверления арт. 22.0390

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

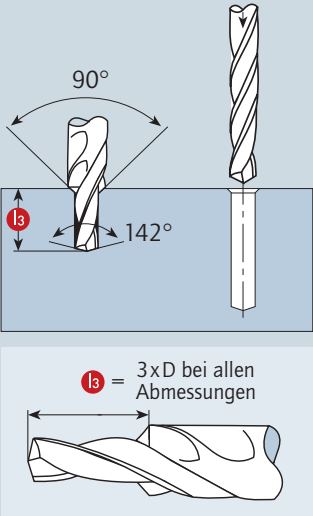
30°

142°

HSC  
HPC

DVC-X2

Schnittdaten  
Cutting data



| Art.            | d1 h7  | l3 = 3xD | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----------|----|-----|-------|--------|
| 220389.0350.105 | ▲ 3,5  | 10,5     | 24 | 62  | 6     | 55,50  |
| 220389.0400.120 | ▲ 4,0  | 12,0     | 26 | 66  | 6     | 55,50  |
| 220389.0450.135 | ▲ 4,5  | 13,5     | 28 | 66  | 6     | 55,50  |
| 220389.0500.150 | ▲ 5,0  | 15,0     | 35 | 79  | 8     | 70,00  |
| 220389.0550.165 | ▲ 5,5  | 16,5     | 35 | 79  | 8     | 70,00  |
| 220389.0600.180 | ▲ 6,0  | 18,0     | 35 | 79  | 8     | 70,00  |
| 220389.0650.195 | ▲ 6,5  | 19,5     | 38 | 79  | 8     | 73,50  |
| 220389.0700.210 | ▲ 7,0  | 21,0     | 46 | 89  | 10    | 101,00 |
| 220389.0800.240 | ▲ 8,0  | 24,0     | 48 | 89  | 10    | 101,00 |
| 220389.0850.255 | ▲ 8,5  | 25,5     | 48 | 89  | 10    | 103,00 |
| 220389.0900.270 | ▲ 9,0  | 27,0     | 55 | 102 | 12    | 134,00 |
| 220389.1000.300 | ▲ 10,0 | 30,0     | 57 | 102 | 12    | 134,00 |
| 220389.1100.330 | ▲ 11,0 | 33,0     | 60 | 107 | 14    | 161,50 |
| 220389.1200.360 | ▲ 12,0 | 36,0     | 62 | 107 | 14    | 161,50 |

Alternativwerkzeug: 22.0471 + 22.0473  
Alternative Tool: 22.0402 + 22.0405

| m7      | Bohrungstoleranz<br>hole tolerance |
|---------|------------------------------------|
| > 3-6   | +0,004<br>+0,016                   |
| > 6-10  | +0,006<br>+0,021                   |
| > 10-18 | +0,007<br>+0,025                   |

| h7      | Bohrungstoleranz<br>hole tolerance |
|---------|------------------------------------|
| > 3-6   | +0,000<br>-0,012                   |
| > 6-10  | +0,000<br>-0,015                   |
| > 10-18 | +0,000<br>-0,018                   |

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer ohne Innenkühlung  
Recommended cutting data for solid carbide twist drill, without interior cooling supply

| Werkstoff-<br>gruppe | Werkstoff   | Festigkeit<br>N/mm² | Schnittgeschwindig-<br>keit Vc (m/min)<br>±10% | Ø 3 - 5,5 | Ø 6 - 8,5 | Ø 9 - 12 |
|----------------------|-------------|---------------------|------------------------------------------------|-----------|-----------|----------|
|                      |             |                     |                                                | f = mm/U  | f = mm/U  | f = mm/U |
| 1.1                  | St 42-8     | < 450               | 100                                            | 0,18      | 0,25      | 0,30     |
| 1.2                  | C 50        | < 650               | 90                                             | 0,18      | 0,25      | 0,30     |
| 2.1                  | 51 Cr V4    | < 600               | 70                                             | 0,15      | 0,20      | 0,28     |
| 2.2                  | 26 Cr Mo 4  | < 950               | 70                                             | 0,15      | 0,20      | 0,28     |
| 2.3                  | 100 WV 4    | < 1100              | 60                                             | 0,15      | 0,20      | 0,28     |
| 2.5                  | 34 Cr Al 6  | < 1000              | 60                                             | 0,15      | 0,20      | 0,28     |
| 2.6                  | 31 Cr mo V9 | < 1200              | 70                                             | 0,15      | 0,20      | 0,28     |
| 3.1                  | X 42 Cr 13  | < 700               | 70                                             | 0,15      | 0,20      | 0,27     |
| 3.2                  | S 29 28     | < 1400              | 40                                             | 0,08      | 0,12      | 0,15     |
| 7.1                  | GG 15       | < 180 HB            | 100                                            | 0,24      | 0,32      | 0,42     |
| 7.2                  | GG 30       | < 350 HB            | 100                                            | 0,24      | 0,32      | 0,42     |
| 7.4                  | GGG 60      | < 200 HB            | 90                                             | 0,20      | 0,25      | 0,35     |
| 7.6                  | GTW 3504    | < 230 HB            | 90                                             | 0,20      | 0,25      | 0,35     |
| 8.1                  | Toolox 44   | 44 HRC              | 30                                             | 0,08      | 0,09      | 0,10     |
| 12.0                 | Hardox 400  | < 1350              | 25                                             | 0,08      | 0,12      | 0,15     |
| 12.1                 | Hardox 500  | < 1800              | 20                                             | 0,08      | 0,12      | 0,15     |



# Karnasch Messeausstellungen

Hannover · Stuttgart · Moskau · Chicago

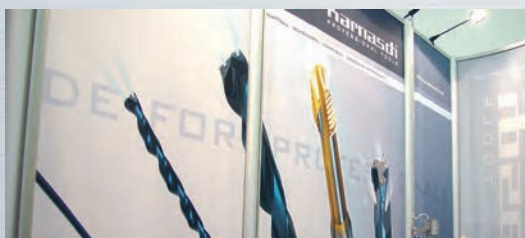
**Karnasch**<sup>TM</sup>  
PROFESSIONAL TOOLS



IHR PARTNER FÜR: Metallindustrie    Automobilindustrie    Flugzeugindustrie    Schiffbau    Schienenbau    Formenbau    Forschung und Entwicklung

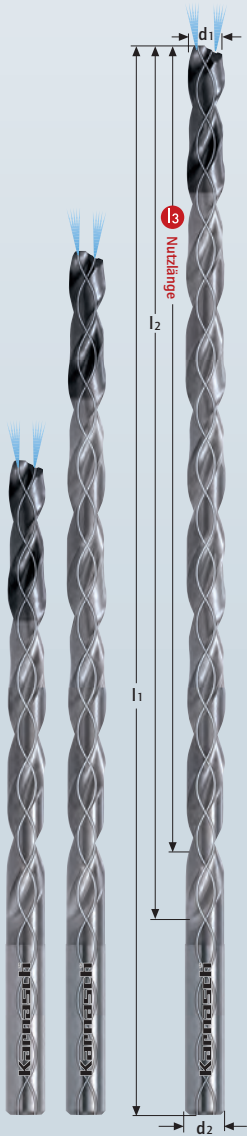
Besuchen Sie uns auf unserem Messestand und überzeugen Sie sich direkt vor Ort von unseren zukunftsweisenden Produkten und Innovationen. Lassen Sie sich in angenehmer Atmosphäre von unser Fachpersonal kompetent beraten. Unsere internationalen Messetermine finden Sie auf unserer Webseite unter [www.karnasch.de](http://www.karnasch.de).

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Art. 22.0390 Vollhartmetall-4-Fasen-Hochleistungsbohrer < 40xD

- STAHL  
steel  
< 1200 N/mm
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- kurz-  
spanend  
short chip

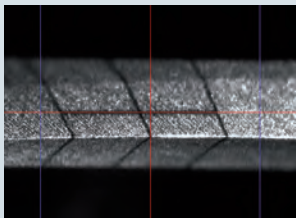


Solid carbide 4-chamfer twist drill < 40xD

Taladro de gran potencia 4-fases de metal duro y macizo < 40xD

Высокопроизводительное сверло сквозной закалки < 40xD

Mit definierter Kantenverrundung  
With a defined edge preparation



MICRO  
GRAIN  
KARNASCH  
NORM

SPEZIAL  
DIN 6535  
Form HAK

30°  
137°

HSC  
HPC

DVC-X2  
hp<sup>2</sup>-  
finish

50-80 bar

Schnittdaten  
Cutting data



i S. 311



MOVIE

| h7            | Bohrertoleranz<br>Drill tolerance |
|---------------|-----------------------------------|
| > 3,0 - 6,0   | + 0,000<br>- 0,012                |
| > 6,0 - 10,0  | + 0,000<br>- 0,015                |
| > 10,0 - 14,0 | + 0,000<br>- 0,018                |

| Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|-------|-----|-----|-----|-------|--------|
| 220390.0300.030 | • 3,0 | 30  | 40  | 80  | 6     | 212,00 |
| 220390.0300.040 | • 3,0 | 40  | 50  | 90  | 6     | 215,00 |
| 220390.0300.050 | • 3,0 | 50  | 60  | 100 | 6     | 217,00 |
| 220390.0300.060 | • 3,0 | 60  | 65  | 105 | 6     | 217,00 |
| 220390.0300.070 | • 3,0 | 70  | 75  | 115 | 6     | 232,00 |
| 220390.0300.080 | • 3,0 | 80  | 85  | 125 | 6     | 265,00 |
| 220390.0300.094 | • 3,0 | 94  | 98  | 140 | 6     | 252,00 |
| 220390.0310.045 | • 3,1 | 45  | 50  | 90  | 6     | 223,00 |
| 220390.0310.056 | • 3,1 | 56  | 60  | 100 | 6     | 223,00 |
| 220390.0320.045 | • 3,2 | 45  | 50  | 90  | 6     | 223,00 |
| 220390.0320.056 | • 3,2 | 56  | 60  | 100 | 6     | 223,00 |
| 220390.0330.045 | • 3,3 | 45  | 50  | 90  | 6     | 223,00 |
| 220390.0330.056 | • 3,3 | 56  | 60  | 100 | 6     | 223,00 |
| 220390.0330.105 | • 3,3 | 105 | 110 | 150 | 6     | 291,00 |
| 220390.0340.045 | • 3,4 | 45  | 50  | 90  | 6     | 223,00 |
| 220390.0340.056 | • 3,4 | 56  | 60  | 100 | 6     | 223,00 |
| 220390.0350.050 | • 3,5 | 50  | 60  | 100 | 6     | 219,00 |
| 220390.0350.060 | • 3,5 | 60  | 65  | 105 | 6     | 219,00 |
| 220390.0350.070 | • 3,5 | 70  | 75  | 115 | 6     | 225,00 |
| 220390.0350.144 | • 3,5 | 144 | 150 | 190 | 6     | 359,00 |
| 220390.0360.050 | • 3,6 | 50  | 55  | 100 | 6     | 223,00 |
| 220390.0360.053 | • 3,6 | 53  | 68  | 110 | 6     | 239,00 |
| 220390.0370.050 | • 3,7 | 50  | 55  | 100 | 6     | 223,00 |
| 220390.0370.053 | • 3,7 | 53  | 68  | 110 | 6     | 239,00 |
| 220390.0380.050 | • 3,8 | 50  | 55  | 100 | 6     | 223,00 |
| 220390.0380.053 | • 3,8 | 53  | 68  | 110 | 6     | 239,00 |
| 220390.0390.050 | • 3,9 | 50  | 55  | 100 | 6     | 223,00 |
| 220390.0390.053 | • 3,9 | 53  | 68  | 110 | 6     | 239,00 |
| 220390.0400.055 | • 4,0 | 55  | 65  | 105 | 6     | 233,00 |
| 220390.0400.065 | • 4,0 | 65  | 75  | 115 | 6     | 233,00 |
| 220390.0400.075 | • 4,0 | 75  | 80  | 120 | 6     | 237,00 |
| 220390.0400.085 | • 4,0 | 85  | 90  | 130 | 6     | 257,00 |
| 220390.0400.095 | • 4,0 | 95  | 100 | 140 | 6     | 260,00 |
| 220390.0400.105 | • 4,0 | 105 | 110 | 150 | 6     | 291,00 |
| 220390.0400.120 | • 4,0 | 120 | 125 | 165 | 6     | 312,00 |
| 220390.0400.160 | • 4,0 | 160 | 165 | 210 | 6     | 404,00 |
| 220390.0410.060 | • 4,1 | 60  | 65  | 105 | 6     | 233,00 |
| 220390.0410.073 | • 4,1 | 73  | 78  | 118 | 6     | 237,00 |
| 220390.0420.060 | • 4,2 | 60  | 65  | 105 | 6     | 233,00 |
| 220390.0420.073 | • 4,2 | 73  | 78  | 118 | 6     | 237,00 |
| 220390.0420.154 | • 4,2 | 154 | 160 | 205 | 6     | 404,00 |
| 220390.0420.174 | • 4,2 | 174 | 180 | 225 | 6     | 409,00 |
| 220390.0430.060 | • 4,3 | 60  | 65  | 105 | 6     | 233,00 |
| 220390.0430.073 | • 4,3 | 73  | 78  | 118 | 6     | 237,00 |
| 220390.0440.060 | • 4,4 | 60  | 65  | 105 | 6     | 233,00 |
| 220390.0440.073 | • 4,4 | 73  | 78  | 118 | 6     | 237,00 |
| 220390.0450.060 | • 4,5 | 60  | 65  | 105 | 6     | 233,00 |
| 220390.0450.080 | • 4,5 | 80  | 88  | 130 | 6     | 237,00 |
| 220390.0450.110 | • 4,5 | 110 | 118 | 160 | 6     | 272,00 |
| 220390.0450.184 | • 4,5 | 184 | 190 | 230 | 6     | 409,00 |
| 220390.0460.065 | • 4,6 | 65  | 71  | 110 | 6     | 233,00 |
| 220390.0460.079 | • 4,6 | 79  | 85  | 125 | 6     | 257,00 |
| 220390.0470.065 | • 4,7 | 65  | 71  | 110 | 6     | 233,00 |
| 220390.0470.079 | • 4,7 | 79  | 85  | 125 | 6     | 257,00 |
| 220390.0480.065 | • 4,8 | 65  | 71  | 110 | 6     | 233,00 |
| 220390.0480.079 | • 4,8 | 79  | 85  | 125 | 6     | 257,00 |



| Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|-------|-----|-----|-----|-------|--------|
| 220390.0490.065 | • 4,9 | 65  | 71  | 110 | 6     | 233,00 |
| 220390.0490.079 | • 4,9 | 79  | 85  | 125 | 6     | 257,00 |
| 220390.0500.070 | • 5,0 | 70  | 80  | 120 | 6     | 227,00 |
| 220390.0500.090 | • 5,0 | 90  | 98  | 140 | 6     | 240,00 |
| 220390.0500.109 | • 5,0 | 109 | 115 | 155 | 6     | 272,00 |
| 220390.0500.120 | • 5,0 | 120 | 128 | 170 | 6     | 275,00 |
| 220390.0500.150 | • 5,0 | 150 | 158 | 200 | 6     | 312,00 |
| 220390.0500.200 | • 5,0 | 200 | 210 | 250 | 6     | 430,00 |
| 220390.0510.074 | • 5,1 | 74  | 80  | 120 | 6     | 227,00 |
| 220390.0510.088 | • 5,1 | 88  | 95  | 135 | 6     | 240,00 |
| 220390.0520.074 | • 5,2 | 74  | 80  | 120 | 6     | 227,00 |
| 220390.0520.088 | • 5,2 | 88  | 95  | 135 | 6     | 240,00 |
| 220390.0530.074 | • 5,3 | 74  | 80  | 120 | 6     | 227,00 |
| 220390.0530.088 | • 5,3 | 88  | 95  | 135 | 6     | 240,00 |
| 220390.0540.074 | • 5,4 | 74  | 80  | 120 | 6     | 227,00 |
| 220390.0540.088 | • 5,4 | 88  | 95  | 135 | 6     | 240,00 |
| 220390.0550.100 | • 5,5 | 100 | 108 | 150 | 6     | 242,00 |
| 220390.0550.130 | • 5,5 | 130 | 138 | 180 | 6     | 275,00 |
| 220390.0550.160 | • 5,5 | 160 | 168 | 210 | 6     | 306,00 |
| 220390.0560.079 | • 5,6 | 79  | 85  | 125 | 6     | 237,00 |
| 220390.0560.097 | • 5,6 | 97  | 105 | 145 | 6     | 291,00 |
| 220390.0570.079 | • 5,7 | 79  | 85  | 125 | 6     | 237,00 |
| 220390.0570.097 | • 5,7 | 97  | 105 | 145 | 6     | 291,00 |
| 220390.0580.079 | • 5,8 | 79  | 85  | 125 | 6     | 237,00 |
| 220390.0580.097 | • 5,8 | 97  | 105 | 145 | 6     | 291,00 |
| 220390.0590.079 | • 5,9 | 79  | 85  | 125 | 6     | 237,00 |
| 220390.0590.097 | • 5,9 | 97  | 105 | 145 | 6     | 291,00 |
| 220390.0600.070 | • 6,0 | 70  | 85  | 125 | 6     | 237,00 |
| 220390.0600.090 | • 6,0 | 90  | 105 | 145 | 6     | 266,00 |
| 220390.0600.110 | • 6,0 | 110 | 118 | 160 | 6     | 236,00 |
| 220390.0600.145 | • 6,0 | 145 | 153 | 195 | 6     | 271,00 |
| 220390.0600.180 | • 6,0 | 180 | 188 | 230 | 6     | 340,00 |
| 220390.0600.248 | • 6,0 | 248 | 255 | 295 | 6     | 373,00 |
| 220390.0610.082 | • 6,1 | 82  | 90  | 130 | 8     | 309,00 |
| 220390.0610.102 | • 6,1 | 102 | 110 | 150 | 8     | 334,00 |
| 220390.0620.082 | • 6,2 | 82  | 90  | 130 | 8     | 309,00 |
| 220390.0620.102 | • 6,2 | 102 | 110 | 150 | 8     | 334,00 |
| 220390.0630.082 | • 6,3 | 82  | 90  | 130 | 8     | 309,00 |
| 220390.0630.102 | • 6,3 | 102 | 110 | 150 | 8     | 334,00 |
| 220390.0640.082 | • 6,4 | 82  | 90  | 130 | 8     | 309,00 |
| 220390.0640.102 | • 6,4 | 102 | 110 | 150 | 8     | 334,00 |
| 220390.0650.095 | • 6,5 | 95  | 110 | 150 | 8     | 334,00 |
| 220390.0650.115 | • 6,5 | 115 | 130 | 170 | 8     | 347,00 |
| 220390.0650.155 | • 6,5 | 155 | 170 | 210 | 8     | 407,00 |
| 220390.0650.195 | • 6,5 | 195 | 210 | 250 | 8     | 469,00 |
| 220390.0650.262 | • 6,5 | 262 | 270 | 310 | 8     | 611,00 |
| 220390.0660.092 | • 6,6 | 92  | 100 | 140 | 8     | 313,00 |
| 220390.0660.112 | • 6,6 | 112 | 120 | 160 | 8     | 326,00 |
| 220390.0670.092 | • 6,7 | 92  | 100 | 140 | 8     | 313,00 |
| 220390.0670.112 | • 6,7 | 112 | 120 | 160 | 8     | 326,00 |
| 220390.0680.092 | • 6,8 | 92  | 100 | 140 | 8     | 313,00 |
| 220390.0680.112 | • 6,8 | 112 | 120 | 160 | 8     | 326,00 |
| 220390.0690.092 | • 6,9 | 92  | 100 | 140 | 8     | 313,00 |
| 220390.0690.112 | • 6,9 | 112 | 120 | 160 | 8     | 326,00 |
| 220390.0700.095 | • 7,0 | 95  | 110 | 150 | 8     | 337,00 |
| 220390.0700.125 | • 7,0 | 125 | 140 | 180 | 8     | 351,00 |
| 220390.0700.165 | • 7,0 | 165 | 180 | 220 | 8     | 407,00 |
| 220390.0700.210 | • 7,0 | 210 | 225 | 265 | 8     | 476,00 |
| 220390.0710.095 | • 7,1 | 95  | 105 | 150 | 8     | 337,00 |
| 220390.0710.120 | • 7,1 | 120 | 130 | 170 | 8     | 347,00 |
| 220390.0720.100 | • 7,2 | 100 | 110 | 150 | 8     | 337,00 |
| 220390.0730.100 | • 7,3 | 100 | 110 | 150 | 8     | 337,00 |
| 220390.0740.100 | • 7,4 | 100 | 110 | 150 | 8     | 337,00 |
| 220390.0750.100 | • 7,5 | 100 | 110 | 150 | 8     | 337,00 |
| 220390.0750.120 | • 7,5 | 120 | 130 | 170 | 8     | 347,00 |
| 220390.0760.105 | • 7,6 | 105 | 115 | 155 | 8     | 342,00 |
| 220390.0760.125 | • 7,6 | 125 | 135 | 175 | 8     | 351,00 |
| 220390.0770.105 | • 7,7 | 105 | 115 | 155 | 8     | 342,00 |
| 220390.0770.125 | • 7,7 | 125 | 135 | 175 | 8     | 351,00 |
| 220390.0780.105 | • 7,8 | 105 | 115 | 155 | 8     | 342,00 |
| 220390.0780.125 | • 7,8 | 125 | 135 | 175 | 8     | 351,00 |
| 220390.0790.105 | • 7,9 | 105 | 115 | 155 | 8     | 342,00 |
| 220390.0800.095 | • 8,0 | 95  | 115 | 155 | 8     | 337,00 |
| 220390.0800.145 | • 8,0 | 145 | 160 | 200 | 8     | 349,00 |
| 220390.0800.190 | • 8,0 | 190 | 205 | 245 | 8     | 405,00 |
| 220390.0800.240 | • 8,0 | 240 | 260 | 300 | 8     | 496,00 |
| 220390.0810.108 | • 8,1 | 108 | 118 | 160 | 10    | 417,00 |
| 220390.0810.135 | • 8,1 | 135 | 145 | 190 | 10    | 493,00 |
| 220390.0820.108 | • 8,2 | 108 | 118 | 160 | 10    | 417,00 |
| 220390.0820.135 | • 8,2 | 135 | 145 | 190 | 10    | 493,00 |
| 220390.0830.108 | • 8,3 | 108 | 118 | 160 | 10    | 417,00 |

| Art.            | d1 h7  | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|--------|-----|-----|-----|-------|--------|
| 220390.0840.108 | • 8,4  | 108 | 118 | 160 | 10    | 417,00 |
| 220390.0840.135 | • 8,4  | 135 | 145 | 190 | 10    | 493,00 |
| 220390.0850.150 | • 8,5  | 150 | 160 | 205 | 10    | 470,00 |
| 220390.0850.200 | • 8,5  | 200 | 210 | 255 | 10    | 566,00 |
| 220390.0860.118 | • 8,6  | 118 | 130 | 175 | 10    | 441,00 |
| 220390.0860.144 | • 8,6  | 144 | 155 | 200 | 10    | 470,00 |
| 220390.0870.118 | • 8,7  | 118 | 130 | 175 | 10    | 464,00 |
| 220390.0870.144 | • 8,7  | 144 | 155 | 200 | 10    | 470,00 |
| 220390.0880.118 | • 8,8  | 118 | 130 | 175 | 10    | 441,00 |
| 220390.0880.144 | • 8,8  | 144 | 155 | 200 | 10    | 470,00 |
| 220390.0890.118 | • 8,9  | 118 | 130 | 175 | 10    | 441,00 |
| 220390.0900.110 | • 9,0  | 110 | 130 | 175 | 10    | 441,00 |
| 220390.0900.118 | • 9,0  | 118 | 130 | 175 | 10    | 441,00 |
| 220390.0900.150 | • 9,0  | 150 | 160 | 205 | 10    | 455,00 |
| 220390.0900.200 | • 9,0  | 200 | 210 | 255 | 10    | 548,00 |
| 220390.0900.250 | • 9,0  | 250 | 260 | 305 | 10    | 653,00 |
| 220390.0910.123 | • 9,1  | 123 | 135 | 180 | 10    | 448,00 |
| 220390.0910.155 | • 9,1  | 155 | 170 | 210 | 10    | 510,00 |
| 220390.0920.123 | • 9,2  | 123 | 135 | 180 | 10    | 448,00 |
| 220390.0920.155 | • 9,2  | 155 | 170 | 210 | 10    | 510,00 |
| 220390.0930.123 | • 9,3  | 123 | 135 | 180 | 10    | 448,00 |
| 220390.0940.123 | • 9,4  | 123 | 135 | 180 | 10    | 448,00 |
| 220390.0950.123 | • 9,5  | 123 | 135 | 180 | 10    | 448,00 |
| 220390.0950.155 | • 9,5  | 155 | 170 | 210 | 10    | 510,00 |
| 220390.0960.130 | • 9,6  | 130 | 145 | 190 | 10    | 457,00 |
| 220390.0960.163 | • 9,6  | 163 | 175 | 220 | 10    | 515,00 |
| 220390.0970.130 | • 9,7  | 130 | 145 | 190 | 10    | 457,00 |
| 220390.0970.163 | • 9,7  | 163 | 175 | 220 | 10    | 515,00 |
| 220390.0980.130 | • 9,8  | 130 | 145 | 190 | 10    | 457,00 |
| 220390.0980.163 | • 9,8  | 163 | 175 | 220 | 10    | 515,00 |
| 220390.0990.130 | • 9,9  | 130 | 145 | 190 | 10    | 457,00 |
| 220390.0990.163 | • 9,9  | 163 | 175 | 220 | 10    | 515,00 |
| 220390.1000.110 | • 10,0 | 110 | 130 | 175 | 10    | 430,00 |
| 220390.1000.150 | • 10,0 | 150 | 160 | 205 | 10    | 432,00 |
| 220390.1000.180 | • 10,0 | 180 | 190 | 235 | 10    | 472,00 |
| 220390.1000.220 | • 10,0 | 220 | 230 | 275 | 10    | 539,00 |
| 220390.1010.142 | • 10,1 | 142 | 155 | 205 | 12    | 603,00 |
| 220390.1010.167 | • 10,1 | 167 | 180 | 230 | 12    | 701,00 |
| 220390.1020.142 | • 10,2 | 142 | 155 | 205 | 12    | 603,00 |
| 220390.1020.167 | • 10,2 | 167 | 180 | 230 | 12    | 701,00 |
| 220390.1030.142 | • 10,3 | 142 | 155 | 205 | 12    | 603,00 |
| 220390.1040.142 | • 10,4 | 142 | 155 | 205 | 12    | 603,00 |
| 220390.1050.142 | • 10,5 | 142 | 155 | 205 | 12    | 603,00 |
| 220390.1050.167 | • 10,5 | 167 | 180 | 230 | 12    | 701,00 |
| 220390.1070.147 | • 10,7 | 147 | 160 | 210 | 12    | 603,00 |
| 220390.1080.147 | • 10,8 | 147 | 160 | 210 | 12    | 603,00 |
| 220390.1100.180 | • 11,0 | 180 | 194 | 245 | 12    | 610,00 |
| 220390.1100.220 | • 11,0 | 220 | 234 | 285 | 12    | 690,00 |
| 220390.1150.186 | • 11,5 | 186 | 200 | 250 | 12    | 724,00 |
| 220390.1180.186 | • 11,8 | 186 | 200 | 250 | 12    | 724,00 |
| 220390.1200.180 | • 12,0 | 180 | 194 | 245 | 12    | 569,00 |
| 220390.1200.220 | • 12,0 | 220 | 234 | 285 | 12    | 643,00 |

Einsatzempfehlung: Wir empfehlen über 12 x D Bohrtiefe eine Pilotbohrung mit 22.0402 oder 22.0405 in der jeweils kürzesten Ausführung

Application recommendation: We recommend over 12 x D drilling depth a pilot drilling with 22.0402 or 22.0405 in each case the short version

Art. 22.0392 Vollhartmetall- Hochleistungsbohrer < 40 x D

ALU  
aluminium

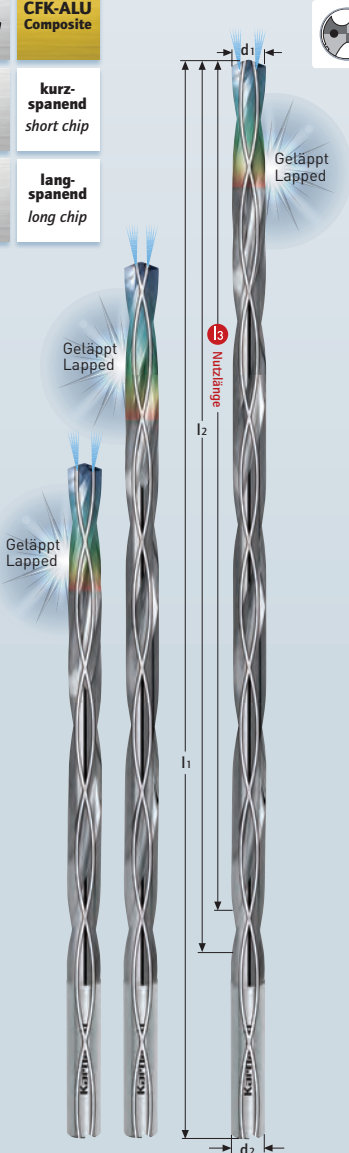
CFK-ALU  
Composite

ALU  
< 6% Si

kurz-  
spanend  
short chip

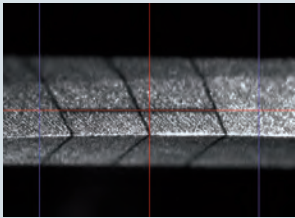
KUPFER  
copper

lang-  
spanend  
long chip



- Solid carbide twist drill < 40xD
- Taladro de gran potencia de metal duro y macizo < 40xD
- Высокопроизводительное сверло сквозной закалки < 40xD

Mit definierter Kantenverrundung  
With a defined edge preparation



| h7      | Bohrungstoleranz<br>hole tolerance |
|---------|------------------------------------|
| > 3-6   | +0,000<br>- 0,012                  |
| > 6-10  | +0,000<br>- 0,015                  |
| > 10-18 | +0,000<br>- 0,018                  |

MICRO  
GRAIN

KARNASCH  
NORM

W/M

DIN 6535  
Form HA

15°

137°

HSC  
HPC

NHC  
7000

50-80 bar

Schnittdaten  
Cutting data

|     | Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|-------|-----|-----|-----|-------|--------|
| NEU | 220392.0100.006 | • 1,0 | 6   | 8   | 55  | 4     | 75,00  |
| NEU | 220392.0110.010 | • 1,1 | 10  | 12  | 55  | 4     | 75,00  |
| NEU | 220392.0120.010 | • 1,2 | 10  | 12  | 55  | 4     | 75,00  |
| NEU | 220392.0130.010 | • 1,3 | 10  | 12  | 55  | 4     | 75,00  |
| NEU | 220392.0140.010 | • 1,4 | 10  | 12  | 55  | 4     | 75,00  |
| NEU | 220392.0150.010 | • 1,5 | 10  | 12  | 55  | 4     | 75,00  |
| NEU | 220392.0160.013 | • 1,6 | 13  | 16  | 55  | 4     | 75,00  |
| NEU | 220392.0170.013 | • 1,7 | 13  | 16  | 55  | 4     | 75,00  |
| NEU | 220392.0180.013 | • 1,8 | 13  | 16  | 55  | 4     | 75,00  |
| NEU | 220392.0190.013 | • 1,9 | 13  | 16  | 55  | 4     | 75,00  |
| NEU | 220392.0200.017 | • 2,0 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0200.040 | ▲ 2,0 | 40  | 44  | 80  | 4     | 119,00 |
| NEU | 220392.0200.047 | • 2,0 | 47  | 50  | 92  | 4     | 119,00 |
|     | 220392.0200.060 | ▲ 2,0 | 60  | 64  | 110 | 4     | 134,00 |
| NEU | 220392.0200.067 | • 2,0 | 67  | 70  | 115 | 4     | 134,00 |
| NEU | 220392.0210.017 | • 2,1 | 17  | 21  | 57  | 4     | 76,00  |
| NEU | 220392.0220.017 | • 2,2 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0220.044 | ▲ 2,2 | 44  | 48  | 80  | 4     | 119,00 |
| NEU | 220392.0220.047 | • 2,2 | 47  | 50  | 92  | 4     | 119,00 |
| NEU | 220392.0220.066 | • 2,2 | 66  | 70  | 110 | 4     | 134,00 |
| NEU | 220392.0230.017 | • 2,3 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0230.046 | ▲ 2,3 | 46  | 50  | 80  | 4     | 119,00 |
| NEU | 220392.0230.047 | • 2,3 | 47  | 50  | 92  | 4     | 119,00 |
| NEU | 220392.0230.067 | • 2,3 | 67  | 70  | 115 | 4     | 134,00 |
|     | 220392.0230.069 | ▲ 2,3 | 69  | 73  | 110 | 4     | 134,00 |
| NEU | 220392.0240.017 | • 2,4 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0240.048 | ▲ 2,4 | 48  | 52  | 85  | 4     | 133,00 |
| NEU | 220392.0240.066 | • 2,4 | 66  | 70  | 112 | 4     | 133,00 |
|     | 220392.0240.072 | ▲ 2,4 | 72  | 76  | 110 | 4     | 156,00 |
| NEU | 220392.0240.086 | • 2,4 | 86  | 90  | 138 | 4     | 156,00 |
| NEU | 220392.0250.017 | • 2,5 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0250.050 | ▲ 2,5 | 50  | 55  | 90  | 4     | 133,00 |
| NEU | 220392.0250.066 | • 2,5 | 66  | 70  | 112 | 4     | 133,00 |
|     | 220392.0250.075 | ▲ 2,5 | 75  | 80  | 110 | 4     | 156,00 |
| NEU | 220392.0250.086 | • 2,5 | 86  | 90  | 138 | 4     | 156,00 |
| NEU | 220392.0260.017 | • 2,6 | 17  | 21  | 57  | 4     | 76,00  |
| NEU | 220392.0270.017 | • 2,7 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0270.054 | ▲ 2,7 | 54  | 59  | 90  | 4     | 133,00 |
| NEU | 220392.0270.066 | • 2,7 | 66  | 70  | 112 | 4     | 133,00 |
|     | 220392.0270.081 | ▲ 2,7 | 81  | 86  | 120 | 4     | 156,00 |
| NEU | 220392.0270.086 | • 2,7 | 86  | 90  | 138 | 4     | 156,00 |
| NEU | 220392.0280.017 | • 2,8 | 17  | 21  | 57  | 4     | 76,00  |
|     | 220392.0280.056 | ▲ 2,8 | 56  | 61  | 95  | 4     | 133,00 |
| NEU | 220392.0280.066 | • 2,8 | 66  | 70  | 112 | 4     | 133,00 |
|     | 220392.0280.084 | ▲ 2,8 | 84  | 89  | 120 | 4     | 156,00 |
| NEU | 220392.0280.086 | • 2,8 | 86  | 90  | 138 | 4     | 156,00 |
| NEU | 220392.0290.017 | • 2,9 | 17  | 21  | 57  | 4     | 76,00  |
| NEU | 220392.0300.022 | • 3,0 | 22  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0300.029 | • 3,0 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0300.045 | • 3,0 | 45  | 51  | 95  | 6     | 149,00 |
| NEU | 220392.0300.055 | • 3,0 | 55  | 60  | 100 | 6     | 159,00 |
|     | 220392.0300.060 | ▲ 3,0 | 60  | 66  | 110 | 6     | 170,00 |
| NEU | 220392.0300.075 | • 3,0 | 75  | 80  | 120 | 6     | 176,00 |
| NEU | 220392.0300.090 | • 3,0 | 90  | 96  | 140 | 6     | 203,00 |
| NEU | 220392.0300.100 | • 3,0 | 100 | 105 | 150 | 6     | 260,00 |
| NEU | 220392.0310.022 | • 3,1 | 22  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0310.029 | • 3,1 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0310.048 | • 3,1 | 48  | 54  | 92  | 6     | 149,00 |
| NEU | 220392.0320.023 | • 3,2 | 23  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0320.029 | • 3,2 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0320.048 | • 3,2 | 48  | 54  | 95  | 6     | 149,00 |
| NEU | 220392.0320.055 | • 3,2 | 55  | 60  | 100 | 6     | 159,00 |



|     | Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|-------|-----|-----|-----|-------|--------|
|     | 220392.0320.064 | ▲ 3,2 | 64  | 70  | 110 | 6     | 170,00 |
| NEU | 220392.0320.075 | ● 3,2 | 75  | 80  | 120 | 6     | 176,00 |
|     | 220392.0320.080 | ▲ 3,2 | 80  | 86  | 125 | 6     | 176,00 |
| NEU | 220392.0320.093 | ● 3,2 | 93  | 98  | 135 | 6     | 203,00 |
|     | 220392.0320.096 | ▲ 3,2 | 96  | 102 | 140 | 6     | 203,00 |
| NEU | 220392.0320.100 | ● 3,2 | 100 | 105 | 150 | 6     | 260,00 |
| NEU | 220392.0330.023 | ● 3,3 | 23  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0330.029 | ● 3,3 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0330.048 | ● 3,3 | 48  | 54  | 92  | 6     | 149,00 |
| NEU | 220392.0330.050 | ● 3,3 | 50  | 56  | 95  | 6     | 159,00 |
|     | 220392.0330.066 | ▲ 3,3 | 66  | 72  | 110 | 6     | 176,00 |
| NEU | 220392.0330.075 | ● 3,3 | 75  | 80  | 120 | 6     | 176,00 |
|     | 220392.0330.083 | ▲ 3,3 | 83  | 89  | 130 | 6     | 185,00 |
|     | 220392.0330.099 | ▲ 3,3 | 99  | 105 | 150 | 6     | 203,00 |
| NEU | 220392.0330.105 | ● 3,3 | 105 | 110 | 150 | 6     | 203,00 |
| NEU | 220392.0330.129 | ● 3,3 | 129 | 135 | 185 | 6     | 260,00 |
| NEU | 220392.0340.023 | ● 3,4 | 23  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0340.029 | ● 3,4 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0340.048 | ● 3,4 | 48  | 54  | 92  | 6     | 149,00 |
| NEU | 220392.0350.023 | ● 3,5 | 23  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0350.029 | ● 3,5 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0350.048 | ● 3,5 | 48  | 54  | 92  | 6     | 149,00 |
| NEU | 220392.0350.053 | ● 3,5 | 53  | 59  | 100 | 6     | 159,00 |
| NEU | 220392.0350.070 | ● 3,5 | 70  | 77  | 120 | 6     | 176,00 |
|     | 220392.0350.088 | ▲ 3,5 | 88  | 94  | 140 | 6     | 203,00 |
| NEU | 220392.0350.105 | ● 3,5 | 105 | 112 | 150 | 6     | 203,00 |
| NEU | 220392.0350.129 | ● 3,5 | 129 | 135 | 185 | 6     | 260,00 |
| NEU | 220392.0360.023 | ● 3,6 | 23  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0360.029 | ● 3,6 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0360.048 | ● 3,6 | 48  | 54  | 92  | 6     | 149,00 |
| NEU | 220392.0370.023 | ● 3,7 | 23  | 28  | 66  | 6     | 76,00  |
| NEU | 220392.0370.029 | ● 3,7 | 29  | 34  | 72  | 6     | 125,00 |
| NEU | 220392.0370.048 | ● 3,7 | 48  | 54  | 92  | 6     | 149,00 |
| NEU | 220392.0380.029 | ● 3,8 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0380.036 | ● 3,8 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0380.057 | ● 3,8 | 57  | 64  | 102 | 6     | 149,00 |
| NEU | 220392.0380.069 | ● 3,8 | 69  | 75  | 115 | 6     | 165,00 |
|     | 220392.0380.076 | ▲ 3,8 | 76  | 83  | 130 | 6     | 183,00 |
| NEU | 220392.0380.084 | ● 3,8 | 84  | 90  | 130 | 6     | 183,00 |
|     | 220392.0380.095 | ▲ 3,8 | 95  | 102 | 150 | 6     | 231,00 |
| NEU | 220392.0380.114 | ● 3,8 | 114 | 120 | 160 | 6     | 231,00 |
|     | 220392.0380.129 | ● 3,8 | 129 | 135 | 185 | 6     | 260,00 |
| NEU | 220392.0390.029 | ● 3,9 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0390.036 | ● 3,9 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0390.057 | ● 3,9 | 57  | 64  | 102 | 6     | 149,00 |
| NEU | 220392.0400.029 | ● 4,0 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0400.036 | ● 4,0 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0400.057 | ● 4,0 | 57  | 64  | 102 | 6     | 150,00 |
|     | 220392.0400.060 | ▲ 4,0 | 60  | 68  | 110 | 6     | 160,00 |
| NEU | 220392.0400.069 | ● 4,0 | 69  | 75  | 115 | 6     | 166,00 |
| NEU | 220392.0400.080 | ● 4,0 | 80  | 88  | 130 | 6     | 196,00 |
|     | 220392.0400.100 | ▲ 4,0 | 100 | 108 | 150 | 6     | 220,00 |
| NEU | 220392.0400.114 | ● 4,0 | 114 | 120 | 160 | 6     | 232,00 |
|     | 220392.0400.120 | ▲ 4,0 | 120 | 128 | 170 | 6     | 250,00 |
| NEU | 220392.0400.129 | ● 4,0 | 129 | 135 | 185 | 6     | 260,00 |
|     | 220392.0400.160 | ▲ 4,0 | 160 | 168 | 210 | 6     | 289,00 |
| NEU | 220392.0410.029 | ● 4,1 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0410.036 | ● 4,1 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0410.057 | ● 4,1 | 57  | 64  | 102 | 6     | 150,00 |
| NEU | 220392.0420.029 | ● 4,2 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0420.036 | ● 4,2 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0420.057 | ● 4,2 | 57  | 64  | 102 | 6     | 150,00 |
|     | 220392.0420.063 | ▲ 4,2 | 63  | 71  | 120 | 6     | 178,00 |
| NEU | 220392.0420.069 | ● 4,2 | 69  | 75  | 115 | 6     | 178,00 |
|     | 220392.0420.084 | ▲ 4,2 | 84  | 92  | 140 | 6     | 190,00 |
| NEU | 220392.0420.103 | ● 4,2 | 103 | 110 | 160 | 6     | 197,00 |
| NEU | 220392.0420.114 | ● 4,2 | 114 | 120 | 160 | 6     | 232,00 |
| NEU | 220392.0420.126 | ● 4,2 | 126 | 134 | 185 | 6     | 260,00 |
| NEU | 220392.0430.029 | ● 4,3 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0430.036 | ● 4,3 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0430.057 | ● 4,3 | 57  | 64  | 102 | 6     | 150,00 |
| NEU | 220392.0440.029 | ● 4,4 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0440.036 | ● 4,4 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0440.057 | ● 4,4 | 57  | 64  | 102 | 6     | 150,00 |
| NEU | 220392.0450.029 | ● 4,5 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0450.036 | ● 4,5 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0450.057 | ● 4,5 | 57  | 64  | 102 | 6     | 150,00 |
|     | 220392.0450.068 | ▲ 4,5 | 68  | 76  | 120 | 6     | 170,00 |
| NEU | 220392.0450.082 | ● 4,5 | 82  | 90  | 130 | 6     | 178,00 |
|     | 220392.0450.090 | ▲ 4,5 | 90  | 99  | 140 | 6     | 190,00 |
| NEU | 220392.0450.103 | ● 4,5 | 103 | 110 | 160 | 6     | 197,00 |
|     | 220392.0450.112 | ▲ 4,5 | 112 | 121 | 165 | 6     | 230,00 |
| NEU | 220392.0450.127 | ● 4,5 | 127 | 135 | 180 | 6     | 242,00 |
|     | 220392.0450.135 | ▲ 4,5 | 135 | 144 | 185 | 6     | 270,00 |
| NEU | 220392.0450.157 | ● 4,5 | 157 | 165 | 215 | 6     | 277,00 |
| NEU | 220392.0460.029 | ● 4,6 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0460.036 | ● 4,6 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0460.057 | ● 4,6 | 57  | 64  | 102 | 6     | 150,00 |
| NEU | 220392.0470.029 | ● 4,7 | 29  | 36  | 74  | 6     | 75,00  |
| NEU | 220392.0470.036 | ● 4,7 | 36  | 43  | 80  | 6     | 125,00 |
| NEU | 220392.0470.057 | ● 4,7 | 57  | 64  | 102 | 6     | 150,00 |

|     | Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|-------|-----|-----|-----|-------|--------|
| NEU | 220392.0480.035 | ● 4,8 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0480.048 | ● 4,8 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0480.069 | ● 4,8 | 69  | 78  | 116 | 6     | 150,00 |
|     | 220392.0480.072 | ▲ 4,8 | 72  | 81  | 125 | 6     | 180,00 |
| NEU | 220392.0480.082 | ● 4,8 | 82  | 90  | 130 | 6     | 188,00 |
|     | 220392.0480.096 | ▲ 4,8 | 96  | 105 | 150 | 6     | 200,00 |
| NEU | 220392.0480.112 | ● 4,8 | 112 | 120 | 160 | 6     | 208,00 |
|     | 220392.0480.120 | ▲ 4,8 | 120 | 129 | 175 | 6     | 235,00 |
| NEU | 220392.0480.127 | ● 4,8 | 127 | 135 | 180 | 6     | 242,00 |
|     | 220392.0480.144 | ▲ 4,8 | 144 | 153 | 200 | 6     | 270,00 |
| NEU | 220392.0480.157 | ● 4,8 | 157 | 165 | 215 | 6     | 277,00 |
| NEU | 220392.0490.035 | ● 4,9 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0490.048 | ● 4,9 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0490.069 | ● 4,9 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0500.035 | ● 5,0 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0500.048 | ● 5,0 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0500.069 | ● 5,0 | 69  | 78  | 116 | 6     | 150,00 |
|     | 220392.0500.075 | ▲ 5,0 | 75  | 85  | 125 | 6     | 180,00 |
| NEU | 220392.0500.082 | ● 5,0 | 82  | 90  | 130 | 6     | 188,00 |
|     | 220392.0500.100 | ▲ 5,0 | 100 | 110 | 150 | 6     | 200,00 |
| NEU | 220392.0500.112 | ● 5,0 | 112 | 120 | 160 | 6     | 208,00 |
| NEU | 220392.0500.125 | ● 5,0 | 125 | 135 | 175 | 6     | 242,00 |
|     | 220392.0500.150 | ▲ 5,0 | 150 | 160 | 200 | 6     | 270,00 |
| NEU | 220392.0500.157 | ● 5,0 | 157 | 165 | 215 | 6     | 277,00 |
|     | 220392.0500.200 | ▲ 5,0 | 200 | 210 | 250 | 6     | 375,00 |
| NEU | 220392.0510.035 | ● 5,1 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0510.048 | ● 5,1 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0510.069 | ● 5,1 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0520.035 | ● 5,2 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0520.048 | ● 5,2 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0520.069 | ● 5,2 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0530.035 | ● 5,3 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0530.048 | ● 5,3 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0530.069 | ● 5,3 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0540.035 | ● 5,4 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0540.048 | ● 5,4 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0540.069 | ● 5,4 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0550.035 | ● 5,5 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0550.048 | ● 5,5 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0550.069 | ● 5,5 | 69  | 78  | 116 | 6     | 150,00 |
|     | 220392.0550.083 | ▲ 5,5 | 83  | 93  | 135 | 6     | 190,00 |
| NEU | 220392.0550.099 | ● 5,5 | 99  | 108 | 150 | 6     | 196,00 |
|     | 220392.0550.110 | ▲ 5,5 | 110 | 121 | 160 | 6     | 210,00 |
| NEU | 220392.0550.131 | ● 5,5 | 131 | 140 | 185 | 6     | 217,00 |
|     | 220392.0550.138 | ▲ 5,5 | 138 | 148 | 190 | 6     | 250,00 |
| NEU | 220392.0550.159 | ● 5,5 | 159 | 168 | 205 | 6     | 260,00 |
|     | 220392.0550.165 | ▲ 5,5 | 165 | 176 | 215 | 6     | 280,00 |
| NEU | 220392.0550.171 | ● 5,5 | 171 | 180 | 230 | 6     | 288,00 |
| NEU | 220392.0560.035 | ● 5,6 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0560.048 | ● 5,6 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0560.069 | ● 5,6 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0570.035 | ● 5,7 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0570.048 | ● 5,7 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0570.069 | ● 5,7 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0580.035 | ● 5,8 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0580.048 | ● 5,8 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0580.069 | ● 5,8 | 69  | 78  | 116 | 6     | 150,00 |
|     | 220392.0580.087 | ▲ 5,8 | 87  | 98  | 140 | 6     | 190,00 |
| NEU | 220392.0580.099 | ● 5,8 | 99  | 108 | 150 | 6     | 196,00 |
|     | 220392.0580.116 | ▲ 5,8 | 116 | 127 | 170 | 6     | 210,00 |
| NEU | 220392.0580.131 | ● 5,8 | 131 | 140 | 185 | 6     | 217,00 |
|     | 220392.0580.145 | ▲ 5,8 | 145 | 156 | 200 | 6     | 250,00 |
| NEU | 220392.0580.159 | ● 5,8 | 159 | 168 | 205 | 6     | 260,00 |
| NEU | 220392.0580.171 | ● 5,8 | 171 | 180 | 230 | 6     | 288,00 |
| NEU | 220392.0590.035 | ● 5,9 | 35  | 44  | 82  | 6     | 75,00  |
| NEU | 220392.0590.048 | ● 5,9 | 48  | 57  | 95  | 6     | 125,00 |
| NEU | 220392.0590.069 | ● 5,9 | 69  | 78  | 116 | 6     | 150,00 |
| NEU | 220392.0600.035 | ● 6,0 | 35  | 44  | 82  | 6     | 76,00  |
| NEU | 220392.0600.048 | ● 6,0 | 48  | 57  | 95  | 6     | 126,00 |
| NEU | 220392.0600.069 | ● 6,0 | 69  | 78  | 116 | 6     | 151,00 |
|     | 220392.0600.090 | ▲ 6,0 | 90  | 100 | 140 | 6     | 190,00 |
| NEU | 220392.0600.099 | ● 6,0 | 99  | 108 | 150 | 6     | 197,00 |
|     | 220392.0600.120 | ▲ 6,0 | 120 | 132 | 170 | 6     | 210,00 |
| NEU | 220392.0600.131 | ● 6,0 | 131 | 140 | 185 | 6     | 218,00 |
|     | 220392.0600.150 | ▲ 6,0 | 150 | 162 | 200 | 6     | 255,00 |
| NEU | 220392.0600.159 | ● 6,0 | 159 | 168 | 205 | 6     | 261,00 |
| NEU | 220392.0600.171 | ● 6,0 | 171 | 180 | 230 | 6     | 289,00 |
|     | 220392.0600.180 | ▲ 6,0 | 180 | 192 | 230 | 6     | 309,50 |
| NEU | 220392.0610.043 | ● 6,1 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0610.066 | ● 6,1 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0610.096 | ● 6,1 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0620.043 | ● 6,2 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0620.066 | ● 6,2 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0620.096 | ● 6,2 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0630.043 | ● 6,3 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0630.066 | ● 6,3 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0630.096 | ● 6,3 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0640.043 | ● 6,4 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0640.066 | ● 6,4 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0640.096 | ● 6,4 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0650.043 | ● 6,5 | 43  | 53  | 90  | 8     | 83,00  |

Art. 22.0392

ALU  
aluminium

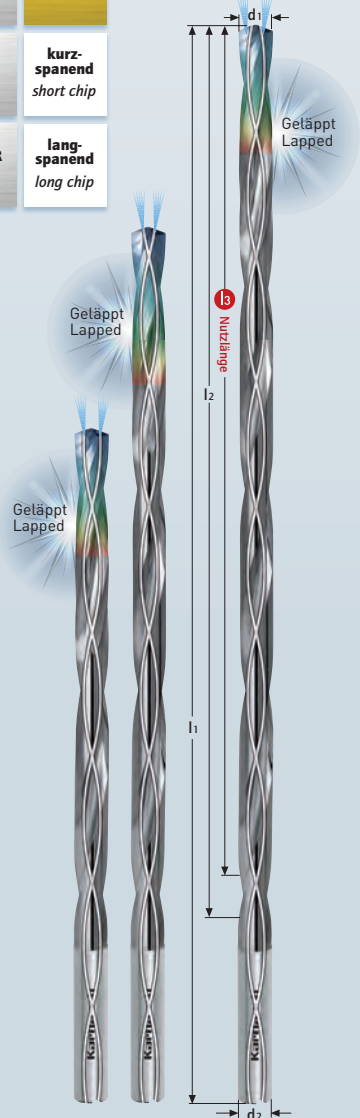
CFK-ALU  
Composite

ALU  
< 6% Si

kurz-  
spanend  
short chip

KUPFER  
copper

lang-  
spanend  
long chip



|     | Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|-------|-----|-----|-----|-------|--------|
| NEU | 220392.0650.066 | • 6,5 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0650.096 | • 6,5 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0650.114 | • 6,5 | 114 | 125 | 165 | 8     | 209,00 |
| NEU | 220392.0650.130 | ▲ 6,5 | 130 | 143 | 185 | 8     | 220,00 |
| NEU | 220392.0650.149 | • 6,5 | 149 | 160 | 210 | 8     | 232,00 |
| NEU | 220392.0650.163 | ▲ 6,5 | 163 | 175 | 215 | 8     | 280,00 |
| NEU | 220392.0650.189 | • 6,5 | 189 | 200 | 240 | 8     | 290,00 |
| NEU | 220392.0650.195 | ▲ 6,5 | 195 | 208 | 250 | 8     | 310,00 |
| NEU | 220392.0650.205 | • 6,5 | 205 | 215 | 280 | 8     | 318,00 |
| NEU | 220392.0660.043 | • 6,6 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0660.066 | • 6,6 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0660.096 | • 6,6 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0670.043 | • 6,7 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0670.066 | • 6,7 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0670.096 | • 6,7 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0680.043 | • 6,8 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0680.066 | • 6,8 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0680.096 | • 6,8 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0680.102 | ▲ 6,8 | 102 | 115 | 160 | 8     | 209,00 |
| NEU | 220392.0680.114 | • 6,8 | 114 | 125 | 165 | 8     | 209,00 |
| NEU | 220392.0680.136 | ▲ 6,8 | 136 | 149 | 195 | 8     | 240,00 |
| NEU | 220392.0680.149 | • 6,8 | 149 | 160 | 210 | 8     | 249,00 |
| NEU | 220392.0680.170 | ▲ 6,8 | 170 | 183 | 230 | 8     | 280,00 |
| NEU | 220392.0680.189 | • 6,8 | 189 | 200 | 240 | 8     | 290,00 |
| NEU | 220392.0680.204 | ▲ 6,8 | 204 | 217 | 265 | 8     | 320,00 |
| NEU | 220392.0680.219 | • 6,8 | 219 | 230 | 280 | 8     | 330,00 |

|     | Art.            | d1 h7 | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|-------|-----|-----|-----|-------|--------|
| NEU | 220392.0690.043 | • 6,9 | 43  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0690.066 | • 6,9 | 66  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0690.096 | • 6,9 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0700.041 | • 7,0 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0700.064 | • 7,0 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0700.096 | • 7,0 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0700.105 | ▲ 7,0 | 105 | 119 | 160 | 8     | 209,00 |
| NEU | 220392.0700.114 | • 7,0 | 114 | 125 | 165 | 8     | 209,00 |
| NEU | 220392.0700.140 | ▲ 7,0 | 140 | 154 | 195 | 8     | 249,00 |
| NEU | 220392.0700.149 | • 7,0 | 149 | 160 | 210 | 8     | 249,00 |
| NEU | 220392.0700.175 | ▲ 7,0 | 175 | 189 | 230 | 8     | 280,00 |
| NEU | 220392.0700.189 | • 7,0 | 189 | 200 | 240 | 8     | 290,00 |
| NEU | 220392.0700.210 | ▲ 7,0 | 210 | 224 | 265 | 8     | 330,00 |
| NEU | 220392.0700.219 | • 7,0 | 219 | 230 | 280 | 8     | 330,00 |
| NEU | 220392.0710.041 | • 7,1 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0710.064 | • 7,1 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0710.096 | • 7,1 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0720.041 | • 7,2 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0720.064 | • 7,2 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0720.096 | • 7,2 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0730.041 | • 7,3 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0730.064 | • 7,3 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0730.096 | • 7,3 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0740.041 | • 7,4 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0740.064 | • 7,4 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0740.096 | • 7,4 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0750.041 | • 7,5 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0750.064 | • 7,5 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0750.096 | • 7,5 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0750.113 | ▲ 7,5 | 113 | 128 | 165 | 8     | 240,00 |
| NEU | 220392.0750.128 | • 7,5 | 128 | 140 | 180 | 8     | 250,00 |
| NEU | 220392.0750.150 | ▲ 7,5 | 150 | 165 | 210 | 8     | 270,00 |
| NEU | 220392.0750.168 | • 7,5 | 168 | 180 | 230 | 8     | 278,00 |
| NEU | 220392.0750.188 | ▲ 7,5 | 188 | 203 | 255 | 8     | 320,00 |
| NEU | 220392.0750.208 | • 7,5 | 208 | 220 | 260 | 8     | 323,00 |
| NEU | 220392.0750.219 | • 7,5 | 219 | 230 | 280 | 8     | 330,00 |
| NEU | 220392.0750.225 | ▲ 7,5 | 225 | 240 | 280 | 8     | 354,50 |
| NEU | 220392.0760.041 | • 7,6 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0760.064 | • 7,6 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0760.096 | • 7,6 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0770.041 | • 7,7 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0770.064 | • 7,7 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0770.096 | • 7,7 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0780.041 | • 7,8 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0780.064 | • 7,8 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0780.096 | • 7,8 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0780.117 | ▲ 7,8 | 117 | 133 | 170 | 8     | 240,00 |
| NEU | 220392.0780.128 | • 7,8 | 128 | 140 | 180 | 8     | 250,00 |
| NEU | 220392.0780.156 | ▲ 7,8 | 156 | 172 | 215 | 8     | 275,00 |
| NEU | 220392.0780.168 | • 7,8 | 168 | 180 | 230 | 8     | 278,00 |
| NEU | 220392.0780.195 | ▲ 7,8 | 195 | 211 | 255 | 8     | 315,00 |
| NEU | 220392.0780.208 | • 7,8 | 208 | 220 | 260 | 8     | 323,00 |
| NEU | 220392.0780.234 | ▲ 7,8 | 234 | 250 | 315 | 8     | 360,00 |
| NEU | 220392.0780.253 | • 7,8 | 253 | 265 | 315 | 8     | 367,00 |
| NEU | 220392.0790.041 | • 7,9 | 41  | 53  | 90  | 8     | 83,00  |
| NEU | 220392.0790.064 | • 7,9 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0790.096 | • 7,9 | 96  | 108 | 146 | 8     | 206,00 |
| NEU | 220392.0800.041 | • 8,0 | 41  | 53  | 90  | 8     | 84,00  |
| NEU | 220392.0800.064 | • 8,0 | 64  | 76  | 114 | 8     | 157,00 |
| NEU | 220392.0800.096 | • 8,0 | 96  | 108 | 146 | 8     | 207,00 |
| NEU | 220392.0800.120 | ▲ 8,0 | 120 | 136 | 180 | 8     | 251,00 |
| NEU | 220392.0800.128 | • 8,0 | 128 | 140 | 180 | 8     | 251,00 |
| NEU | 220392.0800.160 | ▲ 8,0 | 160 | 176 | 215 | 8     | 279,00 |
| NEU | 220392.0800.168 | • 8,0 | 168 | 180 | 230 | 8     | 279,00 |
| NEU | 220392.0800.200 | ▲ 8,0 | 200 | 216 | 255 | 8     | 320,00 |
| NEU | 220392.0800.208 | • 8,0 | 208 | 220 | 260 | 8     | 323,00 |
| NEU | 220392.0800.240 | ▲ 8,0 | 240 | 256 | 315 | 8     | 360,00 |
| NEU | 220392.0800.253 | • 8,0 | 253 | 265 | 315 | 8     | 368,00 |
| NEU | 220392.0810.046 | • 8,1 | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0810.080 | • 8,1 | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0810.106 | • 8,1 | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0820.046 | • 8,2 | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0820.080 | • 8,2 | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0820.106 | • 8,2 | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0830.046 | • 8,3 | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0830.080 | • 8,3 | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0830.106 | • 8,3 | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0840.046 | • 8,4 | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0840.080 | • 8,4 | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0840.106 | • 8,4 | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0850.046 | • 8,5 | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0850.080 | • 8,5 | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0850.106 | • 8,5 | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0850.128 | ▲ 8,5 | 128 | 145 | 190 | 10    | 270,00 |
| NEU | 220392.0850.146 | • 8,5 | 146 | 160 | 205 | 10    | 277,00 |
| NEU | 220392.0850.170 | ▲ 8,5 | 170 | 187 | 230 | 10    | 305,00 |
| NEU | 220392.0850.182 | • 8,5 | 182 | 195 | 260 | 10    | 307,00 |
| NEU | 220392.0850.212 | ▲ 8,5 | 212 | 230 | 285 | 10    | 360,00 |
| NEU | 220392.0850.227 | • 8,5 | 227 | 240 | 285 | 10    | 362,00 |
| NEU | 220392.0850.255 | ▲ 8,5 | 255 | 272 | 315 | 10    | 415,00 |
| NEU | 220392.0850.282 | • 8,5 | 282 | 295 | 350 | 10    | 423,00 |



|     | Art.            | d1 h7  | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|--------|-----|-----|-----|-------|--------|
| NEU | 220392.0860.046 | • 8,6  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0860.080 | • 8,6  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0860.106 | • 8,6  | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0870.046 | • 8,7  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0870.080 | • 8,7  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0870.106 | • 8,7  | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0880.046 | • 8,8  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0880.080 | • 8,8  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0880.106 | • 8,8  | 106 | 120 | 162 | 10    | 261,00 |
|     | 220392.0880.132 | ▲ 8,8  | 132 | 150 | 200 | 10    | 305,00 |
| NEU | 220392.0880.146 | • 8,8  | 146 | 160 | 205 | 10    | 309,00 |
|     | 220392.0880.176 | ▲ 8,8  | 176 | 193 | 240 | 10    | 335,00 |
| NEU | 220392.0880.215 | • 8,8  | 215 | 230 | 290 | 10    | 342,00 |
|     | 220392.0880.220 | ▲ 8,8  | 220 | 238 | 310 | 10    | 390,00 |
| NEU | 220392.0880.253 | • 8,8  | 253 | 268 | 310 | 10    | 393,00 |
|     | 220392.0880.264 | ▲ 8,8  | 264 | 281 | 325 | 10    | 440,00 |
| NEU | 220392.0880.315 | • 8,8  | 315 | 330 | 380 | 10    | 448,00 |
| NEU | 220392.0890.046 | • 8,9  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0890.080 | • 8,9  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0890.106 | • 8,9  | 106 | 120 | 162 | 10    | 261,00 |
| NEU | 220392.0900.046 | • 9,0  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0900.080 | • 9,0  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0900.106 | • 9,0  | 106 | 120 | 162 | 10    | 261,00 |
|     | 220392.0900.135 | ▲ 9,0  | 135 | 153 | 200 | 10    | 305,00 |
| NEU | 220392.0900.146 | • 9,0  | 146 | 160 | 205 | 10    | 309,00 |
|     | 220392.0900.180 | ▲ 9,0  | 180 | 198 | 250 | 10    | 335,00 |
| NEU | 220392.0900.215 | • 9,0  | 215 | 230 | 290 | 10    | 342,00 |
|     | 220392.0900.225 | ▲ 9,0  | 225 | 243 | 310 | 10    | 395,00 |
| NEU | 220392.0900.253 | • 9,0  | 253 | 268 | 310 | 10    | 395,00 |
|     | 220392.0900.270 | ▲ 9,0  | 270 | 288 | 335 | 10    | 440,00 |
| NEU | 220392.0900.315 | • 9,0  | 315 | 330 | 380 | 10    | 448,00 |
| NEU | 220392.0910.046 | • 9,1  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0910.080 | • 9,1  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0910.138 | • 9,1  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0920.046 | • 9,2  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0920.080 | • 9,2  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0920.138 | • 9,2  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0930.046 | • 9,3  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0930.080 | • 9,3  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0930.138 | • 9,3  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0940.046 | • 9,4  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0940.080 | • 9,4  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0940.138 | • 9,4  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0950.046 | • 9,5  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0950.080 | • 9,5  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0950.138 | • 9,5  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0960.046 | • 9,6  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0960.080 | • 9,6  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0960.138 | • 9,6  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0970.046 | • 9,7  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0970.080 | • 9,7  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0970.138 | • 9,7  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.0980.046 | • 9,8  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0980.080 | • 9,8  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0980.138 | • 9,8  | 138 | 156 | 204 | 10    | 261,00 |
|     | 220392.0980.147 | ▲ 9,8  | 147 | 166 | 215 | 10    | 300,00 |
| NEU | 220392.0980.165 | • 9,8  | 165 | 180 | 225 | 10    | 309,00 |
|     | 220392.0980.196 | ▲ 9,8  | 196 | 215 | 265 | 10    | 335,00 |
| NEU | 220392.0980.215 | • 9,8  | 215 | 230 | 290 | 10    | 342,00 |
|     | 220392.0980.245 | ▲ 9,8  | 245 | 264 | 310 | 10    | 395,00 |
| NEU | 220392.0980.253 | • 9,8  | 253 | 268 | 310 | 10    | 395,00 |
|     | 220392.0980.294 | ▲ 9,8  | 294 | 313 | 360 | 10    | 448,00 |
| NEU | 220392.0980.315 | • 9,8  | 315 | 330 | 380 | 10    | 448,00 |
| NEU | 220392.0990.046 | • 9,9  | 46  | 61  | 103 | 10    | 97,00  |
| NEU | 220392.0990.080 | • 9,9  | 80  | 95  | 142 | 10    | 198,00 |
| NEU | 220392.0990.138 | • 9,9  | 138 | 156 | 204 | 10    | 261,00 |
| NEU | 220392.1000.046 | • 10,0 | 46  | 61  | 103 | 10    | 99,00  |
| NEU | 220392.1000.080 | • 10,0 | 80  | 95  | 142 | 10    | 200,00 |
| NEU | 220392.1000.138 | • 10,0 | 138 | 156 | 204 | 10    | 263,00 |
|     | 220392.1000.150 | ▲ 10,0 | 150 | 170 | 215 | 10    | 310,00 |
| NEU | 220392.1000.165 | • 10,0 | 165 | 180 | 225 | 10    | 312,00 |
|     | 220392.1000.200 | ▲ 10,0 | 200 | 220 | 265 | 10    | 335,00 |
| NEU | 220392.1000.215 | • 10,0 | 215 | 230 | 290 | 10    | 345,00 |
|     | 220392.1000.250 | ▲ 10,0 | 250 | 270 | 315 | 10    | 399,00 |
| NEU | 220392.1000.253 | • 10,0 | 253 | 268 | 310 | 10    | 399,00 |
|     | 220392.1000.300 | ▲ 10,0 | 300 | 320 | 365 | 10    | 445,00 |
| NEU | 220392.1000.315 | • 10,0 | 315 | 330 | 380 | 10    | 452,00 |
| NEU | 220392.1010.053 | • 10,1 | 53  | 71  | 118 | 12    | 137,00 |
| NEU | 220392.1020.053 | • 10,2 | 53  | 71  | 118 | 12    | 137,00 |
| NEU | 220392.1020.096 | • 10,2 | 96  | 114 | 162 | 12    | 255,00 |
|     | 220392.1020.138 | • 10,2 | 138 | 156 | 204 | 12    | 357,00 |
|     | 220392.1020.153 | ▲ 10,2 | 153 | 173 | 230 | 12    | 340,00 |
| NEU | 220392.1020.174 | • 10,2 | 174 | 190 | 240 | 12    | 348,00 |

|     | Art.            | d1 h7  | l3  | l2  | l1  | d2 h6 | €      |
|-----|-----------------|--------|-----|-----|-----|-------|--------|
|     | 220392.1020.204 | ▲ 10,2 | 204 | 224 | 275 | 12    | 370,00 |
| NEU | 220392.1020.250 | • 10,2 | 250 | 268 | 315 | 12    | 380,00 |
|     | 220392.1020.255 | ▲ 10,2 | 255 | 275 | 325 | 12    | 380,00 |
| NEU | 220392.1020.306 | • 10,2 | 306 | 326 | 375 | 12    | 570,00 |
| NEU | 220392.1020.362 | • 10,2 | 362 | 380 | 430 | 12    | 576,00 |
| NEU | 220392.1030.053 | • 10,3 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1040.053 | • 10,4 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1050.053 | • 10,5 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1050.096 | • 10,5 | 96  | 114 | 162 | 12    | 253,00 |
| NEU | 220392.1050.138 | • 10,5 | 138 | 156 | 204 | 12    | 355,00 |
| NEU | 220392.1080.053 | • 10,8 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1080.096 | • 10,8 | 96  | 114 | 162 | 12    | 253,00 |
| NEU | 220392.1080.138 | • 10,8 | 138 | 156 | 204 | 12    | 355,00 |
|     | 220392.1080.162 | ▲ 10,8 | 162 | 183 | 230 | 12    | 340,00 |
| NEU | 220392.1080.174 | • 10,8 | 174 | 190 | 240 | 12    | 346,00 |
|     | 220392.1080.216 | ▲ 10,8 | 216 | 237 | 290 | 12    | 370,00 |
| NEU | 220392.1080.250 | • 10,8 | 250 | 268 | 315 | 12    | 379,00 |
|     | 220392.1080.270 | ▲ 10,8 | 270 | 291 | 340 | 12    | 470,00 |
| NEU | 220392.1080.307 | • 10,8 | 307 | 325 | 375 | 12    | 476,00 |
|     | 220392.1080.324 | ▲ 10,8 | 324 | 345 | 395 | 12    | 570,00 |
| NEU | 220392.1080.362 | • 10,8 | 362 | 380 | 430 | 12    | 576,00 |
| NEU | 220392.1100.053 | • 11,0 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1100.096 | • 11,0 | 96  | 114 | 162 | 12    | 253,00 |
| NEU | 220392.1100.138 | • 11,0 | 138 | 156 | 204 | 12    | 355,00 |
| NEU | 220392.1100.362 | • 11,0 | 362 | 380 | 430 | 12    | 576,00 |
| NEU | 220392.1110.053 | • 11,1 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1120.053 | • 11,2 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1120.096 | • 11,2 | 96  | 114 | 162 | 12    | 253,00 |
| NEU | 220392.1120.138 | • 11,2 | 138 | 156 | 204 | 12    | 355,00 |
| NEU | 220392.1130.053 | • 11,3 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1150.053 | • 11,5 | 53  | 71  | 118 | 12    | 135,00 |
| NEU | 220392.1150.096 | • 11,5 | 96  | 114 | 162 | 12    | 253,00 |
| NEU | 220392.1150.138 | • 11,5 | 138 | 156 | 204 | 12    | 355,00 |
| NEU | 220392.1180.053 | • 11,8 | 53  | 71  | 118 | 12    | 134,00 |
| NEU | 220392.1180.096 | • 11,8 | 96  | 114 | 162 | 12    | 252,00 |
| NEU | 220392.1180.138 | • 11,8 | 138 | 156 | 204 | 12    | 355,00 |
|     | 220392.1180.177 | ▲ 11,8 | 177 | 200 | 255 | 12    | 340,00 |
| NEU | 220392.1180.197 | • 11,8 | 197 | 215 | 265 | 12    | 346,00 |
|     | 220392.1180.236 | ▲ 11,8 | 236 | 259 | 315 | 12    | 375,00 |
| NEU | 220392.1180.250 | • 11,8 | 250 | 268 | 315 | 12    | 380,00 |
|     | 220392.1180.295 | ▲ 11,8 | 295 | 318 | 375 | 12    | 478,00 |
| NEU | 220392.1180.307 | • 11,8 | 307 | 325 | 375 | 12    | 478,00 |
|     | 220392.1180.354 | ▲ 11,8 | 354 | 377 | 425 | 12    | 570,00 |
| NEU | 220392.1180.362 | • 11,8 | 362 | 380 | 430 | 12    | 576,00 |
| NEU | 220392.1200.053 | • 12,0 | 53  | 71  | 118 | 12    | 138,00 |
| NEU | 220392.1200.096 | • 12,0 | 96  | 114 | 162 | 12    | 256,00 |
| NEU | 220392.1200.138 | • 12,0 | 138 | 156 | 204 | 12    | 359,00 |
|     | 220392.1200.180 | ▲ 12,0 | 180 | 204 | 255 | 12    | 350,00 |
| NEU | 220392.1200.197 | • 12,0 | 197 | 215 | 265 | 12    | 350,00 |
|     | 220392.1200.240 | ▲ 12,0 | 240 | 264 | 315 | 12    | 385,00 |
| NEU | 220392.1200.250 | • 12,0 | 250 | 268 | 315 | 12    | 385,00 |
|     | 220392.1200.300 | ▲ 12,0 | 300 | 324 | 375 | 12    | 483,00 |
| NEU | 220392.1200.307 | • 12,0 | 307 | 325 | 375 | 12    | 483,00 |
| NEU | 220392.1200.360 | • 12,0 | 360 | 380 | 430 | 12    | 615,00 |

Andere Abmessungen auf Anfrage, Mindestmenge 5 Stück

**Einsatzempfehlung:** Wir empfehlen über 12 x D Bohrtiefe eine Pilotbohrung mit 22.0391.

**Application recommendation:** We recommend over 12xD drilling depth a pilot drilling 22.0391.

Art. 22.0402 Vollhartmetall-Hochleistungsbohrer

- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



- Solid carbide high performance twist drill
- Taladro de gran potencia de metal duro y macizo
- Высокопроизводительное сверло сквозной заковки

MICRO  
GRAIN

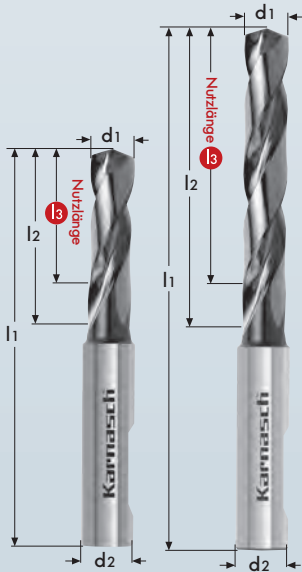
DIN  
6537

N

DIN 6535  
Form HE

DVC-X2

Schnittdaten  
Cutting data



| Art.            | d1 m7 | l3 | l2 | l1 | d2 h6 | €     |
|-----------------|-------|----|----|----|-------|-------|
| 220402.0300.014 | • 3,0 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0300.023 | • 3,0 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0310.014 | • 3,1 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0310.023 | • 3,1 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0320.014 | • 3,2 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0320.023 | • 3,2 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0330.014 | • 3,3 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0330.023 | • 3,3 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0340.014 | • 3,4 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0340.023 | • 3,4 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0350.014 | • 3,5 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0350.023 | • 3,5 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0360.014 | • 3,6 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0360.023 | • 3,6 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0370.014 | • 3,7 | 14 | 20 | 62 | 6,0   | 36,00 |
| 220402.0370.023 | • 3,7 | 23 | 28 | 66 | 6,0   | 45,00 |
| 220402.0380.017 | • 3,8 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0380.029 | • 3,8 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0390.017 | • 3,9 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0390.029 | • 3,9 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0400.017 | • 4,0 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0400.029 | • 4,0 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0410.017 | • 4,1 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0410.029 | • 4,1 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0420.017 | • 4,2 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0420.029 | • 4,2 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0430.017 | • 4,3 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0430.029 | • 4,3 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0440.017 | • 4,4 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0440.029 | • 4,4 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0450.017 | • 4,5 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0450.029 | • 4,5 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0460.017 | • 4,6 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0460.029 | • 4,6 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0470.017 | • 4,7 | 17 | 24 | 66 | 6,0   | 36,00 |
| 220402.0470.029 | • 4,7 | 29 | 36 | 74 | 6,0   | 45,00 |
| 220402.0480.020 | • 4,8 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0480.035 | • 4,8 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0490.020 | • 4,9 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0490.035 | • 4,9 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0500.020 | • 5,0 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0500.035 | • 5,0 | 35 | 44 | 82 | 6,0   | 45,00 |

| Art.            | d1 m7 | l3 | l2 | l1 | d2 h6 | €     |
|-----------------|-------|----|----|----|-------|-------|
| 220402.0510.020 | • 5,1 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0510.035 | • 5,1 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0520.020 | • 5,2 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0520.035 | • 5,2 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0530.020 | • 5,3 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0530.035 | • 5,3 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0540.020 | • 5,4 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0540.035 | • 5,4 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0550.020 | • 5,5 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0550.035 | • 5,5 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0560.020 | • 5,6 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0560.035 | • 5,6 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0570.020 | • 5,7 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0570.035 | • 5,7 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0580.020 | • 5,8 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0580.035 | • 5,8 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0590.020 | • 5,9 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0590.035 | • 5,9 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0600.020 | • 6,0 | 20 | 28 | 66 | 6,0   | 36,00 |
| 220402.0600.035 | • 6,0 | 35 | 44 | 82 | 6,0   | 45,00 |
| 220402.0610.024 | • 6,1 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0610.043 | • 6,1 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0620.024 | • 6,2 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0620.043 | • 6,2 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0630.024 | • 6,3 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0630.043 | • 6,3 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0640.024 | • 6,4 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0640.043 | • 6,4 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0650.024 | • 6,5 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0650.043 | • 6,5 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0660.024 | • 6,6 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0660.043 | • 6,6 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0670.024 | • 6,7 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0670.043 | • 6,7 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0680.024 | • 6,8 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0680.043 | • 6,8 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0690.024 | • 6,9 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0690.043 | • 6,9 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0700.024 | • 7,0 | 24 | 34 | 79 | 8,0   | 44,00 |
| 220402.0700.043 | • 7,0 | 43 | 53 | 91 | 8,0   | 49,50 |
| 220402.0710.029 | • 7,1 | 29 | 41 | 79 | 8,0   | 44,00 |
| 220402.0710.043 | • 7,1 | 43 | 53 | 91 | 8,0   | 49,50 |



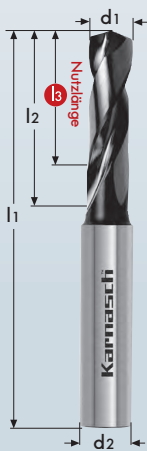
| Art.            | d1 m7  | l3 | l2 | l1  | d2 h6 | €     |
|-----------------|--------|----|----|-----|-------|-------|
| 220402.0720.029 | • 7,2  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0720.043 | • 7,2  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0730.029 | • 7,3  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0730.043 | • 7,3  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0740.029 | • 7,4  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0740.043 | • 7,4  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0750.029 | • 7,5  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0750.043 | • 7,5  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0760.029 | • 7,6  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0760.043 | • 7,6  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0770.029 | • 7,7  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0770.043 | • 7,7  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0780.029 | • 7,8  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0780.043 | • 7,8  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0790.029 | • 7,9  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0790.043 | • 7,9  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0800.029 | • 8,0  | 29 | 41 | 79  | 8,0   | 44,00 |
| 220402.0800.043 | • 8,0  | 43 | 53 | 91  | 8,0   | 49,50 |
| 220402.0810.035 | • 8,1  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0810.049 | • 8,1  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0820.035 | • 8,2  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0820.049 | • 8,2  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0830.035 | • 8,3  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0830.049 | • 8,3  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0840.035 | • 8,4  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0840.049 | • 8,4  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0850.035 | • 8,5  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0850.049 | • 8,5  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0860.035 | • 8,6  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0860.049 | • 8,6  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0870.035 | • 8,7  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0870.049 | • 8,7  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0880.035 | • 8,8  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0880.049 | • 8,8  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0890.035 | • 8,9  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0890.049 | • 8,9  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0900.035 | • 9,0  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0900.049 | • 9,0  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0910.035 | • 9,1  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0910.049 | • 9,1  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0920.035 | • 9,2  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0920.049 | • 9,2  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0930.035 | • 9,3  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0930.049 | • 9,3  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0940.035 | • 9,4  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0940.049 | • 9,4  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0950.035 | • 9,5  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0950.049 | • 9,5  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0960.035 | • 9,6  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0960.049 | • 9,6  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0970.035 | • 9,7  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0970.049 | • 9,7  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0980.035 | • 9,8  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0980.049 | • 9,8  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.0990.035 | • 9,9  | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.0990.049 | • 9,9  | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.1000.035 | • 10,0 | 35 | 47 | 89  | 10,0  | 49,00 |
| 220402.1000.049 | • 10,0 | 49 | 61 | 103 | 10,0  | 56,50 |
| 220402.1010.040 | • 10,1 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1010.056 | • 10,1 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1020.040 | • 10,2 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1020.056 | • 10,2 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1030.040 | • 10,3 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1030.056 | • 10,3 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1040.040 | • 10,4 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1040.056 | • 10,4 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1050.040 | • 10,5 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1050.056 | • 10,5 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1060.040 | • 10,6 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1060.056 | • 10,6 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1070.040 | • 10,7 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1070.056 | • 10,7 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1080.040 | • 10,8 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1080.056 | • 10,8 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1090.040 | • 10,9 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1090.056 | • 10,9 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1100.040 | • 11,0 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1100.056 | • 11,0 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1110.040 | • 11,1 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1110.056 | • 11,1 | 56 | 71 | 118 | 12,0  | 82,50 |
| 220402.1120.040 | • 11,2 | 40 | 55 | 102 | 12,0  | 74,00 |
| 220402.1120.056 | • 11,2 | 56 | 71 | 118 | 12,0  | 82,50 |

| Art.            | d1 m7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220402.1130.040 | • 11,3 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1130.056 | • 11,3 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1140.040 | • 11,4 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1140.056 | • 11,4 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1150.040 | • 11,5 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1150.056 | • 11,5 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1160.040 | • 11,6 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1160.056 | • 11,6 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1170.040 | • 11,7 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1170.056 | • 11,7 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1180.040 | • 11,8 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1180.056 | • 11,8 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1190.040 | • 11,9 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1190.056 | • 11,9 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1200.040 | • 12,0 | 40 | 55 | 102 | 12,0  | 74,00  |
| 220402.1200.056 | • 12,0 | 56 | 71 | 118 | 12,0  | 82,50  |
| 220402.1250.043 | • 12,5 | 43 | 60 | 107 | 14,0  | 97,00  |
| 220402.1250.060 | • 12,5 | 60 | 77 | 124 | 14,0  | 108,00 |
| 220402.1280.043 | • 12,8 | 43 | 60 | 107 | 14,0  | 97,00  |
| 220402.1280.060 | • 12,8 | 60 | 77 | 124 | 14,0  | 108,00 |
| 220402.1300.043 | • 13,0 | 43 | 60 | 107 | 14,0  | 97,00  |
| 220402.1300.060 | • 13,0 | 60 | 60 | 124 | 14,0  | 108,00 |
| 220402.1350.043 | • 13,5 | 43 | 60 | 107 | 14,0  | 97,00  |
| 220402.1350.060 | • 13,5 | 60 | 77 | 124 | 14,0  | 108,00 |
| 220402.1380.043 | • 13,8 | 43 | 60 | 107 | 14,0  | 97,00  |
| 220402.1380.060 | • 13,8 | 60 | 77 | 124 | 14,0  | 108,00 |
| 220402.1400.043 | • 14,0 | 43 | 60 | 107 | 14,0  | 97,00  |
| 220402.1400.060 | • 14,0 | 60 | 77 | 124 | 14,0  | 108,00 |
| 220402.1450.045 | • 14,5 | 45 | 65 | 115 | 16,0  | 123,00 |
| 220402.1450.063 | • 14,5 | 63 | 83 | 133 | 16,0  | 143,50 |
| 220402.1480.045 | • 14,8 | 45 | 65 | 115 | 16,0  | 123,00 |
| 220402.1480.063 | • 14,8 | 63 | 83 | 133 | 16,0  | 143,50 |
| 220402.1500.045 | • 15,0 | 45 | 65 | 115 | 16,0  | 123,00 |
| 220402.1500.063 | • 15,0 | 63 | 83 | 133 | 16,0  | 143,50 |
| 220402.1550.045 | • 15,5 | 45 | 65 | 115 | 16,0  | 123,00 |
| 220402.1550.063 | • 15,5 | 63 | 83 | 133 | 16,0  | 143,50 |
| 220402.1580.045 | • 15,8 | 45 | 65 | 115 | 16,0  | 123,00 |
| 220402.1580.063 | • 15,8 | 63 | 83 | 133 | 16,0  | 143,50 |
| 220402.1600.045 | • 16,0 | 45 | 65 | 115 | 16,0  | 123,00 |
| 220402.1600.063 | • 16,0 | 63 | 83 | 133 | 16,0  | 143,50 |
| 220402.1780.051 | ▲ 17,8 | 51 | 73 | 123 | 18,0  | 178,50 |
| 220402.1880.055 | ▲ 18,8 | 55 | 79 | 131 | 20,0  | 222,00 |
| 220402.1980.055 | ▲ 19,8 | 55 | 79 | 131 | 20,0  | 222,00 |

△ Nachfolgewerkzeug 22.0405

Art. 22.0403 Vollhartmetall-Hochleistungsbohrer / für Bohrung H7 / 2 Fasen

- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



- Solid carbide twist drill / for drill hole tolerances H7 / 2 chamfer
- Taladro de gran potencia de metal duro y macizo/ para taladrar H7 / 2 fases
- Высокопроизводительное сверло сквозной закалки для отверстия H7 / 2 фазы

| H7   | Bohrungstoleranz<br>Hole tolerance |       |           |  |
|------|------------------------------------|-------|-----------|--|
| 3-6  | -0/+0,012                          | 10-18 | -0/+0,018 |  |
| 6-10 | -0/+0,015                          | 18-30 | -0/+0,021 |  |

| Art.            | d1 H7  | l3 | l2 | l1  | d2 h6 | €     |
|-----------------|--------|----|----|-----|-------|-------|
| 220403.0300.014 | • 3,0  | 14 | 20 | 62  | 6,0   | 34,50 |
| 220403.0400.017 | • 4,0  | 17 | 24 | 66  | 6,0   | 34,50 |
| 220403.0500.020 | • 5,0  | 20 | 28 | 66  | 6,0   | 34,50 |
| 220403.0600.020 | • 6,0  | 20 | 28 | 66  | 6,0   | 34,50 |
| 220403.0700.024 | • 7,0  | 24 | 34 | 79  | 8,0   | 40,00 |
| 220403.0800.029 | • 8,0  | 29 | 41 | 79  | 8,0   | 40,00 |
| 220403.0900.035 | • 9,0  | 35 | 47 | 89  | 10,0  | 44,50 |
| 220403.1000.035 | • 10,0 | 35 | 47 | 89  | 10,0  | 44,50 |
| 220403.1200.040 | • 12,0 | 40 | 55 | 102 | 12,0  | 69,50 |

MICRO  
GRAIN

DIN  
6537

N

DIN 6535  
Form HA

HSC  
HPC

XFN-2  
NANO

Schnittdaten  
Cutting data



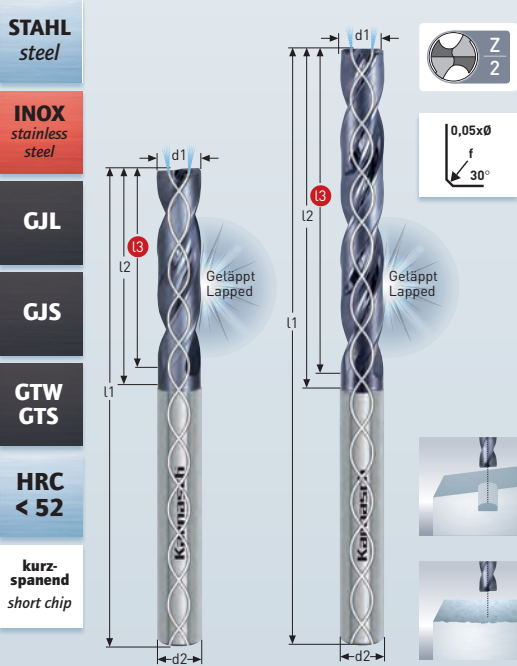
i S. 318

Art. 22.0403

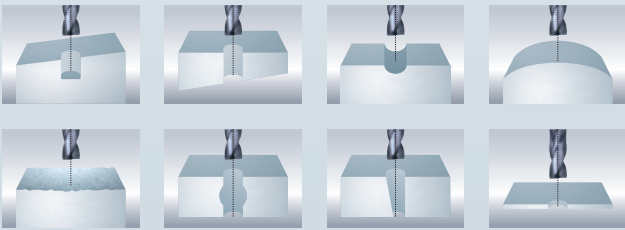
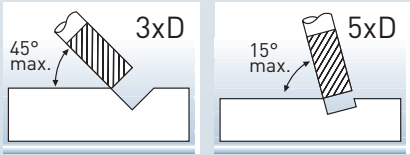


Vollhartmetall-Hochleistungsflachkopfbohrer für Stahl, 180°

Art. 22.0404



- Solid carbide shallow drill 180° for steel
- Taladro de gran potencia de metal duro y macizo, 180°
- Высокопроизводительное сверло сквозной заковки, 180°



MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HAK

30°

180°

HSC HPC

DMC-X2

Schnittdaten  
Cutting data



| Art.            | d1 h7  | l3 | l2 | l1 | d2 h6 | €     |
|-----------------|--------|----|----|----|-------|-------|
| 220404.0300.014 | • 3,00 | 14 | 20 | 62 | 6,0   | 81,00 |
| 220404.0300.023 | • 3,00 | 23 | 28 | 66 | 6,0   | 97,00 |
| 220404.0320.014 | • 3,20 | 14 | 20 | 62 | 6,0   | 81,00 |
| 220404.0320.023 | • 3,20 | 23 | 28 | 66 | 6,0   | 97,00 |
| 220404.0330.014 | • 3,30 | 14 | 20 | 62 | 6,0   | 81,00 |
| 220404.0330.023 | • 3,30 | 23 | 28 | 66 | 6,0   | 97,00 |
| 220404.0340.014 | • 3,40 | 14 | 20 | 62 | 6,0   | 81,00 |
| 220404.0340.023 | • 3,40 | 23 | 28 | 66 | 6,0   | 97,00 |
| 220404.0350.014 | • 3,50 | 14 | 20 | 62 | 6,0   | 81,00 |
| 220404.0350.023 | • 3,50 | 23 | 28 | 66 | 6,0   | 97,00 |
| 220404.0370.017 | • 3,70 | 17 | 20 | 62 | 6,0   | 81,00 |
| 220404.0370.023 | • 3,70 | 23 | 28 | 66 | 6,0   | 97,00 |
| 220404.0380.017 | • 3,80 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0380.029 | • 3,80 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0390.017 | • 3,90 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0390.029 | • 3,90 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0400.017 | • 4,00 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0400.029 | • 4,00 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0420.017 | • 4,20 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0420.029 | • 4,20 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0430.017 | • 4,30 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0430.029 | • 4,30 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0450.017 | • 4,50 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0450.029 | • 4,50 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0465.017 | • 4,65 | 17 | 24 | 66 | 6,0   | 81,00 |
| 220404.0465.029 | • 4,65 | 29 | 36 | 74 | 6,0   | 97,00 |
| 220404.0480.020 | • 4,80 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0480.035 | • 4,80 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0500.020 | • 5,00 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0500.035 | • 5,00 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0510.020 | • 5,10 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0510.035 | • 5,10 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0520.020 | • 5,20 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0520.035 | • 5,20 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0530.020 | • 5,30 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0530.035 | • 5,30 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0540.020 | • 5,40 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0540.035 | • 5,40 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0550.020 | • 5,50 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0550.035 | • 5,50 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0555.020 | • 5,55 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0555.035 | • 5,55 | 35 | 44 | 82 | 6,0   | 97,00 |
| 220404.0560.020 | • 5,60 | 20 | 28 | 66 | 6,0   | 81,00 |
| 220404.0560.035 | • 5,60 | 35 | 44 | 82 | 6,0   | 97,00 |

| Art.            | d1 h7  | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 220404.0570.020 | • 5,70 | 20 | 28 | 66 | 6,0   | 81,00  |
| 220404.0570.035 | • 5,70 | 35 | 44 | 82 | 6,0   | 97,00  |
| 220404.0580.020 | • 5,80 | 20 | 28 | 66 | 6,0   | 81,00  |
| 220404.0580.035 | • 5,80 | 35 | 44 | 82 | 6,0   | 97,00  |
| 220404.0600.020 | • 6,00 | 20 | 28 | 66 | 6,0   | 81,00  |
| 220404.0600.035 | • 6,00 | 35 | 44 | 82 | 6,0   | 97,00  |
| 220404.0610.024 | • 6,10 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0610.043 | • 6,10 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0620.024 | • 6,20 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0620.043 | • 6,20 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0630.024 | • 6,30 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0630.043 | • 6,30 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0640.024 | • 6,40 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0640.043 | • 6,40 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0650.024 | • 6,50 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0650.043 | • 6,50 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0660.024 | • 6,60 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0660.043 | • 6,60 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0670.024 | • 6,70 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0670.043 | • 6,70 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0680.024 | • 6,80 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0680.043 | • 6,80 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0690.024 | • 6,90 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0690.043 | • 6,90 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0700.024 | • 7,00 | 24 | 34 | 79 | 8,0   | 99,00  |
| 220404.0700.043 | • 7,00 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0710.029 | • 7,10 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0710.043 | • 7,10 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0720.029 | • 7,20 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0720.043 | • 7,20 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0730.029 | • 7,30 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0730.043 | • 7,30 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0740.029 | • 7,40 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0740.043 | • 7,40 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0750.029 | • 7,50 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0750.043 | • 7,50 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0760.029 | • 7,60 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0760.043 | • 7,60 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0780.029 | • 7,80 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0780.043 | • 7,80 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0790.029 | • 7,90 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0790.043 | • 7,90 | 43 | 53 | 91 | 8,0   | 108,00 |
| 220404.0800.029 | • 8,00 | 29 | 41 | 79 | 8,0   | 99,00  |
| 220404.0800.043 | • 8,00 | 43 | 53 | 91 | 8,0   | 108,00 |

Art. 22.0404

| Art.            | d1 h7   | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|---------|----|----|-----|-------|--------|
| 220404.0810.035 | • 8,10  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0810.049 | • 8,10  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0820.035 | • 8,20  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0820.049 | • 8,20  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0830.035 | • 8,30  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0830.049 | • 8,30  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0840.035 | • 8,40  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0840.049 | • 8,40  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0850.035 | • 8,50  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0850.049 | • 8,50  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0860.035 | • 8,60  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0860.049 | • 8,60  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0870.035 | • 8,70  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0870.049 | • 8,70  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0880.035 | • 8,80  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0880.049 | • 8,80  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0890.035 | • 8,90  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0890.049 | • 8,90  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0900.035 | • 9,00  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0900.049 | • 9,00  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0910.035 | • 9,10  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0910.049 | • 9,10  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0920.035 | • 9,20  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0920.049 | • 9,20  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0930.035 | • 9,30  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0930.049 | • 9,30  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0950.035 | • 9,50  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0950.049 | • 9,50  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0960.035 | • 9,60  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0960.049 | • 9,60  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0970.035 | • 9,70  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0970.049 | • 9,70  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.0980.035 | • 9,80  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.0980.049 | • 9,80  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.1000.035 | • 10,00 | 35 | 47 | 89  | 10,0  | 135,00 |
| 220404.1000.049 | • 10,00 | 49 | 61 | 103 | 10,0  | 155,00 |
| 220404.1010.040 | • 10,10 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1010.056 | • 10,10 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1020.040 | • 10,20 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1020.056 | • 10,20 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1030.040 | • 10,30 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1030.056 | • 10,30 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1050.040 | • 10,50 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1050.056 | • 10,50 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1060.040 | • 10,60 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1060.056 | • 10,60 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1070.040 | • 10,70 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1070.056 | • 10,70 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1080.040 | • 10,80 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1080.056 | • 10,80 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1090.040 | • 10,90 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1090.056 | • 10,90 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1100.040 | • 11,00 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1100.056 | • 11,00 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1120.040 | • 11,20 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1120.056 | • 11,20 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1150.040 | • 11,50 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1150.056 | • 11,50 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1180.040 | • 11,80 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1180.056 | • 11,80 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220404.1200.040 | • 12,00 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220404.1200.056 | • 12,00 | 56 | 69 | 116 | 12,0  | 216,00 |





Vollhartmetall-Hochleistungsbohrer, DIN 6535 HEK

Art. 22.0405

- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



- Solid carbide high performance twist drill, DIN 6535 HEK
- Taladro de gran potencia de metal duro y macizo, DIN 6535 HEK
- Высокопроизводительное сверло сквозной закали, DIN 6535 HEK

MICRO  
GRAIN

DIN  
6537

N

DIN 6535  
Form HEK



HSC  
HPC



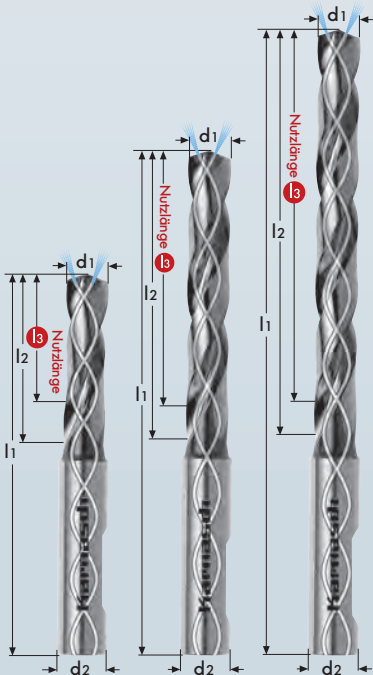
DVC-X2



Schnittdaten  
Cutting data



i S. 318

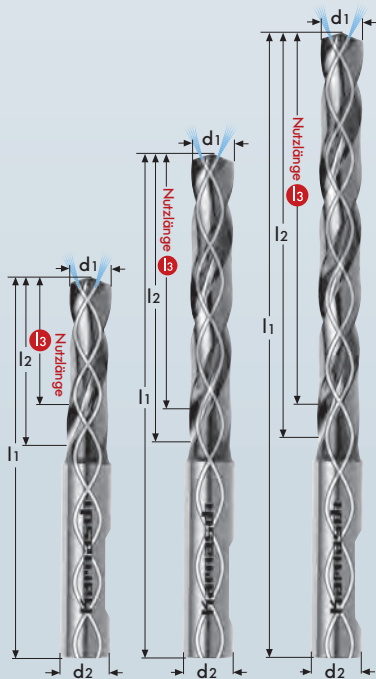


| Art.            | d1 m7 | l3 | l2 | l1 | d2 h6 | €     |
|-----------------|-------|----|----|----|-------|-------|
| 220405.0300.014 | • 3,0 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0300.023 | • 3,0 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0300.029 | • 3,0 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0310.014 | • 3,1 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0310.023 | • 3,1 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0310.029 | • 3,1 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0320.014 | • 3,2 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0320.023 | • 3,2 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0320.029 | • 3,2 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0330.014 | • 3,3 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0330.023 | • 3,3 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0330.029 | • 3,3 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0340.014 | • 3,4 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0340.023 | • 3,4 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0340.029 | • 3,4 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0350.014 | • 3,5 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0350.023 | • 3,5 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0350.029 | • 3,5 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0360.014 | • 3,6 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0360.023 | • 3,6 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0360.029 | • 3,6 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0370.014 | • 3,7 | 14 | 20 | 62 | 6,0   | 67,00 |
| 220405.0370.023 | • 3,7 | 23 | 28 | 66 | 6,0   | 70,00 |
| 220405.0370.029 | • 3,7 | 29 | 34 | 72 | 6,0   | 94,00 |
| 220405.0380.017 | • 3,8 | 17 | 24 | 66 | 6,0   | 67,00 |
| 220405.0380.029 | • 3,8 | 29 | 36 | 74 | 6,0   | 70,00 |
| 220405.0380.036 | • 3,8 | 36 | 43 | 81 | 6,0   | 99,00 |
| 220405.0390.017 | • 3,9 | 17 | 24 | 66 | 6,0   | 67,00 |
| 220405.0390.029 | • 3,9 | 29 | 36 | 74 | 6,0   | 70,00 |
| 220405.0390.036 | • 3,9 | 36 | 43 | 81 | 6,0   | 99,00 |
| 220405.0400.017 | • 4,0 | 17 | 24 | 66 | 6,0   | 67,00 |
| 220405.0400.029 | • 4,0 | 29 | 36 | 74 | 6,0   | 70,00 |
| 220405.0400.036 | • 4,0 | 36 | 43 | 81 | 6,0   | 99,00 |
| 220405.0410.017 | • 4,1 | 17 | 24 | 66 | 6,0   | 67,00 |
| 220405.0410.029 | • 4,1 | 29 | 36 | 74 | 6,0   | 70,00 |
| 220405.0410.036 | • 4,1 | 36 | 43 | 81 | 6,0   | 99,00 |

| Art.            | d1 m7 | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|-------|----|----|----|-------|--------|
| 220405.0420.017 | • 4,2 | 17 | 24 | 66 | 6,0   | 67,00  |
| 220405.0420.029 | • 4,2 | 29 | 36 | 74 | 6,0   | 70,00  |
| 220405.0420.036 | • 4,2 | 36 | 43 | 81 | 6,0   | 99,00  |
| 220405.0430.017 | • 4,3 | 17 | 24 | 66 | 6,0   | 67,00  |
| 220405.0430.029 | • 4,3 | 29 | 36 | 74 | 6,0   | 70,00  |
| 220405.0430.036 | • 4,3 | 36 | 43 | 81 | 6,0   | 99,00  |
| 220405.0440.017 | • 4,4 | 17 | 24 | 66 | 6,0   | 67,00  |
| 220405.0440.029 | • 4,4 | 29 | 36 | 74 | 6,0   | 70,00  |
| 220405.0440.036 | • 4,4 | 36 | 43 | 81 | 6,0   | 99,00  |
| 220405.0450.017 | • 4,5 | 17 | 24 | 66 | 6,0   | 67,00  |
| 220405.0450.029 | • 4,5 | 29 | 36 | 74 | 6,0   | 70,00  |
| 220405.0450.036 | • 4,5 | 36 | 43 | 81 | 6,0   | 99,00  |
| 220405.0460.017 | • 4,6 | 17 | 24 | 66 | 6,0   | 67,00  |
| 220405.0460.029 | • 4,6 | 29 | 36 | 74 | 6,0   | 70,00  |
| 220405.0460.036 | • 4,6 | 36 | 43 | 81 | 6,0   | 99,00  |
| 220405.0470.017 | • 4,7 | 17 | 24 | 66 | 6,0   | 67,00  |
| 220405.0470.029 | • 4,7 | 29 | 36 | 74 | 6,0   | 70,00  |
| 220405.0470.036 | • 4,7 | 36 | 43 | 81 | 6,0   | 99,00  |
| 220405.0480.020 | • 4,8 | 20 | 28 | 66 | 6,0   | 67,00  |
| 220405.0480.035 | • 4,8 | 35 | 44 | 82 | 6,0   | 70,00  |
| 220405.0480.048 | • 4,8 | 48 | 57 | 95 | 6,0   | 107,00 |
| 220405.0490.020 | • 4,9 | 20 | 28 | 66 | 6,0   | 67,00  |
| 220405.0490.035 | • 4,9 | 35 | 44 | 82 | 6,0   | 70,00  |
| 220405.0490.048 | • 4,9 | 48 | 57 | 95 | 6,0   | 107,00 |
| 220405.0500.020 | • 5,0 | 20 | 28 | 66 | 6,0   | 67,00  |
| 220405.0500.035 | • 5,0 | 35 | 44 | 82 | 6,0   | 70,00  |
| 220405.0500.048 | • 5,0 | 48 | 57 | 95 | 6,0   | 107,00 |
| 220405.0510.020 | • 5,1 | 20 | 28 | 66 | 6,0   | 67,00  |
| 220405.0510.035 | • 5,1 | 35 | 44 | 82 | 6,0   | 70,00  |
| 220405.0510.048 | • 5,1 | 48 | 57 | 95 | 6,0   | 107,00 |
| 220405.0520.020 | • 5,2 | 20 | 28 | 66 | 6,0   | 67,00  |
| 220405.0520.035 | • 5,2 | 35 | 44 | 82 | 6,0   | 70,00  |
| 220405.0520.048 | • 5,2 | 48 | 57 | 95 | 6,0   | 107,00 |
| 220405.0530.020 | • 5,3 | 20 | 28 | 66 | 6,0   | 67,00  |
| 220405.0530.035 | • 5,3 | 35 | 44 | 82 | 6,0   | 70,00  |
| 220405.0530.048 | • 5,3 | 48 | 57 | 95 | 6,0   | 107,00 |

Art. 22.0405

- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



| Art.            | d1 m7 | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|-------|----|----|-----|-------|--------|
| 220405.0540.020 | • 5,4 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0540.035 | • 5,4 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0540.048 | • 5,4 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0550.020 | • 5,5 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0550.035 | • 5,5 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0550.048 | • 5,5 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0560.020 | • 5,6 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0560.035 | • 5,6 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0560.048 | • 5,6 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0570.020 | • 5,7 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0570.035 | • 5,7 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0570.048 | • 5,7 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0580.020 | • 5,8 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0580.035 | • 5,8 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0580.048 | • 5,8 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0590.020 | • 5,9 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0590.035 | • 5,9 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0590.048 | • 5,9 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0600.020 | • 6,0 | 20 | 28 | 66  | 6,0   | 67,00  |
| 220405.0600.035 | • 6,0 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220405.0600.048 | • 6,0 | 48 | 57 | 95  | 6,0   | 107,00 |
| 220405.0610.024 | • 6,1 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0610.043 | • 6,1 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0610.064 | • 6,1 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0620.024 | • 6,2 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0620.043 | • 6,2 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0620.064 | • 6,2 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0630.024 | • 6,3 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0630.043 | • 6,3 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0630.064 | • 6,3 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0640.024 | • 6,4 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0640.043 | • 6,4 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0640.064 | • 6,4 | 64 | 76 | 114 | 8,0   | 141,00 |

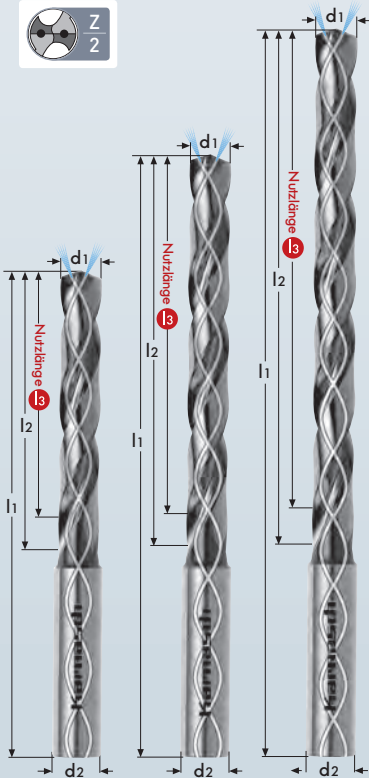
| Art.            | d1 m7 | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|-------|----|----|-----|-------|--------|
| 220405.0650.024 | • 6,5 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0650.043 | • 6,5 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0650.064 | • 6,5 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0660.024 | • 6,6 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0660.043 | • 6,6 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0660.064 | • 6,6 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0670.024 | • 6,7 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0670.043 | • 6,7 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0670.064 | • 6,7 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0680.024 | • 6,8 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0680.043 | • 6,8 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0680.064 | • 6,8 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0690.024 | • 6,9 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0690.043 | • 6,9 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0690.064 | • 6,9 | 64 | 76 | 114 | 8,0   | 141,00 |
| 220405.0700.024 | • 7,0 | 24 | 34 | 79  | 8,0   | 76,50  |
| 220405.0700.043 | • 7,0 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0700.066 | • 7,0 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0710.029 | • 7,1 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0710.043 | • 7,1 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0710.066 | • 7,1 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0720.029 | • 7,2 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0720.043 | • 7,2 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0720.066 | • 7,2 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0730.029 | • 7,3 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0730.043 | • 7,3 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0730.066 | • 7,3 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0740.029 | • 7,4 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0740.043 | • 7,4 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0740.066 | • 7,4 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0750.029 | • 7,5 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0750.043 | • 7,5 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0750.066 | • 7,5 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0760.029 | • 7,6 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0760.043 | • 7,6 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0760.066 | • 7,6 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0770.029 | • 7,7 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0770.043 | • 7,7 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0770.066 | • 7,7 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0780.029 | • 7,8 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0780.043 | • 7,8 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0780.066 | • 7,8 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0790.029 | • 7,9 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0790.043 | • 7,9 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0790.066 | • 7,9 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0800.029 | • 8,0 | 29 | 41 | 79  | 8,0   | 76,50  |
| 220405.0800.043 | • 8,0 | 43 | 53 | 91  | 8,0   | 80,00  |
| 220405.0800.066 | • 8,0 | 66 | 76 | 116 | 8,0   | 141,00 |
| 220405.0810.035 | • 8,1 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0810.049 | • 8,1 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0810.080 | • 8,1 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0820.035 | • 8,2 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0820.049 | • 8,2 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0820.080 | • 8,2 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0830.035 | • 8,3 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0830.049 | • 8,3 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0830.080 | • 8,3 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0840.035 | • 8,4 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0840.049 | • 8,4 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0840.080 | • 8,4 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0850.035 | • 8,5 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0850.049 | • 8,5 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0850.080 | • 8,5 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0860.035 | • 8,6 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0860.049 | • 8,6 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0860.080 | • 8,6 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0870.035 | • 8,7 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0870.049 | • 8,7 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0870.080 | • 8,7 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0880.035 | • 8,8 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0880.049 | • 8,8 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0880.080 | • 8,8 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0890.035 | • 8,9 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0890.049 | • 8,9 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0890.080 | • 8,9 | 80 | 95 | 142 | 10,0  | 188,00 |
| 220405.0900.035 | • 9,0 | 35 | 47 | 89  | 10,0  | 89,00  |
| 220405.0900.049 | • 9,0 | 49 | 61 | 103 | 10,0  | 93,00  |
| 220405.0900.080 | • 9,0 | 80 | 95 | 142 | 10,0  | 188,00 |

| Art.            | d1 m7  | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|--------|-----|-----|-----|-------|--------|
| 220405.0910.035 | • 9,1  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0910.049 | • 9,1  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0910.080 | • 9,1  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0920.035 | • 9,2  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0920.049 | • 9,2  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0920.080 | • 9,2  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0930.035 | • 9,3  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0930.049 | • 9,3  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0930.080 | • 9,3  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0940.035 | • 9,4  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0940.049 | • 9,4  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0940.080 | • 9,4  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0950.035 | • 9,5  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0950.049 | • 9,5  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0950.080 | • 9,5  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0960.035 | • 9,6  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0960.049 | • 9,6  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0960.080 | • 9,6  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0970.035 | • 9,7  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0970.049 | • 9,7  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0970.080 | • 9,7  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0980.035 | • 9,8  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0980.049 | • 9,8  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0980.080 | • 9,8  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.0990.035 | • 9,9  | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.0990.049 | • 9,9  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.0990.080 | • 9,9  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.1000.035 | • 10,0 | 35  | 47  | 89  | 10,0  | 89,00  |
| 220405.1000.049 | • 10,0 | 49  | 61  | 103 | 10,0  | 93,00  |
| 220405.1000.080 | • 10,0 | 80  | 95  | 142 | 10,0  | 188,00 |
| 220405.1010.040 | • 10,1 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1010.056 | • 10,1 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1010.096 | • 10,1 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1020.040 | • 10,2 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1020.056 | • 10,2 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1020.096 | • 10,2 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1030.040 | • 10,3 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1030.056 | • 10,3 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1030.096 | • 10,3 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1040.040 | • 10,4 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1040.056 | • 10,4 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1040.096 | • 10,4 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1050.040 | • 10,5 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1050.056 | • 10,5 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1050.096 | • 10,5 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1060.040 | • 10,6 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1060.056 | • 10,6 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1060.096 | • 10,6 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1060.142 | ▲ 10,6 | 142 | 156 | 204 | 12,0  | 329,50 |
| 220405.1070.040 | • 10,7 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1070.056 | • 10,7 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1070.096 | • 10,7 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1070.142 | ▲ 10,7 | 142 | 156 | 204 | 12,0  | 329,50 |
| 220405.1080.040 | • 10,8 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1080.056 | • 10,8 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1080.096 | • 10,8 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1090.040 | • 10,9 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1090.056 | • 10,9 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1090.096 | • 10,9 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1100.040 | • 11,0 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1100.056 | • 11,0 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1100.096 | • 11,0 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1110.040 | • 11,1 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1110.056 | • 11,1 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1110.096 | • 11,1 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1120.040 | • 11,2 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1120.056 | • 11,2 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1120.096 | • 11,2 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1130.040 | • 11,3 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1130.056 | • 11,3 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1130.096 | • 11,3 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1140.040 | • 11,4 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1140.056 | • 11,4 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1140.096 | • 11,4 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1140.142 | ▲ 11,4 | 142 | 156 | 204 | 12,0  | 329,50 |
| 220405.1150.040 | • 11,5 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1150.056 | • 11,5 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1150.096 | • 11,5 | 96  | 114 | 162 | 12,0  | 261,50 |

| Art.            | d1 m7  | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|--------|-----|-----|-----|-------|--------|
| 220405.1160.040 | • 11,6 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1160.056 | • 11,6 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1160.096 | • 11,6 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1170.040 | • 11,7 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1170.056 | • 11,7 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1170.096 | • 11,7 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1170.142 | ▲ 11,7 | 142 | 156 | 204 | 12,0  | 329,50 |
| 220405.1180.040 | • 11,8 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1180.056 | • 11,8 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1180.096 | • 11,8 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1190.040 | • 11,9 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1190.056 | • 11,9 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1190.096 | • 11,9 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1190.142 | ▲ 11,9 | 142 | 156 | 204 | 12,0  | 329,50 |
| 220405.1200.040 | • 12,0 | 40  | 55  | 102 | 12,0  | 126,00 |
| 220405.1200.056 | • 12,0 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220405.1200.096 | • 12,0 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220405.1210.060 | ▲ 12,1 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1230.060 | • 12,3 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1240.060 | • 12,4 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1250.043 | • 12,5 | 43  | 60  | 107 | 14,0  | 167,00 |
| 220405.1250.060 | • 12,5 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1250.112 | • 12,5 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220405.1270.060 | • 12,7 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1280.060 | • 12,8 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1280.112 | • 12,8 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220405.1300.043 | • 13,0 | 43  | 60  | 107 | 14,0  | 167,00 |
| 220405.1300.060 | • 13,0 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1300.112 | • 13,0 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220405.1350.043 | • 13,5 | 43  | 60  | 107 | 14,0  | 167,00 |
| 220405.1350.060 | • 13,5 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1350.112 | • 13,5 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220405.1380.043 | • 13,8 | 43  | 60  | 107 | 14,0  | 167,00 |
| 220405.1380.060 | • 13,8 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1380.112 | • 13,8 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220405.1400.043 | • 14,0 | 43  | 60  | 107 | 14,0  | 167,00 |
| 220405.1400.060 | • 14,0 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220405.1400.112 | • 14,0 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220405.1450.045 | • 14,5 | 45  | 65  | 115 | 16,0  | 237,00 |
| 220405.1450.063 | • 14,5 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220405.1450.128 | • 14,5 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220405.1500.045 | • 15,0 | 45  | 65  | 115 | 16,0  | 237,00 |
| 220405.1500.063 | • 15,0 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220405.1500.128 | • 15,0 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220405.1550.045 | • 15,5 | 45  | 65  | 115 | 16,0  | 237,00 |
| 220405.1550.063 | • 15,5 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220405.1550.128 | • 15,5 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220405.1580.128 | • 15,8 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220405.1600.045 | • 16,0 | 45  | 65  | 115 | 16,0  | 237,00 |
| 220405.1600.063 | • 16,0 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220405.1650.051 | • 16,5 | 51  | 73  | 123 | 18,0  | 329,00 |
| 220405.1650.071 | • 16,5 | 71  | 93  | 143 | 18,0  | 358,00 |
| 220405.1680.051 | • 16,8 | 51  | 73  | 123 | 18,0  | 329,00 |
| 220405.1680.071 | • 16,8 | 71  | 93  | 143 | 18,0  | 358,00 |
| 220405.1700.051 | • 17,0 | 51  | 73  | 123 | 18,0  | 329,00 |
| 220405.1700.071 | • 17,0 | 71  | 93  | 143 | 18,0  | 358,00 |
| 220405.1750.051 | • 17,5 | 51  | 73  | 123 | 18,0  | 329,00 |
| 220405.1750.071 | • 17,5 | 71  | 93  | 143 | 18,0  | 358,00 |
| 220405.1780.071 | • 17,8 | 71  | 93  | 143 | 18,0  | 358,00 |
| 220405.1800.051 | • 18,0 | 51  | 73  | 123 | 18,0  | 329,00 |
| 220405.1800.071 | • 18,0 | 71  | 93  | 143 | 18,0  | 358,00 |
| 220405.1850.055 | • 18,5 | 55  | 79  | 131 | 20,0  | 407,50 |
| 220405.1850.077 | • 18,5 | 77  | 101 | 153 | 20,0  | 453,00 |
| 220405.1850.160 | • 18,5 | 160 | 190 | 243 | 20,0  | 788,50 |
| 220405.1880.077 | ▲ 18,8 | 77  | 101 | 153 | 20,0  | 453,00 |
| 220405.1900.055 | • 19,0 | 55  | 79  | 131 | 20,0  | 407,50 |
| 220405.1900.077 | • 19,0 | 77  | 101 | 153 | 20,0  | 453,00 |
| 220405.1950.055 | • 19,5 | 55  | 79  | 131 | 20,0  | 407,50 |
| 220405.1950.077 | • 19,5 | 77  | 101 | 153 | 20,0  | 453,00 |
| 220405.2000.055 | • 20,0 | 55  | 79  | 131 | 20,0  | 407,50 |
| 220405.2000.077 | • 20,0 | 77  | 101 | 153 | 20,0  | 453,00 |

Art. 22.0406 Vollhartmetall-Hochleistungsbohrer, DIN 6535 HAK

- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



- Solid carbide high performance twist drill, DIN 6535 HAK
- Taladro de gran potencia de metal duro y macizo, DIN 6535 HAK
- Высокопроизводительное сверло сквозной закалки, DIN 6535 HAK

MICRO  
GRAIN

DIN  
6537

N

DIN 6535  
Form HAK

DVC-X2

Schnittdaten  
Cutting data



i S. 318

| Art.            | d1 m7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220406.0300.023 | • 3,0  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0300.029 | • 3,0  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0300.048 | • 3,0  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0310.023 | • 3,1  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0310.029 | • 3,1  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0310.048 | • 3,1  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0320.023 | • 3,2  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0320.029 | • 3,2  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0320.048 | • 3,2  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0330.023 | • 3,3  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0330.029 | • 3,3  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0330.048 | • 3,3  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0340.023 | • 3,4  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0340.029 | • 3,4  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0340.048 | • 3,4  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0350.023 | • 3,5  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0350.029 | • 3,5  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0350.048 | • 3,5  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0360.023 | • 3,6  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0360.029 | • 3,6  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0360.048 | • 3,6  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0365.023 | • 3,65 | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0370.023 | • 3,7  | 23 | 28 | 66  | 6,0   | 70,00  |
| 220406.0370.029 | • 3,7  | 29 | 34 | 72  | 6,0   | 94,00  |
| 220406.0370.048 | • 3,7  | 48 | 54 | 92  | 6,0   | 115,00 |
| 220406.0380.029 | • 3,8  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0380.036 | • 3,8  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0380.058 | • 3,8  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0390.029 | • 3,9  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0390.036 | • 3,9  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0390.058 | • 3,9  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0400.029 | • 4,0  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0400.036 | • 4,0  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0400.058 | • 4,0  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0410.029 | • 4,1  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0410.036 | • 4,1  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0410.058 | • 4,1  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0420.029 | • 4,2  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0420.036 | • 4,2  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0420.058 | • 4,2  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0430.029 | • 4,3  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0430.036 | • 4,3  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0430.058 | • 4,3  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0440.029 | • 4,4  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0440.036 | • 4,4  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0440.058 | • 4,4  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0450.029 | • 4,5  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0450.036 | • 4,5  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0450.058 | • 4,5  | 58 | 64 | 102 | 6,0   | 115,00 |

| Art.            | d1 m7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220406.0460.029 | • 4,6  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0460.036 | • 4,6  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0460.058 | • 4,6  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0465.029 | • 4,65 | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0470.029 | • 4,7  | 29 | 36 | 74  | 6,0   | 70,00  |
| 220406.0470.036 | • 4,7  | 36 | 43 | 81  | 6,0   | 99,00  |
| 220406.0470.058 | • 4,7  | 58 | 64 | 102 | 6,0   | 115,00 |
| 220406.0480.035 | • 4,8  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0480.048 | • 4,8  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0480.070 | • 4,8  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0490.035 | • 4,9  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0490.048 | • 4,9  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0490.070 | • 4,9  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0500.035 | • 5,0  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0500.048 | • 5,0  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0500.070 | • 5,0  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0510.035 | • 5,1  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0510.048 | • 5,1  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0510.070 | • 5,1  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0520.035 | • 5,2  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0520.048 | • 5,2  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0520.070 | • 5,2  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0530.035 | • 5,3  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0530.048 | • 5,3  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0530.070 | • 5,3  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0540.035 | • 5,4  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0540.048 | • 5,4  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0540.070 | • 5,4  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0550.035 | • 5,5  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0550.048 | • 5,5  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0550.070 | • 5,5  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0555.035 | • 5,55 | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0560.035 | • 5,6  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0560.048 | • 5,6  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0560.070 | • 5,6  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0570.035 | • 5,7  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0570.048 | • 5,7  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0570.070 | • 5,7  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0580.035 | • 5,8  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0580.048 | • 5,8  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0580.070 | • 5,8  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0590.035 | • 5,9  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0590.048 | • 5,9  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0590.070 | • 5,9  | 70 | 78 | 116 | 6,0   | 115,00 |
| 220406.0600.035 | • 6,0  | 35 | 44 | 82  | 6,0   | 70,00  |
| 220406.0600.048 | • 6,0  | 48 | 57 | 95  | 6,0   | 107,00 |
| 220406.0600.070 | • 6,0  | 70 | 78 | 116 | 6,0   | 115,00 |



| Art.            | d1 m7  | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|--------|-----|-----|-----|-------|--------|
| 220406.0610.043 | • 6,1  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0610.064 | • 6,1  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0610.094 | • 6,1  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0620.043 | • 6,2  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0620.064 | • 6,2  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0620.094 | • 6,2  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0630.043 | • 6,3  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0630.064 | • 6,3  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0630.094 | • 6,3  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0640.043 | • 6,4  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0640.064 | • 6,4  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0640.094 | • 6,4  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0650.043 | • 6,5  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0650.064 | • 6,5  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0650.094 | • 6,5  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0660.043 | • 6,6  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0660.064 | • 6,6  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0660.094 | • 6,6  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0670.043 | • 6,7  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0670.064 | • 6,7  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0670.094 | • 6,7  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0680.043 | • 6,8  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0680.064 | • 6,8  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0680.094 | • 6,8  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0690.043 | • 6,9  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0690.064 | • 6,9  | 64  | 76  | 114 | 8,0   | 141,00 |
| 220406.0690.094 | • 6,9  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0700.043 | • 7,0  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0700.066 | • 7,0  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0700.094 | • 7,0  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0710.043 | • 7,1  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0710.066 | • 7,1  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0710.094 | • 7,1  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0720.043 | • 7,2  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0720.066 | • 7,2  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0720.094 | • 7,2  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0730.043 | • 7,3  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0730.066 | • 7,3  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0730.094 | • 7,3  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0740.043 | • 7,4  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0740.066 | • 7,4  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0740.094 | • 7,4  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0745.043 | • 7,45 | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0750.043 | • 7,5  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0750.066 | • 7,5  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0750.094 | • 7,5  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0760.043 | • 7,6  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0760.066 | • 7,6  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0760.094 | • 7,6  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0770.043 | • 7,7  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0770.066 | • 7,7  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0770.094 | • 7,7  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0780.043 | • 7,8  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0780.066 | • 7,8  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0780.094 | • 7,8  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0790.043 | • 7,9  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0790.066 | • 7,9  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0790.094 | • 7,9  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0800.043 | • 8,0  | 43  | 53  | 91  | 8,0   | 80,00  |
| 220406.0800.066 | • 8,0  | 66  | 76  | 116 | 8,0   | 141,00 |
| 220406.0800.094 | • 8,0  | 94  | 108 | 146 | 8,0   | 155,00 |
| 220406.0810.049 | • 8,1  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0810.080 | • 8,1  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0810.110 | • 8,1  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0820.049 | • 8,2  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0820.080 | • 8,2  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0820.110 | • 8,2  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0830.049 | • 8,3  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0830.080 | • 8,3  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0830.110 | • 8,3  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0840.049 | • 8,4  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0840.080 | • 8,4  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0840.110 | • 8,4  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0850.049 | • 8,5  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0850.080 | • 8,5  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0850.110 | • 8,5  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0860.049 | • 8,6  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0860.080 | • 8,6  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0860.110 | • 8,6  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0870.049 | • 8,7  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0870.080 | • 8,7  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0870.110 | • 8,7  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0880.049 | • 8,8  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0880.080 | • 8,8  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0880.110 | • 8,8  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0890.049 | • 8,9  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0890.080 | • 8,9  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0890.110 | • 8,9  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0900.049 | • 9,0  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0900.080 | • 9,0  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0900.110 | • 9,0  | 110 | 120 | 162 | 10,0  | 203,00 |

| Art.            | d1 m7  | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|--------|-----|-----|-----|-------|--------|
| 220406.0910.049 | • 9,1  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0910.080 | • 9,1  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0910.110 | • 9,1  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0920.049 | • 9,2  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0920.080 | • 9,2  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0920.110 | • 9,2  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0930.049 | • 9,3  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0930.080 | • 9,3  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0930.110 | • 9,3  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0935.049 | • 9,35 | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0940.049 | • 9,4  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0940.080 | • 9,4  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0940.110 | • 9,4  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0950.049 | • 9,5  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0950.080 | • 9,5  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0950.110 | • 9,5  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0960.049 | • 9,6  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0960.080 | • 9,6  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0960.110 | • 9,6  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0970.049 | • 9,7  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0970.080 | • 9,7  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0970.110 | • 9,7  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0980.049 | • 9,8  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0980.080 | • 9,8  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0980.110 | • 9,8  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.0990.049 | • 9,9  | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.0990.080 | • 9,9  | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.0990.110 | • 9,9  | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.1000.049 | • 10,0 | 49  | 61  | 103 | 10,0  | 93,00  |
| 220406.1000.080 | • 10,0 | 80  | 95  | 142 | 10,0  | 188,00 |
| 220406.1000.110 | • 10,0 | 110 | 120 | 162 | 10,0  | 203,00 |
| 220406.1010.056 | • 10,1 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1010.096 | • 10,1 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1010.142 | • 10,1 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1020.056 | • 10,2 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1020.096 | • 10,2 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1020.142 | • 10,2 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1030.056 | • 10,3 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1030.096 | • 10,3 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1030.142 | • 10,3 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1040.056 | • 10,4 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1040.096 | ▲ 10,4 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1040.142 | ▲ 10,4 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1050.056 | • 10,5 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1050.096 | • 10,5 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1050.142 | • 10,5 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1080.056 | • 10,8 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1080.096 | ▲ 10,8 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1080.142 | ▲ 10,8 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1100.056 | • 11,0 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1100.096 | • 11,0 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1100.142 | • 11,0 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1110.142 | ▲ 11,1 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1120.056 | • 11,2 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1120.142 | ▲ 11,2 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1150.056 | • 11,5 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1150.096 | • 11,5 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1150.142 | • 11,5 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1200.056 | • 12,0 | 56  | 71  | 118 | 12,0  | 131,50 |
| 220406.1200.096 | • 12,0 | 96  | 114 | 162 | 12,0  | 261,50 |
| 220406.1200.142 | • 12,0 | 142 | 156 | 204 | 12,0  | 277,00 |
| 220406.1250.060 | • 12,5 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220406.1250.112 | • 12,5 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220406.1250.166 | • 12,5 | 166 | 182 | 230 | 14,0  | 386,00 |
| 220406.1280.060 | • 12,8 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220406.1280.112 | • 12,8 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220406.1280.166 | • 12,8 | 166 | 182 | 230 | 14,0  | 386,00 |
| 220406.1300.060 | • 13,0 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220406.1300.112 | • 13,0 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220406.1300.166 | • 13,0 | 166 | 182 | 230 | 14,0  | 386,00 |
| 220406.1350.060 | • 13,5 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220406.1350.112 | • 13,5 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220406.1350.166 | • 13,5 | 166 | 182 | 230 | 14,0  | 386,00 |
| 220406.1380.060 | ▲ 13,8 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220406.1400.060 | • 14,0 | 60  | 77  | 124 | 14,0  | 174,00 |
| 220406.1400.112 | • 14,0 | 112 | 133 | 178 | 14,0  | 370,50 |
| 220406.1450.063 | • 14,5 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220406.1450.128 | ▲ 14,5 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220406.1450.192 | ▲ 14,5 | 192 | 208 | 260 | 16,0  | 618,00 |
| 220406.1480.192 | ▲ 14,8 | 192 | 208 | 260 | 16,0  | 618,00 |
| 220406.1500.063 | • 15,0 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220406.1500.128 | • 15,0 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220406.1550.063 | • 15,5 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220406.1580.192 | ▲ 15,8 | 192 | 208 | 260 | 16,0  | 618,00 |
| 220406.1600.063 | • 16,0 | 63  | 83  | 133 | 16,0  | 234,00 |
| 220406.1600.128 | • 16,0 | 128 | 152 | 203 | 16,0  | 485,50 |
| 220406.1800.216 | ▲ 18,0 | 216 | 234 | 285 | 18,0  | 779,00 |

Art. 22.0409 Vollhartmetall-Hochleistungsbohrer

INOX  
stainless steel  
< 900 N/mm  
ferritic

HASTELLOY

INOX  
stainless steel  
> 900 N/mm  
martensitic

MONEL

INOX  
stainless steel  
< 900 N/mm  
austenitic

NIMONIC

NI-ALLOYS  
< 900 N/mm

Ampco

NI-CO  
ALLOYS  
> 900 N/mm

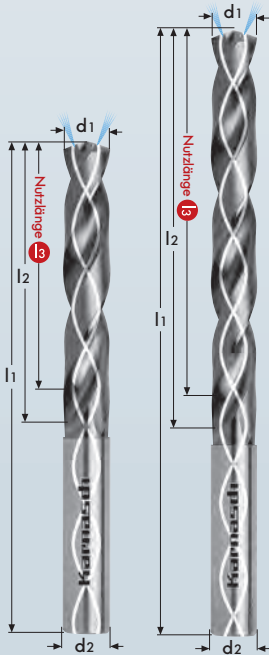
Nickel  
< 500  
N/mm²

HARDOX

lang-  
spanend  
long chip



- Solid carbide high performance twist drill
- Taladro de gran potencia de metal duro y macizo
- Высокопроизводительное сверло сквозной заковки



MICRO  
GRAIN

DIN  
6537

SPEZIAL

DIN 6535  
Form HAK

HSC  
HPC

DVC-X1²

Schnittdaten  
Cutting data



| Art.            | d1 m7 | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|-------|----|----|----|-------|--------|
| 220409.0300.023 | • 3,0 | 23 | 28 | 66 | 6,0   | 64,50  |
| 220409.0300.029 | • 3,0 | 29 | 34 | 72 | 6,0   | 88,00  |
| 220409.0310.023 | • 3,1 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0310.029 | • 3,1 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0320.023 | • 3,2 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0320.029 | • 3,2 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0330.023 | • 3,3 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0330.029 | • 3,3 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0340.023 | • 3,4 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0340.029 | • 3,4 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0350.023 | • 3,5 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0350.029 | • 3,5 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0360.023 | • 3,6 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0360.029 | • 3,6 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0370.023 | • 3,7 | 23 | 28 | 66 | 6,0   | 65,50  |
| 220409.0370.029 | • 3,7 | 29 | 34 | 72 | 6,0   | 89,00  |
| 220409.0380.029 | • 3,8 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0380.036 | • 3,8 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0390.029 | • 3,9 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0390.036 | • 3,9 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0400.029 | • 4,0 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0400.036 | • 4,0 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0410.029 | • 4,1 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0410.036 | • 4,1 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0420.029 | • 4,2 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0420.036 | • 4,2 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0430.029 | • 4,3 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0430.036 | • 4,3 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0440.029 | • 4,4 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0440.036 | • 4,4 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0450.029 | • 4,5 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0450.036 | • 4,5 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0460.029 | • 4,6 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0460.036 | • 4,6 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0470.029 | • 4,7 | 29 | 36 | 74 | 6,0   | 65,50  |
| 220409.0470.036 | • 4,7 | 36 | 43 | 81 | 6,0   | 93,00  |
| 220409.0480.035 | • 4,8 | 35 | 44 | 82 | 6,0   | 65,50  |
| 220409.0480.048 | • 4,8 | 48 | 57 | 95 | 6,0   | 100,50 |

| Art.            | d1 m7 | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|-------|----|----|-----|-------|--------|
| 220409.0490.035 | • 4,9 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0490.048 | • 4,9 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0500.035 | • 5,0 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0500.048 | • 5,0 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0510.035 | • 5,1 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0510.048 | • 5,1 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0520.035 | • 5,2 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0520.048 | • 5,2 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0530.035 | • 5,3 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0530.048 | • 5,3 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0540.035 | • 5,4 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0540.048 | • 5,4 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0550.035 | • 5,5 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0550.048 | • 5,5 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0560.035 | • 5,6 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0560.048 | • 5,6 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0570.035 | • 5,7 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0570.048 | • 5,7 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0580.035 | • 5,8 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0580.048 | • 5,8 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0590.035 | • 5,9 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0590.048 | • 5,9 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0600.035 | • 6,0 | 35 | 44 | 82  | 6,0   | 65,50  |
| 220409.0600.048 | • 6,0 | 48 | 57 | 95  | 6,0   | 100,50 |
| 220409.0610.043 | • 6,1 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0610.064 | • 6,1 | 64 | 76 | 114 | 8,0   | 133,50 |
| 220409.0620.043 | • 6,2 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0620.064 | • 6,2 | 64 | 76 | 114 | 8,0   | 133,50 |
| 220409.0630.043 | • 6,3 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0630.064 | • 6,3 | 64 | 76 | 114 | 8,0   | 133,50 |
| 220409.0640.043 | • 6,4 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0640.064 | • 6,4 | 64 | 76 | 114 | 8,0   | 133,50 |
| 220409.0650.043 | • 6,5 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0650.064 | • 6,5 | 64 | 76 | 114 | 8,0   | 133,50 |
| 220409.0660.043 | • 6,6 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0660.064 | • 6,6 | 64 | 76 | 114 | 8,0   | 133,50 |
| 220409.0670.043 | • 6,7 | 43 | 53 | 91  | 8,0   | 75,50  |
| 220409.0670.064 | • 6,7 | 64 | 76 | 114 | 8,0   | 133,50 |

Mindestbestellmenge für Zwischenabmessungen 5 Stück / Minimum order volume for intermediate dimensions 5 pieces ♦ auf Anfrage / on request

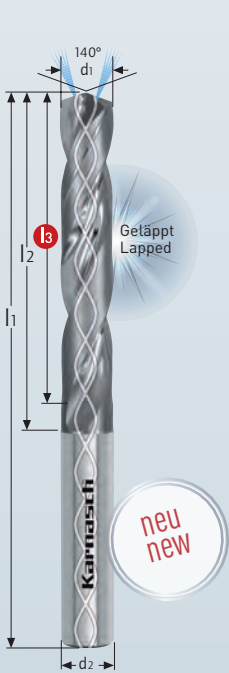
| Art.            | d1 m7  | l3 | l2  | l1  | d2 h6 | €      |
|-----------------|--------|----|-----|-----|-------|--------|
| 220409.0680.043 | • 6,8  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0680.064 | • 6,8  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0690.043 | • 6,9  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0690.064 | • 6,9  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0700.043 | • 7,0  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0700.064 | • 7,0  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0710.043 | • 7,1  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0710.064 | • 7,1  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0720.043 | • 7,2  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0720.064 | • 7,2  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0730.043 | • 7,3  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0730.064 | • 7,3  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0740.043 | • 7,4  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0740.064 | • 7,4  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0750.043 | • 7,5  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0750.064 | • 7,5  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0760.043 | • 7,6  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0760.064 | • 7,6  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0770.043 | • 7,7  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0770.064 | • 7,7  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0780.043 | • 7,8  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0780.064 | • 7,8  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0790.043 | • 7,9  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0790.064 | • 7,9  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0800.043 | • 8,0  | 43 | 53  | 91  | 8,0   | 75,50  |
| 220409.0800.064 | • 8,0  | 64 | 76  | 114 | 8,0   | 133,50 |
| 220409.0810.049 | • 8,1  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0810.080 | • 8,1  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0820.049 | • 8,2  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0820.080 | • 8,2  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0830.049 | • 8,3  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0830.080 | • 8,3  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0840.049 | • 8,4  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0840.080 | • 8,4  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0850.049 | • 8,5  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0850.080 | • 8,5  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0860.049 | • 8,6  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0860.080 | • 8,6  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0870.049 | • 8,7  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0870.080 | • 8,7  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0880.049 | • 8,8  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0880.080 | • 8,8  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0890.049 | • 8,9  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0890.080 | • 8,9  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0900.049 | • 9,0  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0900.080 | • 9,0  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0910.049 | • 9,1  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0910.080 | • 9,1  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0920.049 | • 9,2  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0920.080 | • 9,2  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0930.049 | • 9,3  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0930.080 | • 9,3  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0940.049 | • 9,4  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0940.080 | • 9,4  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0950.049 | • 9,5  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0950.080 | • 9,5  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0960.049 | • 9,6  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0960.080 | • 9,6  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0970.049 | • 9,7  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0970.080 | • 9,7  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0980.049 | • 9,8  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0980.080 | • 9,8  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.0990.049 | • 9,9  | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.0990.080 | • 9,9  | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.1000.049 | • 10,0 | 49 | 61  | 103 | 10,0  | 86,50  |
| 220409.1000.080 | • 10,0 | 80 | 95  | 142 | 10,0  | 177,00 |
| 220409.1010.056 | • 10,1 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1010.096 | • 10,1 | 96 | 114 | 162 | 12,0  | 242,50 |
| 220409.1020.056 | • 10,2 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1020.096 | • 10,2 | 96 | 114 | 162 | 12,0  | 242,50 |
| 220409.1030.056 | • 10,3 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1030.096 | • 10,3 | 96 | 114 | 162 | 12,0  | 242,50 |
| 220409.1040.056 | • 10,4 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1040.096 | • 10,4 | 96 | 114 | 162 | 12,0  | 242,50 |
| 220409.1050.056 | • 10,5 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1050.096 | • 10,5 | 96 | 114 | 162 | 12,0  | 242,50 |
| 220409.1060.056 | • 10,6 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1060.096 | • 10,6 | 96 | 114 | 162 | 12,0  | 242,50 |
| 220409.1070.056 | • 10,7 | 56 | 71  | 118 | 12,0  | 124,00 |
| 220409.1070.096 | • 10,7 | 96 | 114 | 162 | 12,0  | 242,50 |

| Art.            | d1 m7  | l3  | l2  | l1  | d2 h6 | €      |
|-----------------|--------|-----|-----|-----|-------|--------|
| 220409.1080.056 | • 10,8 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1080.096 | • 10,8 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1090.056 | • 10,9 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1090.096 | • 10,9 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1100.056 | • 11,0 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1100.096 | • 11,0 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1110.056 | • 11,1 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1110.096 | • 11,1 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1120.056 | • 11,2 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1120.096 | • 11,2 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1130.056 | • 11,3 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1130.096 | • 11,3 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1140.056 | • 11,4 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1140.096 | • 11,4 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1150.056 | • 11,5 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1150.096 | • 11,5 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1160.056 | • 11,6 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1160.096 | • 11,6 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1170.056 | • 11,7 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1170.096 | • 11,7 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1180.056 | • 11,8 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1180.096 | • 11,8 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1190.056 | • 11,9 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1190.096 | • 11,9 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1200.056 | • 12,0 | 56  | 71  | 118 | 12,0  | 124,00 |
| 220409.1200.096 | • 12,0 | 96  | 114 | 162 | 12,0  | 242,50 |
| 220409.1250.060 | • 12,5 | 60  | 77  | 124 | 14,0  | 165,00 |
| 220409.1250.112 | • 12,5 | 112 | 133 | 178 | 14,0  | 345,50 |
| 220409.1280.060 | • 12,8 | 60  | 77  | 124 | 14,0  | 165,00 |
| 220409.1280.112 | • 12,8 | 112 | 133 | 178 | 14,0  | 345,50 |
| 220409.1300.060 | • 13,0 | 60  | 77  | 124 | 14,0  | 165,00 |
| 220409.1300.112 | • 13,0 | 112 | 133 | 178 | 14,0  | 345,50 |
| 220409.1350.060 | • 13,5 | 60  | 77  | 124 | 14,0  | 165,00 |
| 220409.1350.112 | • 13,5 | 112 | 133 | 178 | 14,0  | 345,50 |
| 220409.1380.060 | • 13,8 | 60  | 77  | 124 | 14,0  | 165,00 |
| 220409.1380.112 | • 13,8 | 112 | 133 | 178 | 14,0  | 345,50 |
| 220409.1400.060 | • 14,0 | 60  | 77  | 124 | 14,0  | 165,00 |
| 220409.1400.112 | • 14,0 | 112 | 133 | 178 | 14,0  | 345,50 |
| 220409.1450.063 | • 14,5 | 63  | 83  | 133 | 16,0  | 221,00 |
| 220409.1450.128 | • 14,5 | 128 | 152 | 203 | 16,0  | 455,00 |
| 220409.1480.063 | • 14,8 | 63  | 83  | 133 | 16,0  | 221,00 |
| 220409.1480.128 | • 14,8 | 128 | 152 | 203 | 16,0  | 455,00 |
| 220409.1500.063 | • 15,0 | 63  | 83  | 133 | 16,0  | 221,00 |
| 220409.1500.128 | • 15,0 | 128 | 152 | 203 | 16,0  | 455,00 |
| 220409.1550.063 | • 15,5 | 63  | 83  | 133 | 16,0  | 221,00 |
| 220409.1550.128 | • 15,5 | 128 | 152 | 203 | 16,0  | 455,00 |
| 220409.1580.128 | ▲ 15,8 | 128 | 152 | 203 | 16,0  | 454,50 |
| 220409.1600.063 | • 16,0 | 63  | 83  | 133 | 16,0  | 221,00 |
| 220409.1600.128 | • 16,0 | 128 | 152 | 203 | 16,0  | 455,00 |



Art. 22.0410 VHM-Hochleistungsbohrer mit Innenkühlung für INCONEL

- INCONEL
- HASTELLOY
- MONEL
- NIMONIC
- NI-ALLOYS < 900 N/mm
- NI-CO ALLOYS > 900 N/mm



- Solid carbide high performance twist drill with interior cooling for INCONEL
- Broca de gran potencia de metal duro y enfriamiento interno para INCONEL
- Высокопроизводительное сверло сквозной заковки с внутренним охлаждением, для сплавов INCONEL

MICRO GRAIN

DIN 6537 5xD

SPEZIAL

DIN 6535 Form HAK

30°

140°

HSC HPC

GELÄPPT LAPPED

Schnittdaten  
Cutting data



| Art.            | d1 h7  | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 220410.0300.023 | • 3,0  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0320.023 | • 3,2  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0330.023 | • 3,3  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0340.023 | • 3,4  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0350.023 | • 3,5  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0370.023 | • 3,7  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0380.029 | • 3,8  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0390.029 | • 3,9  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0400.029 | • 4,0  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0420.029 | • 4,2  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0430.029 | • 4,3  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0450.029 | • 4,5  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0465.029 | • 4,65 | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0480.035 | • 4,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0500.035 | • 5,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0510.035 | • 5,1  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0520.035 | • 5,2  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0530.035 | • 5,3  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0540.035 | • 5,4  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0550.035 | • 5,5  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0555.035 | • 5,55 | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0560.035 | • 5,6  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0570.035 | • 5,7  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0580.035 | • 5,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0600.035 | • 6,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0610.043 | • 6,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0620.043 | • 6,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0630.043 | • 6,3  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0640.043 | • 6,4  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0650.043 | • 6,5  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0660.043 | • 6,6  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0670.043 | • 6,7  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0680.043 | • 6,8  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0690.043 | • 6,9  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0700.043 | • 7,0  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0710.043 | • 7,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0720.043 | • 7,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0730.043 | • 7,3  | 43 | 53 | 91 | 8     | 117,50 |

| Art.            | d1 h7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220410.0740.043 | • 7,4  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0750.043 | • 7,5  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0760.043 | • 7,6  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0780.043 | • 7,8  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0790.043 | • 7,9  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0800.043 | • 8,0  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0810.049 | • 8,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0820.049 | • 8,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0830.049 | • 8,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0840.049 | • 8,4  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0850.049 | • 8,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0860.049 | • 8,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0870.049 | • 8,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0880.049 | • 8,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0890.049 | • 8,9  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0900.049 | • 9,0  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0910.049 | • 9,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0920.049 | • 9,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0930.049 | • 9,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0950.049 | • 9,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0960.049 | • 9,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0970.049 | • 9,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0980.049 | • 9,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.1000.049 | • 10,0 | 49 | 61 | 103 | 10    | 178,00 |
| 220410.1010.056 | • 10,1 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1020.056 | • 10,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1030.056 | • 10,3 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1050.056 | • 10,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1060.056 | • 10,6 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1070.056 | • 10,7 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1080.056 | • 10,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1090.056 | • 10,9 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1100.056 | • 11,0 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1120.056 | • 11,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1150.056 | • 11,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1180.056 | • 11,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1200.056 | • 12,0 | 56 | 69 | 116 | 12    | 242,50 |

Empfohlene Schnittdaten

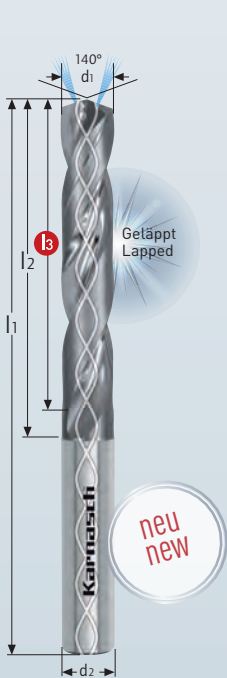
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                               | Festigkeit<br>Closeness  | Schnittgeschwindigkeit<br>Cutting speed<br>Vc m/min | Vorschub pro Umdrehung<br>Feed per revolution<br>mm |             |             |
|-----------------------------------|-----------------------------------------------------|--------------------------|-----------------------------------------------------|-----------------------------------------------------|-------------|-------------|
|                                   |                                                     |                          |                                                     | Ø3 - Ø5                                             | Ø5 - Ø8     | Ø8 - Ø12    |
| 5.1<br>5.2<br>5.3                 | Nickel 100%<br>Nickel-Legierung<br>Nickel-Legierung | <900 N/mm²<br>>900 N/mm² | 25-35                                               | 0,04 - 0,09                                         | 0,06 - 0,16 | 0,13 - 0,22 |



VHM-Hochleistungsbohrer mit Innenkühlung für TITAN

Art. 22.0412

- TITAN
- TITAN < 1200 N/mm
- TITAN GRADE 1
- TITAN GRADE 2
- TITAN GRADE 3
- TITAN GRADE 4
- TITAN GRADE 5
- TITAN GRADE 12



- Solid carbide high performance twist drill with interior cooling for TITANIUM
- Broca de gran potencia de metal duro y enfriamiento interno para TITANIO
- Высокопроизводительное сверло сквозной заковки с внутренним охлаждением, для титановых сплавов

MICRO GRAIN

DIN 6537 5xD

SPEZIAL

DIN 6535 Form HAK



HSC HPC



GELÄPPT LAPPED



Schnittdaten  
Cutting data



i S. 151

| Art.            | d1 h7  | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 220412.0300.023 | • 3,0  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0320.023 | • 3,2  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0330.023 | • 3,3  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0340.023 | • 3,4  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0350.023 | • 3,5  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0370.023 | • 3,7  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0380.029 | • 3,8  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0390.029 | • 3,9  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0400.029 | • 4,0  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0420.029 | • 4,2  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0430.029 | • 4,3  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0450.029 | • 4,5  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0465.029 | • 4,65 | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0480.035 | • 4,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0500.035 | • 5,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0510.035 | • 5,1  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0520.035 | • 5,2  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0530.035 | • 5,3  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0540.035 | • 5,4  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0550.035 | • 5,5  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0555.035 | • 5,55 | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0560.035 | • 5,6  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0570.035 | • 5,7  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0580.035 | • 5,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0600.035 | • 6,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0610.043 | • 6,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0620.043 | • 6,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0630.043 | • 6,3  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0640.043 | • 6,4  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0650.043 | • 6,5  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0660.043 | • 6,6  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0670.043 | • 6,7  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0680.043 | • 6,8  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0690.043 | • 6,9  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0700.043 | • 7,0  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0710.043 | • 7,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0720.043 | • 7,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0730.043 | • 7,3  | 43 | 53 | 91 | 8     | 117,50 |

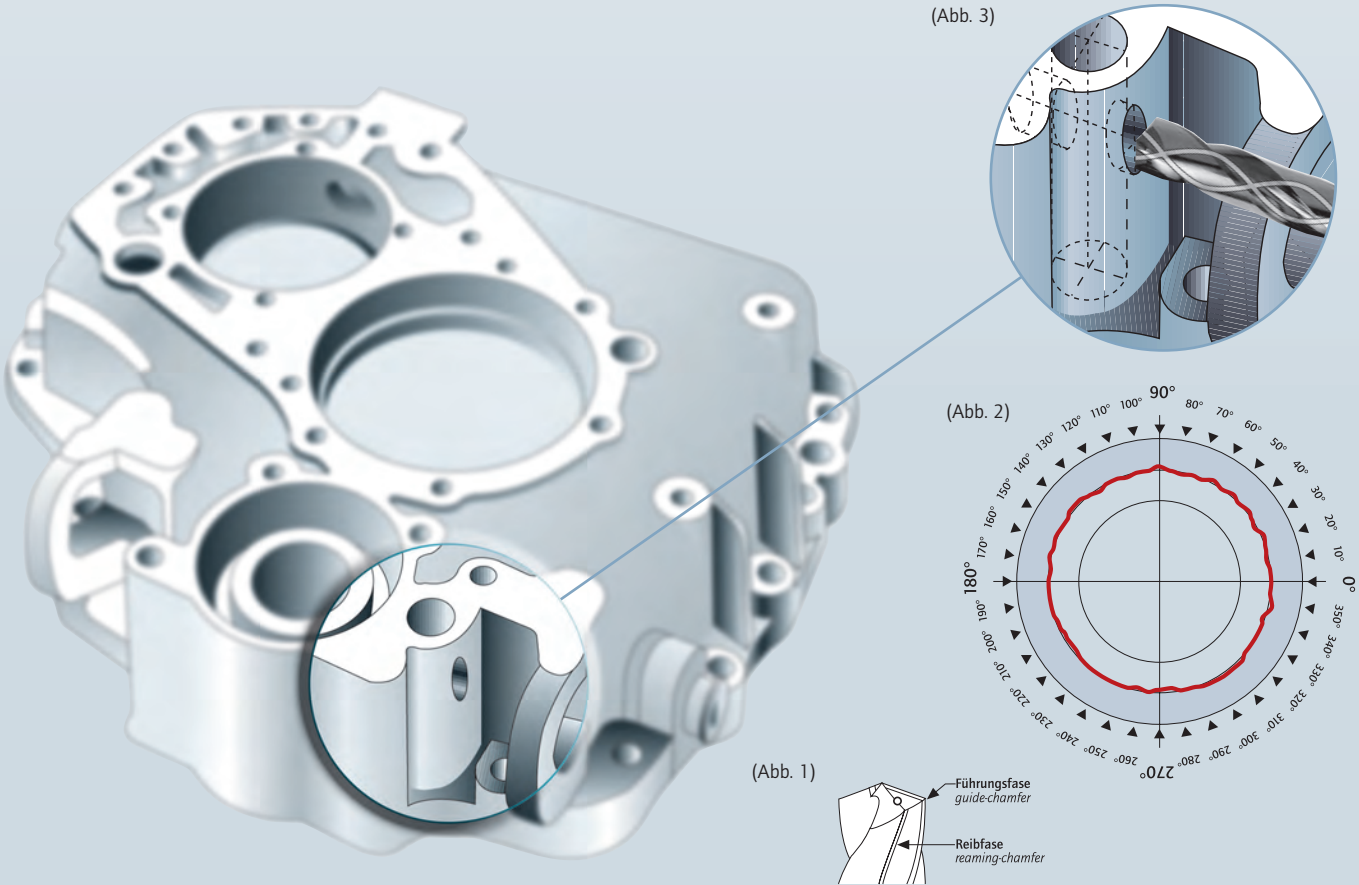
| Art.            | d1 h7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220412.0740.043 | • 7,4  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0750.043 | • 7,5  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0760.043 | • 7,6  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0780.043 | • 7,8  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0790.043 | • 7,9  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0800.043 | • 8,0  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0810.049 | • 8,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0820.049 | • 8,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0830.049 | • 8,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0840.049 | • 8,4  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0850.049 | • 8,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0860.049 | • 8,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0870.049 | • 8,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0880.049 | • 8,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0890.049 | • 8,9  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0900.049 | • 9,0  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0910.049 | • 9,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0920.049 | • 9,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0930.049 | • 9,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0950.049 | • 9,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0960.049 | • 9,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0970.049 | • 9,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0980.049 | • 9,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.1000.049 | • 10,0 | 49 | 61 | 103 | 10    | 178,00 |
| 220412.1010.056 | • 10,1 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1020.056 | • 10,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1030.056 | • 10,3 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1050.056 | • 10,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1060.056 | • 10,6 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1070.056 | • 10,7 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1080.056 | • 10,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1090.056 | • 10,9 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1100.056 | • 11,0 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1120.056 | • 11,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1150.056 | • 11,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1180.056 | • 11,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1200.056 | • 12,0 | 56 | 69 | 116 | 12    | 242,50 |

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                                     | Festigkeit<br>Closeness  | Schnittgeschwindigkeit<br>Cutting speed<br>Vc m/min | Vorschub pro Umdrehung<br>Feed per revolution<br>mm |             |             |
|-----------------------------------|-----------------------------------------------------------|--------------------------|-----------------------------------------------------|-----------------------------------------------------|-------------|-------------|
|                                   |                                                           |                          |                                                     | Ø3 - Ø5                                             | Ø5 - Ø8     | Ø8 - Ø12    |
| 4.1<br>4.2<br>4.3                 | Reintitan<br>3.7105-3.7115-3.7124<br>3.7154-3.7164-3.7124 | <900 N/mm²<br>>900 N/mm² | 30-45                                               | 0,10 - 0,17                                         | 0,14 - 0,26 | 0,20 - 0,40 |

- Art. 22.0419
- Art. 22.0424
- Art. 22.0425

IQ-DRILL- 4 Fasen Bohrer für H7- Bohrung 5 x D und 8 x D mit/ohne Innenkühlung. Wir optimieren Ihre Fertigung  
IQ-Drill 4-chamfer 5 x D and 8 x D with/without interior cooling supply. We optimize your production.



- 1 Diese Neuentwicklung aus unserem Hause erfüllt höchste Anforderungen an die Bohrungsqualität. Auf Reiboperationen kann in vielen Fällen verzichtet werden.

*This new development from Karnasch meets highest demands on drill quality. Reming after drilling is often not necessary any more.*

- 2 4 Fasen optimal am Bohrumfang positioniert (Abb. 1) erschließen neue Anwendungen. Diese zusätzlichen Führungsfasen stabilisieren bereits in der Anbohrfase entscheidend das weitere Bohrverhalten.

*4 chamfer are optimal ajustet on the drill-diameter (see picture 1) develops new application. This additional guide-chamfer stabilizes already on the very beginning of drilling and is responsible for the further drilling process.*

- 3 Mit IQ-Drill garantieren wir eine maximale Fluchtungsgenauigkeit (Abb. 2) und Koaxialität bei extremen Bohrtiefen besonders über 5xD Bohrtiefe.

*IQ-Drill guarantees maximal alignment accuracy (see picture 2) and coaxiality in particular for drilling depths exceeding 5 x D.*

- 4 Durch das einzigartige Eigenzentrierverhalten, auch bei unterbrochenem Schnitt, (Abb. 3) bleibt die Rundheit und Fluchtungsgenauigkeit mit IQ-Drill nahezu konstant.

*Because of the extraordinary self-centering-ability, also by interrupting drill holes (see picture 3), the alignment and concentricity stays almost constant.*

- 5 Vorteile beim Einsatz mit IQ-Drill · Advantages IQ-Drill:

kein Anzentrieren / no center drilling  
kein Vorbohren / no predrilling  
kein Aufbohren / no counterboring  
keine Bohrbuchse / no drill bushing  
hohe Oberflächenqualität / Reibqualität  
hohe Fluchtungsgenauigkeit / high alignment accuracy  
Toleranz H7 / tolerance H7

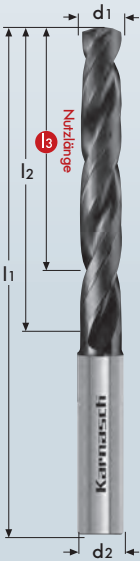
| H7   |           | Bohrungstoleranz / Hole tolerance |           |
|------|-----------|-----------------------------------|-----------|
| 3-6  | -0/+0,012 | 10-18                             | -0/+0,018 |
| 6-10 | -0/+0,015 | 18-30                             | -0/+0,021 |

| m7   |        | Bohrertoleranz / Drill tolerance |        |
|------|--------|----------------------------------|--------|
| 3-6  | +0,004 | 10-18                            | +0,007 |
|      | +0,016 |                                  | +0,025 |
| 6-10 | +0,006 | 18-30                            | +0,008 |
|      | +0,021 |                                  | +0,029 |

IQ-DRILL Vollhartmetall-Hochleistungsbohrer für Bohrung H7, 4 Fasenbohrer

Art. 22.0419

- UNI
- STAHL steel
- INOX stainless steel
- GJL
- GJS
- GTW GTS
- kurz-spanend short chip



- Solid carbide twist IQ-drill for drill hole tolerances H7, 4 chamfer drill
- Berbiquí IQ taladro de gran potencia de metal duro y macizo para taladrar H7-taladro de cuatro fases
- Высокопроизводительное сверло сквозной закалки для отверстия H7 -четырёхфазное сверло

| H7   | Bohrungstoleranz / Hole tolerance |       |           |  |
|------|-----------------------------------|-------|-----------|--|
| 3-6  | -0/+0,012                         | 10-18 | -0/+0,018 |  |
| 6-10 | -0/+0,015                         | 18-30 | -0/+0,021 |  |

| Art.            | d1 H7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220419.0300.023 | • 3,0  | 23 | 28 | 66  | 6,0   | 56,00  |
| 220419.0400.029 | • 4,0  | 29 | 36 | 74  | 6,0   | 56,00  |
| 220419.0500.035 | • 5,0  | 35 | 44 | 82  | 6,0   | 56,00  |
| 220419.0600.035 | • 6,0  | 35 | 44 | 82  | 6,0   | 56,00  |
| 220419.0800.043 | • 8,0  | 43 | 53 | 91  | 8,0   | 67,00  |
| 220419.1000.049 | • 10,0 | 49 | 61 | 103 | 10,0  | 77,00  |
| 220419.1200.056 | • 12,0 | 56 | 71 | 118 | 12,0  | 111,00 |

Zwischenabmessungen sind kurzfristig lieferbar  
Intermediate sizes are available at short notice

MICRO GRAIN

DIN 6537

N

DIN 6535  
Form HA



HSC  
HPC



XFN-2  
NANO



Schnittdaten  
Cutting data



i S. 318

IQ-DRILL Vollhartmetall-Hochleistungsbohrer für Bohrung H7, 4 Fasen

Art. 22.0425

- UNI
- STAHL steel
- INOX stainless steel
- GJL
- GJS
- GTW GTS
- kurz-spanend short chip



- Solid carbide twist IQ-drill for drill hole tolerances H7, 4 chamfer drill
- Berbiquí IQ taladro de gran potencia de metal duro y macizo para taladrar H7-taladro de cuatro fases
- Высокопроизводительное сверло сквозной закалки для отверстия H7 -четырёхфазное сверло

| H7   | Bohrungstoleranz / hole tolerance |       |           |  |
|------|-----------------------------------|-------|-----------|--|
| 3-6  | -0/+0,012                         | 10-18 | -0/+0,018 |  |
| 6-10 | -0/+0,015                         | 18-30 | -0/+0,021 |  |

| Art.            | d1 H7 | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|-------|----|----|-----|-------|--------|
| 220425.0400.036 | ▲ 4,0 | 36 | 43 | 81  | 6,0   | 88,00  |
| 220425.0600.048 | ▲ 6,0 | 48 | 57 | 95  | 6,0   | 88,00  |
| 220425.0800.064 | ▲ 8,0 | 64 | 76 | 114 | 8,0   | 100,00 |

MICRO GRAIN

DIN 6537

N

DIN 6535  
Form HAK



HSC  
HPC



XFN-2  
NANO



Schnittdaten  
Cutting data



i S. 318

Art. 22.0424 IQ-DRILL Vollhartmetall Hochleistungsbohrer für Bohrungen H7, übermaß und untermaß, 4 Fasen

UNI

STAHL  
steel  
< 1000 N/mm

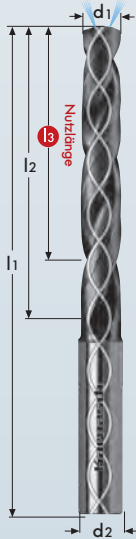
INOX  
stainless steel  
< 900 N/mm  
ferritic

GJL

GJS

GTW  
GTS

kurz-  
spanend  
short chip



- Solid carbide twist IQ-drill for drill hole tolerances H7, 4 chamfer drill
- Berbiquí IQ taladro de gran potencia de metal duro y macizo para taladrar H7-taladro de cuatro fases
- Высокопроизводительное сверло сквозной закалки для отверстия H7 -четырёхфазное сверло

MICRO GRAIN

DIN 6537

N

DIN 6535 Form HAK

HSC HPC

XFN-2 NANO

| Art.            | d1                    | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|-----------------------|----|----|-----|-------|--------|
| 220424.0298.023 | • 2,98 -0,002/+0,004  | 23 | 28 | 66  | 6     | 124,00 |
| 220424.0299.023 | • 2,99 -0,002/+0,004  | 23 | 28 | 66  | 6     | 124,00 |
| 220424.0300.023 | • 3,00 H7             | 23 | 28 | 66  | 6     | 124,00 |
| 220424.0301.023 | • 3,01 -0,002/+0,004  | 23 | 28 | 66  | 6     | 124,00 |
| 220424.0302.023 | • 3,02 -0,002/+0,004  | 23 | 28 | 66  | 6     | 124,00 |
| 220424.0398.029 | • 3,98 -0,002/+0,004  | 29 | 36 | 74  | 6     | 124,00 |
| 220424.0399.029 | • 3,99 -0,002/+0,004  | 29 | 36 | 74  | 6     | 124,00 |
| 220424.0400.029 | • 4,00 H7             | 29 | 36 | 74  | 6     | 124,00 |
| 220424.0401.029 | • 4,01 -0,002/+0,004  | 29 | 36 | 74  | 6     | 124,00 |
| 220424.0402.029 | • 4,02 -0,002/+0,004  | 29 | 36 | 74  | 6     | 124,00 |
| 220424.0498.035 | • 4,98 -0,002/+0,004  | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0499.035 | • 4,99 -0,002/+0,004  | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0500.035 | • 5,00 H7             | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0501.035 | • 5,01 -0,002/+0,004  | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0502.035 | • 5,02 -0,002/+0,004  | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0598.035 | • 5,98 -0,002/+0,004  | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0599.035 | • 5,99 -0,002/+0,004  | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0600.035 | • 6,00 H7             | 35 | 44 | 82  | 6     | 124,00 |
| 220424.0601.035 | • 6,01 -0,002/+0,004  | 35 | 44 | 82  | 6     | 123,00 |
| 220424.0602.035 | • 6,02 -0,002/+0,004  | 35 | 44 | 82  | 6     | 123,00 |
| 220424.0700.043 | • 7,00 H7             | 43 | 53 | 91  | 8     | 159,00 |
| 220424.0798.043 | • 7,98 -0,002/+0,004  | 43 | 53 | 91  | 8     | 159,00 |
| 220424.0799.043 | • 7,99 -0,002/+0,004  | 43 | 53 | 91  | 8     | 159,00 |
| 220424.0800.043 | • 8,00 H7             | 43 | 53 | 91  | 8     | 159,00 |
| 220424.0801.043 | • 8,01 -0,002/+0,004  | 43 | 53 | 91  | 8     | 159,00 |
| 220424.0802.043 | • 8,02 -0,002/+0,004  | 43 | 53 | 91  | 8     | 159,00 |
| 220424.0900.049 | • 9,00 H7             | 49 | 61 | 103 | 10    | 181,00 |
| 220424.0998.049 | • 9,98 -0,002/+0,004  | 49 | 61 | 103 | 10    | 181,00 |
| 220424.0999.049 | • 9,99 -0,002/+0,004  | 49 | 61 | 103 | 10    | 181,00 |
| 220424.1000.049 | • 10,00 H7            | 49 | 61 | 103 | 10    | 181,00 |
| 220424.1001.049 | • 10,01 -0,002/+0,004 | 49 | 61 | 103 | 10    | 181,00 |
| 220424.1002.049 | • 10,02 -0,002/+0,004 | 49 | 61 | 103 | 10    | 181,00 |
| 220424.1100.056 | • 11,00 H7            | 56 | 71 | 118 | 12    | 232,00 |
| 220424.1200.056 | • 12,00 H7            | 56 | 71 | 118 | 12    | 232,00 |

| H7      | Bohrungstoleranz<br>hole tolerance |
|---------|------------------------------------|
| > 3-6   | -0,000<br>+0,012                   |
| > 6-10  | -0,000<br>+0,015                   |
| > 10-18 | -0,000<br>+0,018                   |
| > 18-30 | -0,000<br>+0,021                   |

Schnittdaten  
Cutting data



i S. 154

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer mit Innenkühlung  
Recommended cutting data for solid carbide twist drill, with interior cooling supply

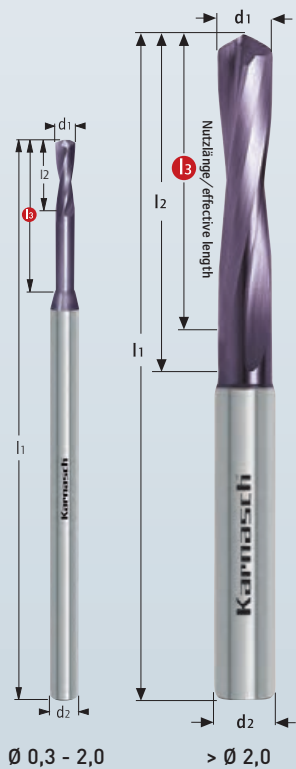
| Werkstoffgruppe<br>material group | Werkstoff | Festigkeit<br>N/mm² | Schnittgeschwin-<br>digkeit<br>Vc m/min<br>±10% | 2,98 Ø - 5,02 Ø |                       |            | 5,98 Ø - 9,00 Ø |                       |            | 9,98 Ø - 12,0 Ø |                       |            |
|-----------------------------------|-----------|---------------------|-------------------------------------------------|-----------------|-----------------------|------------|-----------------|-----------------------|------------|-----------------|-----------------------|------------|
|                                   |           |                     |                                                 | f = mm/U        | n = min <sup>-1</sup> | f = mm/min | f = mm/U        | n = min <sup>-1</sup> | f = mm/min | f = mm/U        | n = min <sup>-1</sup> | f = mm/min |
| 1.1                               | 36Mn 6    | < 450               | 110                                             | 0,18            | 7.000                 | 1260       | 0,24            | 4.200                 | 1.000      | 0,30            | 3.100                 | 930        |
| 1.2                               | CM45      | <650                | 90                                              | 0,18            | 6.500                 | 1170       | 0,24            | 3.800                 | 920        | 0,30            | 2.700                 | 810        |
| 1.3                               | 24CrMo5   | <850                | 110                                             | 0,18            | 7.000                 | 1260       | 0,24            | 4.200                 | 1.000      | 0,30            | 3.100                 | 930        |
| 1.4                               | 43CrMo4   | <950                | 90                                              | 0,18            | 6.500                 | 1170       | 0,24            | 3.800                 | 920        | 0,30            | 2.700                 | 810        |
| 2.1                               | 21MnCr5   | <600                | 80                                              | 0,15            | 5.400                 | 800        | 0,22            | 3.200                 | 700        | 0,28            | 2.300                 | 650        |
| 2.2                               | 26CrMo4   | <950                | 80                                              | 0,16            | 5.400                 | 870        | 0,22            | 3.200                 | 700        | 0,28            | 2.300                 | 650        |
| 2.3                               | 41CrAlMo7 | <1100               | 60                                              | 0,15            | 4.200                 | 630        | 0,20            | 2.600                 | 520        | 0,26            | 1.800                 | 470        |
| 2.5                               | 34CrAlS5  | <1000               | 80                                              | 0,15            | 5.400                 | 800        | 0,20            | 3.200                 | 640        | 0,26            | 2.300                 | 600        |
| 2.6                               | 31CrMoV9  | >1000               | 80                                              | 0,15            | 5.400                 | 800        | 0,20            | 3.200                 | 640        | 0,26            | 2.300                 | 600        |
| 3.1                               | X36CrMo17 | <700-1000           | 45                                              | 0,08            | 2.800                 | 220        | 0,12            | 1.700                 | 200        | 0,18            | 1.000                 | 180        |
| 3.2                               | X12CrS13  | <700                | 45                                              | 0,08            | 2.800                 | 220        | 0,12            | 1.700                 | 200        | 0,18            | 1.000                 | 180        |
| 7.1                               | GG15      | <260HB              | 110                                             | 0,24            | 8.000                 | 1900       | 0,30            | 5.200                 | 1.550      | 0,40            | 3.400                 | 1.350      |
| 7.2                               | GG40      | <200HB              | 90                                              | 0,24            | 6.700                 | 1600       | 0,30            | 4.200                 | 1.250      | 0,40            | 2.800                 | 1.120      |
| 7.3                               | GG50      | <250HB              | 80                                              | 0,20            | 6.400                 | 1300       | 0,25            | 4.000                 | 1.000      | 0,35            | 2.600                 | 910        |
| 7.4                               | GGG70     | <250HB              | 70                                              | 0,10            | 4.800                 | 480        | 0,12            | 3.000                 | 360        | 0,15            | 2.000                 | 300        |



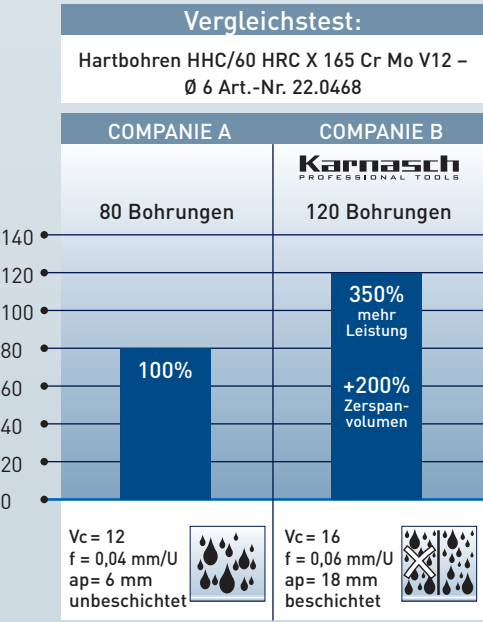
Vollhartmetall-Hochleistungsbohrer 55<70 HRC

Art. 22.0468

- HRC 55-70
- GJL
- GJS
- GTW GTS
- kurzspanend short chip



- Solid carbide twist drill, hardness of work materials 55<70 HRC
- taladro de gran potencia 55<70 HRC
- Высокопроизводительное сверло 55<70 HRC



MICRO GRAIN KARNASCH NORM

H DIN 6535 Form HA

15° 140°

HHC

HARDLUBE

Schnittdaten  
Cutting data

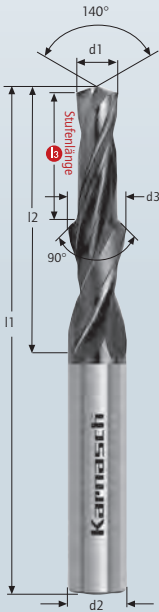
i S. 320

| Art.            | d1 m7          | l3  | d2 h6 | l1 | l2  | €     |
|-----------------|----------------|-----|-------|----|-----|-------|
| 220468.0030     | • 0,3          | 2,5 | 3     | 38 | 0,9 | 43,50 |
| 220468.0040     | • 0,4          | 2,5 | 3     | 38 | 1,2 | 43,50 |
| 220468.0050     | • 0,5          | 2,5 | 3     | 38 | 1,5 | 43,50 |
| 220468.0060     | • 0,6          | 2,5 | 3     | 38 | 1,8 | 43,50 |
| 220468.0070     | • 0,7          | 2,5 | 3     | 38 | 2,1 | 43,50 |
| 220468.0080     | • 0,8          | 2,5 | 3     | 38 | 2,4 | 43,50 |
| 220468.0090     | • 0,9          | 2,5 | 3     | 38 | 2,7 | 43,50 |
| 220468.0100     | • 1,0          | 8   | 3     | 50 | 3,0 | 43,50 |
| 220468.0110     | • 1,1          | 8   | 3     | 50 | 3,3 | 45,50 |
| 220468.0120     | • 1,2          | 8   | 3     | 50 | 3,6 | 45,50 |
| 220468.0130     | • 1,3          | 8   | 3     | 50 | 3,9 | 45,50 |
| 220468.0140     | • 1,4          | 8   | 3     | 50 | 4,2 | 45,50 |
| 220468.0150     | • 1,5          | 8   | 3     | 50 | 4,5 | 45,50 |
| 220468.0160     | • 1,6          | 8   | 3     | 50 | 4,8 | 45,50 |
| 220468.0170     | • 1,7          | 8   | 3     | 50 | 5,1 | 45,50 |
| 220468.0180     | • 1,8          | 8   | 3     | 50 | 5,4 | 45,50 |
| 220468.0190     | • 1,9          | 8   | 3     | 50 | 5,8 | 45,50 |
| 220468.0200     | • 2,0          | 14  | 3     | 50 | 6,0 | 45,50 |
| 220468.0260     | • 2,6/M3 x 0,5 | 6   | 3     | 46 | 16  | 64,00 |
| 220468.0300     | • 3,0          | 6   | 3     | 46 | 16  | 64,00 |
| NEU 220468.0320 | • 3,2          | 6   | 4     | 48 | 16  | 64,00 |
| NEU 220468.0330 | • 3,3          | 6   | 4     | 48 | 16  | 64,00 |
| NEU 220468.0340 | • 3,4          | 10  | 4     | 50 | 20  | 64,00 |
| 220468.0350     | • 3,5/M4 x 0,7 | 10  | 4     | 50 | 20  | 64,00 |
| NEU 220468.0380 | • 3,8          | 12  | 4     | 52 | 22  | 64,00 |
| NEU 220468.0390 | • 3,9          | 12  | 4     | 52 | 22  | 64,00 |
| 220468.0400     | • 4,0          | 12  | 4     | 52 | 22  | 64,00 |
| NEU 220468.0410 | • 4,1          | 15  | 6     | 65 | 25  | 73,50 |
| NEU 220468.0420 | • 4,2          | 15  | 6     | 65 | 25  | 73,50 |
| NEU 220468.0430 | • 4,3          | 15  | 6     | 68 | 28  | 73,50 |
| 220468.0440     | • 4,4/M5 x 0,8 | 15  | 6     | 68 | 28  | 73,50 |
| 220468.0450     | • 4,5          | 15  | 6     | 68 | 28  | 73,50 |
| NEU 220468.0470 | • 4,7          | 15  | 6     | 68 | 28  | 73,50 |
| NEU 220468.0480 | • 4,8          | 18  | 6     | 72 | 32  | 76,50 |
| NEU 220468.0490 | • 4,9          | 18  | 6     | 72 | 32  | 76,50 |
| 220468.0500     | • 5,0          | 18  | 6     | 72 | 32  | 76,50 |
| NEU 220468.0510 | • 5,1          | 18  | 6     | 72 | 32  | 76,50 |
| NEU 220468.0520 | • 5,2          | 18  | 6     | 72 | 32  | 76,50 |
| 220468.0530     | • 5,3/M6 x 1   | 18  | 6     | 72 | 32  | 76,50 |
| 220468.0550     | • 5,5          | 18  | 6     | 75 | 35  | 76,50 |

| Art.            | d1 m7             | l3 | d2 h6 | l1  | l2 | €      |
|-----------------|-------------------|----|-------|-----|----|--------|
| NEU 220468.0560 | • 5,6             | 18 | 6     | 75  | 35 | 76,50  |
| NEU 220468.0570 | • 5,7             | 18 | 6     | 75  | 35 | 76,50  |
| NEU 220468.0580 | • 5,8             | 18 | 6     | 75  | 35 | 76,50  |
| NEU 220468.0590 | • 5,9             | 18 | 6     | 75  | 35 | 76,50  |
| 220468.0600     | • 6,0             | 18 | 6     | 75  | 35 | 76,50  |
| NEU 220468.0610 | • 6,1             | 25 | 8     | 80  | 40 | 95,50  |
| NEU 220468.0640 | • 6,4             | 25 | 8     | 80  | 40 | 95,50  |
| NEU 220468.0650 | • 6,5             | 25 | 8     | 80  | 40 | 95,50  |
| NEU 220468.0660 | • 6,6             | 25 | 8     | 80  | 40 | 95,50  |
| NEU 220468.0670 | • 6,7             | 25 | 8     | 80  | 40 | 95,50  |
| NEU 220468.0680 | • 6,8             | 30 | 8     | 85  | 45 | 95,50  |
| NEU 220468.0690 | • 6,9             | 30 | 8     | 85  | 45 | 95,50  |
| NEU 220468.0700 | • 7,0             | 30 | 8     | 85  | 45 | 95,50  |
| 220468.0710     | • 7,1/M8 x 1,25   | 30 | 8     | 85  | 45 | 95,50  |
| NEU 220468.0720 | • 7,2             | 30 | 8     | 85  | 45 | 95,50  |
| 220468.0730     | • 7,3/M8 x 1      | 30 | 8     | 85  | 45 | 95,50  |
| 220468.0750     | • 7,5             | 30 | 8     | 85  | 45 | 95,50  |
| NEU 220468.0760 | • 7,6             | 35 | 8     | 98  | 50 | 125,50 |
| NEU 220468.0780 | • 7,8             | 35 | 8     | 98  | 50 | 125,50 |
| 220468.0800     | • 8,0             | 35 | 8     | 98  | 50 | 125,50 |
| NEU 220468.0850 | • 8,5             | 35 | 10    | 98  | 50 | 125,50 |
| NEU 220468.0860 | • 8,6             | 42 | 10    | 105 | 57 | 125,50 |
| 220468.0880     | • 8,8/M10 x 1,5   | 42 | 10    | 105 | 57 | 125,50 |
| 220468.0900     | ▲ 9,0             | 42 | 10    | 105 | 57 | 125,50 |
| 220468.0930     | • 9,3/M10 x 1,0   | 42 | 10    | 105 | 57 | 125,50 |
| 220468.0950     | ▲ 9,5             | 42 | 10    | 105 | 57 | 125,50 |
| NEU 220468.0970 | • 9,7             | 45 | 10    | 111 | 63 | 125,50 |
| NEU 220468.0980 | • 9,8             | 45 | 10    | 111 | 63 | 125,50 |
| 220468.1000     | • 10,0            | 45 | 10    | 111 | 63 | 125,50 |
| NEU 220468.1020 | • 10,2            | 45 | 10    | 111 | 63 | 152,00 |
| NEU 220468.1030 | • 10,3            | 45 | 10    | 111 | 63 | 152,00 |
| 220468.1050     | • 10,5/M12 x 1,75 | 45 | 12    | 111 | 63 | 152,00 |
| 220468.1080     | • 10,8/M12 x 1,5  | 50 | 12    | 111 | 63 | 154,00 |
| NEU 220468.1100 | • 11,0            | 50 | 12    | 119 | 71 | 154,00 |
| 220468.1150     | ▲ 11,5            | 50 | 12    | 119 | 71 | 158,00 |
| 220468.1190     | • 11,9            | 50 | 12    | 119 | 71 | 158,00 |
| NEU 220468.1200 | • 12,0            | 50 | 12    | 119 | 71 | 158,00 |
| NEU 220468.1300 | • 13,0            | 55 | 14    | 125 | 77 | 171,50 |
| NEU 220468.1400 | • 14,0            | 55 | 14    | 125 | 77 | 171,50 |

Art. 22.0471 Hochleistung-Vollhartmetall-Stufenbohrer

- UNI
- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 52
- kurz-  
spanend  
short chip



- High capacity solid carbide twist drill
- Taladro de niveles de gran potencia y metal duro y macizo
- Высокопроизводительное ступенчатое сверло сквозной закалки

| Art.      | Gewinde Ø | d1 m7 | d2 h6 | d3 h8 | l3   | l2 | l1  | €      |
|-----------|-----------|-------|-------|-------|------|----|-----|--------|
| 220471.03 | • M 3     | 2,5   | 6,0   | 6     | 8,8  | 20 | 62  | 33,00  |
| 220471.04 | • M 4     | 3,3   | 6,0   | 6     | 11,4 | 24 | 62  | 37,00  |
| 220471.05 | • M 5     | 4,2   | 6,0   | 6     | 13,6 | 28 | 66  | 43,00  |
| 220471.06 | • M 6     | 5,0   | 8,0   | 8     | 16,5 | 34 | 79  | 54,00  |
| 220471.08 | • M 8     | 6,8   | 10,0  | 10    | 21,0 | 47 | 89  | 86,00  |
| 220471.10 | • M 10    | 8,5   | 12,0  | 12    | 25,5 | 55 | 102 | 106,00 |
| 220471.12 | • M 12    | 10,2  | 14,0  | 14    | 30,0 | 60 | 107 | 149,00 |
| 220471.14 | • M 14    | 12,0  | 16,0  | 16    | 34,5 | 65 | 115 | 175,00 |
| 220471.16 | • M 16    | 14,0  | 18,0  | 18    | 38,5 | 73 | 123 | 186,00 |

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HA

HSC HPC

DVC-X2

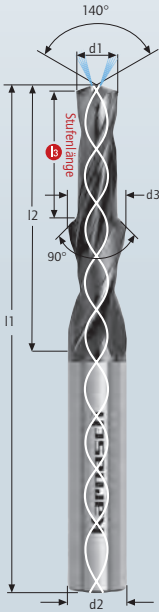
Schnittdaten  
Cutting data



i S. 318

Art. 22.0473 Hochleistung-Vollhartmetall-Mehrfasen-Stufenbohrer, mit Innenkühlung

- UNI
- STAHL  
steel
- INOX  
stainless  
steel
- GJL
- GJS
- GTW  
GTS
- HRC  
< 45
- kurz-  
spanend  
short chip



- High capacity Solid carbide subland twist drill, with interior cooling
- Taladro de niveles de gran potencia de varias fases y metal duro y macizo con refrigeración interna
- Высокопроизводительное многофазное ступенчатое сверло сквозной закалки с внутренним охлаждением

| Art.      | Gewinde Ø | d1 m7 | d2 h6 | d3 h8 | l3   | l2 | l1  | €      |
|-----------|-----------|-------|-------|-------|------|----|-----|--------|
| 220473.04 | • M 4     | 3,3   | 6,0   | 6     | 11,4 | 24 | 62  | 56,00  |
| 220473.05 | • M 5     | 4,2   | 6,0   | 6     | 13,6 | 28 | 66  | 62,00  |
| 220473.06 | • M 6     | 5,0   | 8,0   | 8     | 16,5 | 34 | 79  | 82,00  |
| 220473.08 | • M 8     | 6,8   | 10,0  | 10    | 21,0 | 47 | 89  | 131,00 |
| 220473.10 | • M 10    | 8,5   | 12,0  | 12    | 25,5 | 55 | 102 | 162,00 |
| 220473.12 | • M 12    | 10,2  | 14,0  | 14    | 30,0 | 60 | 107 | 221,00 |
| 220473.14 | • M 14    | 12,0  | 16,0  | 16    | 34,5 | 65 | 115 | 271,00 |
| 220473.16 | • M 16    | 14,0  | 18,0  | 18    | 38,5 | 73 | 123 | 306,00 |

MICRO GRAIN

KARNASCH NORM

N

DIN 6535 Form HAK

HSC HPC

DVC-X2

Schnittdaten  
Cutting data



i S. 318

Vollhartmetall Hochleistungsbohrer- und Aufbohrer, 3 Schneiden

Art. 22.0520

GJL

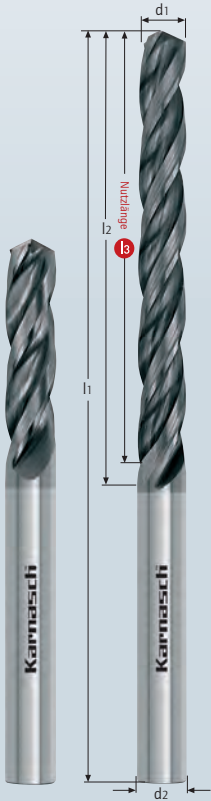
GJS

GTW  
GTS

GRAPHIT  
graphite

HRC  
< 52

kurz-  
spanend  
short chip



Solid carbide twist drill/cordrill, 3 cutting edges

Broca escariadora de metal duro integral de alto rendimiento, 3 filos de corte

Цельно-твердосплавные спиральные сверла, 3 режущие кромки

| Art.            | d1 h7  | l3 | l2  | l1  | d2 <sup>-0,002</sup> <sub>-0,005</sub> | €      |
|-----------------|--------|----|-----|-----|----------------------------------------|--------|
| 220520.0300.012 | • 3,0  | 12 | 16  | 46  | 3                                      | 22,50  |
| 220520.0300.029 | • 3,0  | 29 | 33  | 61  | 3                                      | 24,50  |
| 220520.0400.017 | • 4,0  | 17 | 22  | 55  | 4                                      | 22,50  |
| 220520.0400.038 | • 4,0  | 38 | 43  | 75  | 4                                      | 24,50  |
| 220520.0500.020 | • 5,0  | 20 | 26  | 62  | 5                                      | 24,50  |
| 220520.0500.046 | • 5,0  | 46 | 52  | 86  | 5                                      | 35,00  |
| 220520.0600.021 | • 6,0  | 21 | 28  | 66  | 6                                      | 29,00  |
| 220520.0600.050 | • 6,0  | 50 | 57  | 93  | 6                                      | 39,50  |
| 220520.0700.026 | • 7,0  | 26 | 34  | 74  | 7                                      | 34,00  |
| 220520.0700.061 | • 7,0  | 61 | 70  | 109 | 7                                      | 55,50  |
| 220520.0800.027 | • 8,0  | 27 | 37  | 79  | 8                                      | 41,50  |
| 220520.0800.065 | • 8,0  | 65 | 75  | 117 | 8                                      | 63,00  |
| 220520.0900.029 | • 9,0  | 29 | 40  | 84  | 9                                      | 50,00  |
| 220520.0900.070 | • 9,0  | 70 | 80  | 125 | 9                                      | 94,50  |
| 220520.1000.031 | • 10,0 | 31 | 44  | 90  | 10                                     | 63,00  |
| 220520.1000.075 | • 10,0 | 75 | 87  | 135 | 10                                     | 116,00 |
| 220520.1200.037 | • 12,0 | 37 | 50  | 102 | 12                                     | 109,50 |
| 220520.1200.088 | • 12,0 | 88 | 100 | 150 | 12                                     | 165,50 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HSC  
HPC



DVC-X2



Schnittdaten  
Cutting data



i S. 316

Vollhartmetall Hochleistungsbohrer- und Aufbohrer, 3 Schneiden

Art. 22.0525

GJL

GJS

GTW  
GTS

GRAPHIT  
graphite

HRC  
< 52

kurz-  
spanend  
short chip



Solid carbide twist drill/cordrill, 3 cutting edges

Broca escariadora de metal duro integral de alto rendimiento 3 filos de corte, refrigeración interior

Цельно-твердосплавные спиральные сверла, 3 режущие кромки с внутренней подачей Сож

| Art.            | d1 h7  | l3 | l2  | l1  | d2 <sup>-0,002</sup> <sub>-0,005</sub> | €      |
|-----------------|--------|----|-----|-----|----------------------------------------|--------|
| 220525.0400.040 | • 4,0  | 40 | 43  | 82  | 6                                      | 81,00  |
| 220525.0500.045 | • 5,0  | 45 | 52  | 92  | 6                                      | 81,00  |
| 220525.0600.050 | • 6,0  | 50 | 57  | 95  | 6                                      | 81,00  |
| 220525.0800.065 | • 8,0  | 65 | 75  | 115 | 8                                      | 120,00 |
| 220525.1000.075 | • 10,0 | 75 | 88  | 130 | 10                                     | 147,50 |
| 220525.1200.088 | • 12,0 | 88 | 100 | 150 | 12                                     | 236,50 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HAK



HSC  
HPC



DVC-X2



Schnittdaten  
Cutting data



i S. 316

Art. 22.0526

PKD- bestückte Vollhartmetall- Hochleistungsbohrer Vierfasenbohrer

ALU  
> 6% Si

ALU  
< 6% Si

ALU  
aluminium

MESSING  
brass

KUPFER  
copper

GFK-CFK  
GFK-CFK

THERMO-PLAST  
THERMO-PLASTICS

DURO-PLASTE  
DURO-PLASTICS

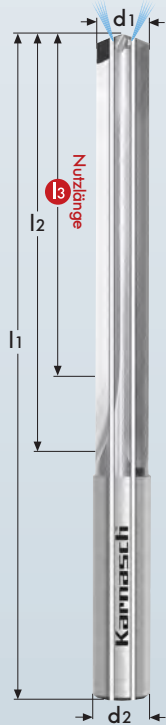
Aramid-faser  
AFK-SFK

Hybrid-stoffe

CFK-ALU  
Composite

GRAPHIT  
graphite

NE  
non-ferrous



- Solid carbide four-phase drill with PCD tips
- Talandro de gran potencia de PCD cuatro fases, para taladrar H7
- PCD Высокопроизводительное сверло сквозной закалки для отверстия H7 - четырехфазное сверло

PKD  
MICRO-GRAIN

DIN  
6537

SPEZIAL

DIN 6535  
Form HAK

HSC  
High-Speed-Cutting

GELÄPPT  
LAPPED

Oil Mist  
ANW. AIR

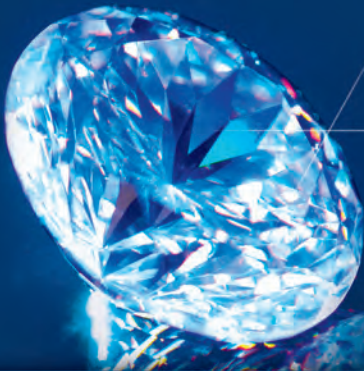
Schnittdaten  
Cutting data

i S. 320

| Art.            | d1 H7  | l3  | l2  | l1  | d2 <sup>-0,002</sup> <sub>-0,005</sub> | €        |
|-----------------|--------|-----|-----|-----|----------------------------------------|----------|
| 220526.0800.094 | • 8,0  | 94  | 108 | 146 | 8,0                                    | 583,00   |
| 220526.1000.080 | • 10,0 | 80  | 95  | 142 | 10,0                                   | 588,50   |
| 220526.1000.110 | • 10,0 | 110 | 120 | 162 | 10,0                                   | 742,00   |
| 220526.1200.056 | • 12,0 | 56  | 71  | 118 | 12,0                                   | 535,50   |
| 220526.1200.096 | • 12,0 | 96  | 114 | 162 | 12,0                                   | 806,00   |
| 220526.1200.142 | • 12,0 | 142 | 156 | 204 | 12,0                                   | 1.028,00 |

Karnasch™  
PROFESSIONAL TOOLS

DIAMOND COATED



CBN



PKD  
PCD



Naturdiamant  
ND



Monokristallin  
Diamant  
MCD



CVD /  
Diamant coated

PKD/PCD EXTREME



# High-Precision-Werkzeuge aus dem Hause Karnasch

## High-Precision-Tools from Karnasch

Metallverarbeitende Unternehmen brauchen die absolute Gewissheit, mit hochwertigen, leistungsstarken und prozesssicheren Werkzeugen zu arbeiten. Karnasch Professional Tools bietet das, worauf es ankommt!

Wir sind ein weltweit agierendes Unternehmen mit Hauptsitz im badischen Heddesheim, das

- Hochleistungswerkzeuge zur Metallverarbeitung von herausragender Qualität produziert und vertreibt,
- seit 1961 auf dem Markt tätig ist und dementsprechend über große Erfahrung, umfassendes Know-how sowie überdurchschnittliche Kundenorientierung verfügt,
- durch intelligente Lagerhaltung jederzeit die sofortige Lieferbarkeit seiner Produkte garantiert,
- in vielen Regionen der Welt Vertriebspartner hat, damit auch für Ihre Auslandsniederlassungen eine permanente Versorgung und begleitender Service gewährleistet ist,
- Support groß schreibt und diesen Anspruch u.a. durch eine Service-Hotline auch erfüllt,
- mit der Eröffnung einer Niederlassung in Görsdorf (Brandenburg) bereits im Jahr 1992 auf gesamtdeutsche Präsenz gesetzt hat.

Weltweit zählen Kunden aus folgenden Bereichen auf Karnasch Professional Tools:

- Werkzeug- und Formenbau,
- Luft- und Raumfahrt,
- Automobilindustrie,
- Schiff- und Eisenbahnbau,
- Hoch-, Stahl- und Brückenbau.

Metal working companies require absolute certainty to work with high-quality, high-performance and reliable tools. Karnasch Professional Tools offers all that matters!

We are a family-run business that is actively involved on a worldwide scale, with our head office in Heddesheim in Baden, which

- produces and distributes excellent quality, high performance tools for metal working,
- has been active in the market since 1961 and has accordingly obtained invaluable experience, comprehensive know-how and above average customer orientation,
- guarantees immediate availability of our products at any time thanks to intelligent stock-keeping,
- has sales partners in many regions of the world, and can thus also ensure a continuous and accompanying service for your overseas branches.
- places an emphasis on support and fulfils this claim via, amongst other things, a service hotline.
- cemented our presence throughout Germany with the opening of a branch in Görsdorf (Brandenburg) in 1992.

**Our customers predominantly come from the following sectors:**

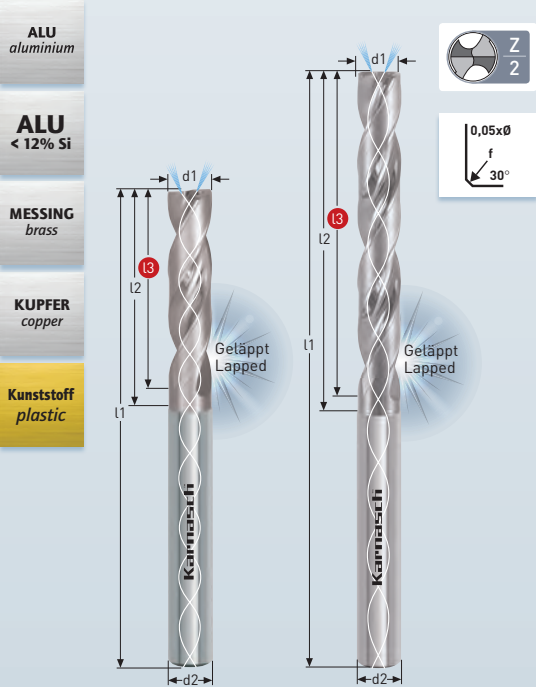
- Tool and mould making,
- Aviation and astronautics,
- The automotive industry,
- Shipbuilding and railway construction,
- Structural engineering, steel construction and bridge building.



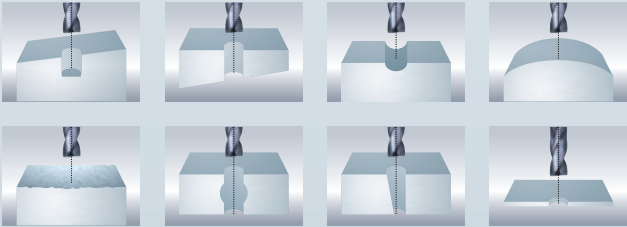
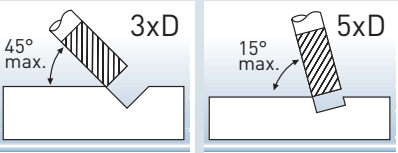
Weitere Informationen zu unserer kompletten Produktpalette erhalten Sie auch im Internet unter:

[WWW.KARNASCH.COM](http://WWW.KARNASCH.COM)

Art. 22.0530 Vollhartmetall-Hochleistungsflachkopfborher für Aluminium



- Solid carbide shallow drill 180° for aluminium
- Taladro de gran potencia de metal duro y macizo
- Высокопроизводительное сверло сквозной заковки



**MICRO GRAIN**

**KARNASCH NORM**

**W**

**DIN 6535 Form HAK**

**HSC HPC**

**GELÄPPT LAPPED**

Schnittdaten  
Cutting data



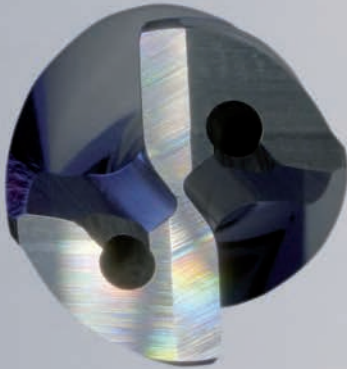
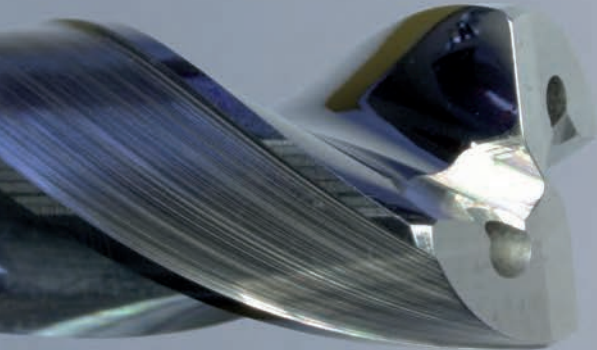
i S. 308

| Art.            | d1 h7  | <b>l3</b> | l2 | l1 | d2 h6 | €            |
|-----------------|--------|-----------|----|----|-------|--------------|
| 220530.0300.014 | • 3,00 | <b>14</b> | 20 | 62 | 6,0   | <b>81,00</b> |
| 220530.0300.023 | • 3,00 | <b>23</b> | 28 | 66 | 6,0   | <b>97,00</b> |
| 220530.0320.014 | • 3,20 | <b>14</b> | 20 | 62 | 6,0   | <b>81,00</b> |
| 220530.0320.023 | • 3,20 | <b>23</b> | 28 | 66 | 6,0   | <b>97,00</b> |
| 220530.0330.014 | • 3,30 | <b>14</b> | 20 | 62 | 6,0   | <b>81,00</b> |
| 220530.0330.023 | • 3,30 | <b>23</b> | 28 | 66 | 6,0   | <b>97,00</b> |
| 220530.0340.014 | • 3,40 | <b>14</b> | 20 | 62 | 6,0   | <b>81,00</b> |
| 220530.0340.023 | • 3,40 | <b>23</b> | 28 | 66 | 6,0   | <b>97,00</b> |
| 220530.0350.014 | • 3,50 | <b>14</b> | 20 | 62 | 6,0   | <b>81,00</b> |
| 220530.0350.023 | • 3,50 | <b>23</b> | 28 | 66 | 6,0   | <b>97,00</b> |
| 220530.0370.017 | • 3,70 | <b>17</b> | 20 | 62 | 6,0   | <b>81,00</b> |
| 220530.0370.023 | • 3,70 | <b>23</b> | 28 | 66 | 6,0   | <b>97,00</b> |
| 220530.0380.017 | • 3,80 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0380.029 | • 3,80 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0390.017 | • 3,90 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0390.029 | • 3,90 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0400.017 | • 4,00 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0400.029 | • 4,00 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0420.017 | • 4,20 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0420.029 | • 4,20 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0430.017 | • 4,30 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0430.029 | • 4,30 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0450.017 | • 4,50 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0450.029 | • 4,50 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0465.017 | • 4,65 | <b>17</b> | 24 | 66 | 6,0   | <b>81,00</b> |
| 220530.0465.029 | • 4,65 | <b>29</b> | 36 | 74 | 6,0   | <b>97,00</b> |
| 220530.0480.020 | • 4,80 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0480.035 | • 4,80 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0500.020 | • 5,00 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0500.035 | • 5,00 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0510.020 | • 5,10 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0510.035 | • 5,10 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0520.020 | • 5,20 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0520.035 | • 5,20 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0530.020 | • 5,30 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0530.035 | • 5,30 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0540.020 | • 5,40 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0540.035 | • 5,40 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0550.020 | • 5,50 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0550.035 | • 5,50 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0555.020 | • 5,55 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0555.035 | • 5,55 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0560.020 | • 5,60 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0560.035 | • 5,60 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0570.020 | • 5,70 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0570.035 | • 5,70 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |
| 220530.0580.020 | • 5,80 | <b>20</b> | 28 | 66 | 6,0   | <b>81,00</b> |
| 220530.0580.035 | • 5,80 | <b>35</b> | 44 | 82 | 6,0   | <b>97,00</b> |

| Art.            | d1 h7  | <b>l3</b> | l2 | l1  | d2 h6 | €             |
|-----------------|--------|-----------|----|-----|-------|---------------|
| 220530.0600.020 | • 6,00 | <b>20</b> | 28 | 66  | 6,0   | <b>81,00</b>  |
| 220530.0600.035 | • 6,00 | <b>35</b> | 44 | 82  | 6,0   | <b>97,00</b>  |
| 220530.0610.024 | • 6,10 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0610.043 | • 6,10 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0620.024 | • 6,20 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0620.043 | • 6,20 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0630.024 | • 6,30 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0630.043 | • 6,30 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0640.024 | • 6,40 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0640.043 | • 6,40 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0650.024 | • 6,50 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0650.043 | • 6,50 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0660.024 | • 6,60 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0660.043 | • 6,60 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0670.024 | • 6,70 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0670.043 | • 6,70 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0680.024 | • 6,80 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0680.043 | • 6,80 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0690.024 | • 6,90 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0690.043 | • 6,90 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0700.024 | • 7,00 | <b>24</b> | 34 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0700.043 | • 7,00 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0710.029 | • 7,10 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0710.043 | • 7,10 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0720.029 | • 7,20 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0720.043 | • 7,20 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0730.029 | • 7,30 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0730.043 | • 7,30 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0740.029 | • 7,40 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0740.043 | • 7,40 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0750.029 | • 7,50 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0750.043 | • 7,50 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0760.029 | • 7,60 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0760.043 | • 7,60 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0780.029 | • 7,80 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0780.043 | • 7,80 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0790.029 | • 7,90 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0790.043 | • 7,90 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0800.029 | • 8,00 | <b>29</b> | 41 | 79  | 8,0   | <b>99,00</b>  |
| 220530.0800.043 | • 8,00 | <b>43</b> | 53 | 91  | 8,0   | <b>108,00</b> |
| 220530.0810.035 | • 8,10 | <b>35</b> | 47 | 89  | 10,0  | <b>135,00</b> |
| 220530.0810.049 | • 8,10 | <b>49</b> | 61 | 103 | 10,0  | <b>155,00</b> |
| 220530.0820.035 | • 8,20 | <b>35</b> | 47 | 89  | 10,0  | <b>135,00</b> |
| 220530.0820.049 | • 8,20 | <b>49</b> | 61 | 103 | 10,0  | <b>155,00</b> |
| 220530.0830.035 | • 8,30 | <b>35</b> | 47 | 89  | 10,0  | <b>135,00</b> |
| 220530.0830.049 | • 8,30 | <b>49</b> | 61 | 103 | 10,0  | <b>155,00</b> |
| 220530.0840.035 | • 8,40 | <b>35</b> | 47 | 89  | 10,0  | <b>135,00</b> |
| 220530.0840.049 | • 8,40 | <b>49</b> | 61 | 103 | 10,0  | <b>155,00</b> |

| Art.            | d1 h7   | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|---------|----|----|-----|-------|--------|
| 220530.0850.035 | • 8,50  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0850.049 | • 8,50  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0860.035 | • 8,60  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0860.049 | • 8,60  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0870.035 | • 8,70  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0870.049 | • 8,70  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0880.035 | • 8,80  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0880.049 | • 8,80  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0890.035 | • 8,90  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0890.049 | • 8,90  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0900.035 | • 9,00  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0900.049 | • 9,00  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0910.035 | • 9,10  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0910.049 | • 9,10  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0920.035 | • 9,20  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0920.049 | • 9,20  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0930.035 | • 9,30  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0930.049 | • 9,30  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0950.035 | • 9,50  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0950.049 | • 9,50  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0960.035 | • 9,60  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0960.049 | • 9,60  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0970.035 | • 9,70  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0970.049 | • 9,70  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.0980.035 | • 9,80  | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.0980.049 | • 9,80  | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.1000.035 | • 10,00 | 35 | 47 | 89  | 10,0  | 135,00 |
| 220530.1000.049 | • 10,00 | 49 | 61 | 103 | 10,0  | 155,00 |
| 220530.1010.040 | • 10,10 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1010.056 | • 10,10 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1020.040 | • 10,20 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1020.056 | • 10,20 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1030.040 | • 10,30 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1030.056 | • 10,30 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1050.040 | • 10,50 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1050.056 | • 10,50 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1060.040 | • 10,60 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1060.056 | • 10,60 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1070.040 | • 10,70 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1070.056 | • 10,70 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1080.040 | • 10,80 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1080.056 | • 10,80 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1090.040 | • 10,90 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1090.056 | • 10,90 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1100.040 | • 11,00 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1100.056 | • 11,00 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1120.040 | • 11,20 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1120.056 | • 11,20 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1150.040 | • 11,50 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1150.056 | • 11,50 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1180.040 | • 11,80 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1180.056 | • 11,80 | 56 | 69 | 116 | 12,0  | 216,00 |
| 220530.1200.040 | • 12,00 | 40 | 53 | 100 | 12,0  | 172,00 |
| 220530.1200.056 | • 12,00 | 56 | 69 | 116 | 12,0  | 216,00 |

Art. **22.0530**



Art. 22.2025 Vollhartmetall-Maschinengewindebohrer 50 < 63 HRC, < 1,5 x D

- HRC 50-63
- GJL
- GJS
- GTW GTS
- GRAPHIT graphite
- kurz-spanend short chip



- Solid carbide machine taps, metric 50 < 63 HRC
- Macho metal duro para roscar a máquina 50 < 63 HRC
- Приборный метчик 50 < 63 HRC

**Bearbeitungshinweis:** Verwenden Sie ausschließlich Schneidpaste mit hochdruckzusätzen wie Karnasch Art.-Nr. 60.1155 + 60.1156. Alternativ geeignetes Schneidöl, keine Emulsion.

**Machining indication:** Please use exclusively our cutting paste with the extreme pressure additive karnasch art.-no. 60.1155 + 60.1156. Alternative suitable cutting oil, no emulsion.

**Richtwerte für den Einsatz von VHM-Maschinengewindebohrern 50 < 63 HRC**  
Recommended cutting data for Micro Grain Maschine Taps 50 < 63 HRC

|                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| 50 - 54 HRC<br>Vc = 4 - 6 m/min | 55 < 59 HRC<br>Vc = 3 - 5 m/min | 60 < 63 HRC<br>Vc = 2 - 4 m/min |
|---------------------------------|---------------------------------|---------------------------------|

Vorausgesetzt werden stabile Maschinenverhältnisse. Wir empfehlen Synchronspindel. Keinesfalls von Hand schneiden.  
Prerequisite are stabil machines. Absolutely no manual use. We recommend Synchronspindl. Only with machine.

| Art.      | d1 Gewinde | P    | l1  | l2 | d2 h6 | k   |      | €      |
|-----------|------------|------|-----|----|-------|-----|------|--------|
| 222025.03 | • M 3      | 0,5  | 56  | 14 | 3,5   | 2,7 | 2,6  | 179,00 |
| 222025.04 | • M 4      | 0,7  | 63  | 14 | 4,5   | 3,4 | 3,5  | 183,00 |
| 222025.05 | • M 5      | 0,8  | 70  | 20 | 6,0   | 4,9 | 4,4  | 190,50 |
| 222025.06 | • M 6      | 1,0  | 80  | 24 | 6,0   | 4,9 | 5,3  | 172,00 |
| 222025.08 | • M 8      | 1,25 | 90  | 24 | 8,0   | 6,2 | 7,1  | 201,00 |
| 222025.10 | • M 10     | 1,5  | 100 | 26 | 10,0  | 8,0 | 8,8  | 231,50 |
| 222025.12 | • M 12     | 1,75 | 110 | 24 | 9,0   | 7,0 | 10,5 | 300,50 |

- MICRO GRAIN
- DIN 371 376
- M
- ISO 2 6HX
- 50-63 HRC
- 4-5 x P
- Form D
- 
- HHC
- 
- XXM-1
- 
- 

Art. 22.2215 Vollhartmetall-Maschinengewindebohrer Feingewinde 50 < 63 HRC, < 1,5 x D

- HRC 50-63
- GJL
- GJS
- GTW GTS
- GRAPHIT graphite
- kurz-spanend short chip



- Solid carbide machine taps, metric fine thread 50 < 63 HRC
- Macho metal duro para roscar a máquina rosca fina 50 < 63 HRC
- Приборный метчик, прецизионная резьба, 50 < 63 HRC

**Bearbeitungshinweis:** Verwenden Sie ausschließlich Schneidpaste mit hochdruckzu-sätzen wie Karnasch Art.-Nr. 60.1155 + 60.1156. Alternativ geeignetes Schneidöl, keine Emulsion.

**Machining indication:** Please use exclusively our cutting paste with the extreme pressure additive karnasch art.-no. 60.1155 + 60.1156. Alternative suitable cutting oil, no emulsion.

**Richtwerte für den Einsatz von VHM-Maschinengewindebohrern 50 < 63 HRC**  
Recommended cutting data for Micro Grain Maschine Taps 50 < 63 HRC

|                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| 50 - 54 HRC<br>Vc = 4 - 6 m/min | 55 < 59 HRC<br>Vc = 3 - 5 m/min | 60 < 63 HRC<br>Vc = 2 - 4 m/min |
|---------------------------------|---------------------------------|---------------------------------|

Vorausgesetzt werden stabile Maschinenverhältnisse. Wir empfehlen Synchronspindel. Keinesfalls von Hand schneiden.  
Prerequisite are stabil machines. Absolutely no manual use. We recommend Synchronspindl. Only with machine.

| Art.        | d1 Gewinde | P   | l1  | l2 | d2 | k   |      | €      |
|-------------|------------|-----|-----|----|----|-----|------|--------|
| 222215.081  | • M 8      | 1,0 | 90  | 18 | 8  | 6,2 | 7,3  | 416,00 |
| 222215.101  | • M 10     | 1,0 | 90  | 18 | 10 | 8,0 | 9,3  | 456,50 |
| 222215.1215 | • M 12     | 1,5 | 100 | 18 | 9  | 7,0 | 10,8 | 605,00 |

- MICRO GRAIN
- DIN 371 376
- MF
- ISO 2 6HX
- 50-63 HRC
- 4,5 - P
- Form B
- 
- HHC
- 
- XXM-1
- 
-



Vollhartmetall-Whitworth Rohrgewinde-Gewindebohrer 50-63 HRC, < 1,5 x D

Art. 22.2239

- HRC 50-63
- GJL
- GJS
- GTW GTS
- GRAPHIT graphite
- kurz-spanend short chip



- Solid carbide Whitworth screw tap 50-63 HRC
- Whitworth macho metal duro de roscar 50-63 HRC
- Твердосплавный метчик Whitworth 50-63 HRC

**Bearbeitungshinweis:** Verwenden Sie ausschließlich Schneidpaste mit hochdruckzu-sätzen wie Karnasch Art.-Nr. 60.1155 + 60.1156. Alternativ geeignetes Schneidöl, keine Emulsion.

**Machining indication:** Please use exclusively our cutting paste with the extreme pressure additive karnasch art.-no. 60.1155 + 60.1156. Alternative suitable cutting oil, no emulsion.

**Richtwerte für den Einsatz von VHM-Maschinengewindebohrern 50 < 63 HRC**  
Recommended cutting data for Micro Grain Maschine Taps 50 < 63 HRC

|                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| 50 - 54 HRC<br>Vc = 4 - 6 m/min | 55 < 59 HRC<br>Vc = 3 - 5 m/min | 60 < 63 HRC<br>Vc = 2 - 4 m/min |
|---------------------------------|---------------------------------|---------------------------------|

Vorausgesetzt werden stabile Maschinenverhältnisse. Wir empfehlen Synchronspindel. Keinesfalls von Hand schneiden.  
Prerequisite are stabil machines. Absolutely no manual use. We recommend Synchronspindel. Only with machine.

MICRO GRAIN

DIN 5156

G

ISO 228/BS P

HRC 50-63

4-5 x P  
Form D

HHC

XXM-1

| Art.       | d1 Gewinde | P  | l1  | l2 | d2/h6 | k   |      | €      |
|------------|------------|----|-----|----|-------|-----|------|--------|
| 222239.1/4 | ▲ G 1/8    | 28 | 90  | 24 | 7     | 5,5 | 8,8  | 641,50 |
| 222239.1/8 | ▲ G 1/4    | 19 | 100 | 18 | 11    | 9,0 | 11,9 | 523,50 |

Schmierstoffe & Schneidöl  
Lubricant & Cutting fluids

Art. 60.1156 Art. 60.1155



125 g  
Hochleistungs- SCHNEIDPASTE  
high-effective cutting-paste  
chlorfrei  
chlorine free

60.1155



750 g  
Hochleistungs- SCHNEIDPASTE  
high-effective cutting-paste  
chlorfrei  
chlorine free

60.1156

- Ausführung:** Diese Schneidpaste mit hochwertigen Druckzusätzen erreicht eine extrem hohe Schmierwirkung. Die an den Schneiden haftende Paste wird erst beim Einsatz an gewünschter Stelle flüssig. (Werkzeug in Paste eintauchen) Umweltfreundlich!
- Verwendung:** Unbedingt erforderlich für die HHC-Gewindebearbeitung. Weitere Anwendungsgebiete: Gewindefräsen, Reiben, Räumen, Sägen, Kernlochbohren. Bei schwierigsten Materialien wie: Titan, Chrom-Nickel-Legierungen, rost- und hitzebeständige Stähle. Gebinde: 125g/Dose
- Model:** New developed cutting-paste with pressure additives for high effective lubrication. The paste sticks perfectly on the cutting edges and liquefies itself during performance. (Please dip the tool in the paste)
- Application:** Highly recommended for HHC performance like: thread cutting, reaming, broaching, core drilling, sawing in difficult materials like: titan, chrom-nickel alloys, stainless steel a.s.o. tin/can 125g

| Art.    | g/Dose  | Stück/ piece | €                                       |
|---------|---------|--------------|-----------------------------------------|
| 60.1155 | • 125 g | 1            | Preise siehe Schmierstoffe Gruppe 10    |
| 60.1155 | • 125 g | 10           | For prices refer to lubricants group 10 |

- Ausführung:** Diese Schneidpaste mit hochwertigen Druckzusätzen erreicht eine extrem hohe Schmierwirkung. Die an den Schneiden haftende Paste wird erst beim Einsatz an gewünschter Stelle flüssig. (Werkzeug in Paste eintauchen) Umweltfreundlich!
- Verwendung:** Unbedingt erforderlich für die HHC-Gewindebearbeitung. Weitere Anwendungsgebiete: Gewindefräsen, Reiben, Räumen, Sägen, Kernlochbohren. Bei schwierigsten Materialien wie: Titan, Chrom-Nickel-Legierungen, rost- und hitzebeständige Stähle. Gebinde: 750g/Dose
- Model:** New developed cutting-paste with pressure additives for high effective lubrication. The paste sticks perfectly on the cutting edges and liquefies itself during performance. (Please dip the tool in the paste)
- Application:** Highly recommended for HHC performance like: thread cutting, reaming, broaching, core drilling, sawing in difficult materials like: titan, chrom-nickel alloys, stainless steel a.s.o. tin/can 750g

| Art.    | g/Dose  | Stück/ piece | €                                       |
|---------|---------|--------------|-----------------------------------------|
| 60.1156 | • 750 g | 1            | Preise siehe Schmierstoffe Gruppe 10    |
| 60.1156 | • 750 g | 10           | For prices refer to lubricants group 10 |

Art. 29.0060 PKD-Vollhartmetall-Micro-Hochleistungsbohrer

COMPO-SITES

Sandwich

Aramid-faser  
AFK-SFK

GF  
GF25

Hybrid-stoffe

PVDF  
GF25

CFK-ALU  
Composite

GFK

Schicht-stoffe  
Laminat

CFK

Kevlar

PMMA  
GS

PA66  
GF30

ALU  
< 12% Si

PVDF  
GF30

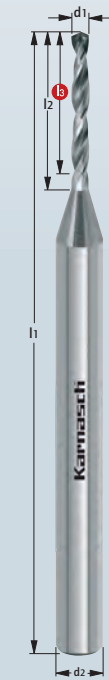
ALU  
> 12% Si

PEEK  
GF30

GRAPHIT  
graphite

PEEK  
CF30

zirkon  
oxid



- PCD equipped solid carbide high performance micro drill
- Microbroca de alto rendimiento de metal duro con contenido de PCD
- Твердосплавные высокопроизводительные микросверла с PCD напылением

| Art.            | d1/h7  | l3 | l2 | l1 | d2/h5 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 290060.0060.060 | ▲ 0,60 | 6  | 7  | 38 | 3     | 311,00 |
| 290060.0080.080 | ▲ 0,80 | 8  | 9  | 38 | 3     | 311,00 |
| 290060.0090.080 | ▲ 0,90 | 8  | 9  | 38 | 3     | 311,00 |
| 290060.0100.090 | ▲ 1,00 | 9  | 10 | 38 | 3     | 311,00 |
| 290060.0110.090 | ▲ 1,10 | 9  | 10 | 38 | 3     | 311,00 |
| 290060.0120.090 | ▲ 1,20 | 9  | 10 | 38 | 3     | 324,00 |
| 290060.0130.080 | ▲ 1,30 | 8  | 10 | 38 | 3     | 324,00 |
| 290060.0140.080 | ▲ 1,40 | 8  | 10 | 38 | 3     | 354,00 |

PKD

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

25°

130°

HSC  
High-Speed-  
Cutting

POLIERT  
POLISHED

OIL Emul  
MMKS

Art. 22.0415 Diamantbeschichtete VHM-Hochleistungsbohrer mit Innenkühlung geeignet für Gewindefräser

Art. 23.2005/23.2006

COMPO-SITES

TI-CFK

GRAPHIT  
graphite

PA66  
GF30

GFK

PVDF  
GF30

CFK

PEEK  
GF30

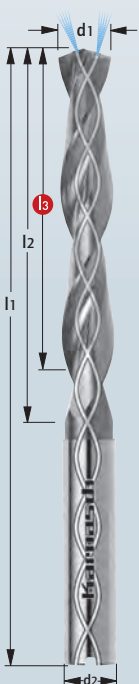
Hybrid-stoffe

PEEK  
CF30

CFK-ALU  
Composite

zirkon  
oxid

Schicht-stoffe  
Laminat



- Diamond coated solid carbide high performance twist drill with internal cooling suitable for thread milling cutter article 23.2005/23.2006
- Brocas de gran rendimiento recubiertas de diamante, de metal duro y macizo, con refrigeración interior apto para fresa de roscas art. 23.2005/23.2006
- Высокопроизводительное цельно-твердосплавное сверло с алмазным слоем и внутренним охлаждением Подходит для резьбовых фрез арт. 23.2005/23.2006

| Art.            | d1 m7               | l3 | l2 | l1  | d2/h6 | €      |
|-----------------|---------------------|----|----|-----|-------|--------|
| 220415.0330.023 | ▲ 3,3 / M4 x 0,7    | 23 | 28 | 66  | 6     | 83,00  |
| 220415.0420.029 | ▲ 4,2 / M5 x 0,8    | 29 | 36 | 74  | 6     | 83,00  |
| 220415.0500.035 | ▲ 5,0 / M6 x 1,0    | 35 | 44 | 82  | 6     | 89,00  |
| 220415.0680.043 | ▲ 6,8 / M8 x 1,25   | 43 | 53 | 91  | 8     | 118,00 |
| 220415.0850.049 | ▲ 8,5 / M10 x 1,50  | 49 | 61 | 103 | 10    | 137,00 |
| 220415.1030.056 | ▲ 10,3 / M12 x 1,75 | 56 | 71 | 118 | 12    | 178,00 |

Nachfolgewerkzeug 29.0120 + 29.0121 + 29.0122

Richtwerte für den Einsatz von Karnasch diamantbeschichtete Hochleistungsbohrer  
Recommended cutting data for twist drill with diamond coating

DIAMANT  
DIAMOND

DIN  
6537

W

DIN 6535  
Form HA

30°

130°

HSC  
HPC

DIAMANT  
DCC 0312

Air

Schnittdaten  
Cutting data



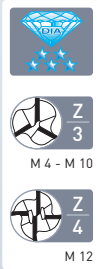
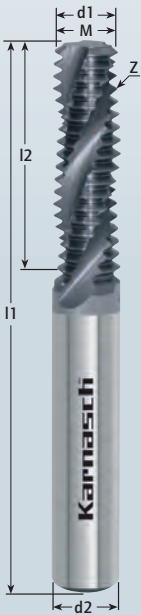
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| Werkstoffgruppe<br>Material group | Werkstoff<br>Workpiece material | Schnittgeschwindigkeit<br>Vc [m/min.] | VORSCHUB PRO UMDREHUNG (mm) |             |              |
|-----------------------------------|---------------------------------|---------------------------------------|-----------------------------|-------------|--------------|
|                                   |                                 |                                       | Ø 3,0 - 5,0                 | Ø 5,1 - 8,0 | Ø 8,1 - 12,0 |
| 14                                | Graphit < Grad 10               | 250                                   | 0,10 - 0,20                 | 0,15 - 0,25 | 0,30 - 0,45  |

Diamantbeschichteter Vollhartmetall Gewindefräser, spiralisiert 30° für Innengewinde ohne Innenkühlung, ohne Senkstufe, metrisches ISO-Gewinde DIN 13 – 2,5 x D

Art. 23.2005

|                        |             |
|------------------------|-------------|
| COMPO-SITES            | TI-CFK      |
| GRAPHIT graphite       | PA66 GF30   |
| GFK                    | PVDF GF30   |
| CFK                    | PEEK GF30   |
| Hybrid-stoffe          | PEEK CF30   |
| CFK-ALU Composite      | zirkon oxid |
| Schicht-stoffe Laminat |             |



Diamond coated solid carbide thread milling cutter, 30° spiral for internal threads, without internal cooling

Fresa de roscas recubierta de diamante, de metal duro y macizo, espiral de 30° – para rosca interior, sin refrigeración interior

Цельно-твердосплавная резьбовая фреза с алмазным слоем, спираль 30° – для внутренней резьбы, без внутреннего охлаждения

|                 |                        |
|-----------------|------------------------|
| DIAMANT DIAMOND | DIN 13                 |
| M               | DIN 6535 Form HA       |
| 30°             |                        |
| 60°             | HSC High-Speed-Cutting |
| DCC 0318        |                        |
| Air             |                        |

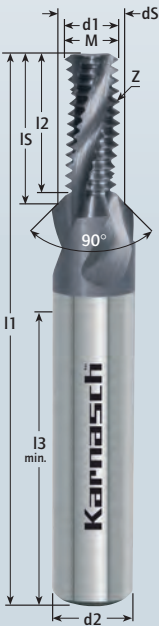
| Art.             | M      | Stg  | x D   | l2    | l1 | d1   | d2 h5 | Z | €      |
|------------------|--------|------|-------|-------|----|------|-------|---|--------|
| 232005.04.070.25 | • M 4  | 0,7  | 2,5xD | 10,85 | 55 | 3,15 | 6     | 3 | 156,00 |
| 232005.05.080.25 | • M 5  | 0,8  | 2,5xD | 13,15 | 55 | 4,00 | 6     | 3 | 159,00 |
| 232005.06.100.25 | • M 6  | 1,0  | 2,5xD | 16,50 | 55 | 4,80 | 6     | 3 | 164,00 |
| 232005.08.125.25 | • M 8  | 1,25 | 2,5xD | 21,80 | 55 | 6,00 | 6     | 3 | 174,00 |
| 232005.10.150.25 | • M 10 | 1,50 | 2,5xD | 26,20 | 65 | 8,00 | 8     | 3 | 208,00 |
| 232005.12.175.25 | • M 12 | 1,75 | 2,5xD | 30,60 | 75 | 9,90 | 10    | 4 | 245,00 |

PKD - CVD Gewindefräser kurzfristig lieferbar!

Diamantbeschichteter Vollhartmetall-Gewindefräser, spiralisiert für Innengewinde ohne Innenkühlung, mit 90° Senkstufe, metrisches ISO-Gewinde DIN 13 – 2,0 x D

Art. 23.2006

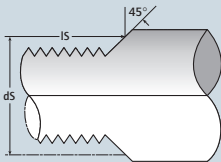
|                        |             |
|------------------------|-------------|
| COMPO-SITES            | TI-CFK      |
| GRAPHIT graphite       | PA66 GF30   |
| GFK                    | PVDF GF30   |
| CFK                    | PEEK GF30   |
| Hybrid-stoffe          | PEEK CF30   |
| CFK-ALU Composite      | zirkon oxid |
| Schicht-stoffe Laminat |             |



Diamond coated solid carbide thread milling cutter, 30° spiral for internal threads, without internal cooling with 90° counter sunk stage

Fresa de roscas recubierta de diamante, de metal duro y macizo, espiral de 30° – para rosca interior, sin refrigeración interior., con descenso de 90°

Цельно-твердосплавная резьбовая фреза с алмазным слоем, спираль 30° – для внутренней резьбы, без внутреннего охлаждения, со ступенью снижения 90°



|                 |                        |
|-----------------|------------------------|
| DIAMANT DIAMOND | DIN 13                 |
| M               | DIN 6535 Form HA       |
| 30°             |                        |
| 60°             | HSC High-Speed-Cutting |
| DCC 0318        |                        |
| Air             |                        |

| Art.             | M      | Stg  | x D   | l2    | l3/min. | l1 | ds   | ls   | d1   | d2 h5 | Z | €      |
|------------------|--------|------|-------|-------|---------|----|------|------|------|-------|---|--------|
| 232006.04.070.20 | • M 4  | 0,7  | 2,0xD | 8,75  | 36      | 55 | 4,2  | 9,3  | 3,14 | 6     | 3 | 162,00 |
| 232006.05.080.20 | • M 5  | 0,8  | 2,0xD | 10,75 | 36      | 55 | 5,3  | 11,3 | 4,00 | 6     | 3 | 169,00 |
| 232006.06.100.20 | • M 6  | 1,0  | 2,0xD | 12,40 | 36      | 65 | 6,3  | 13,1 | 4,80 | 8     | 3 | 186,00 |
| 232006.08.125.20 | • M 8  | 1,25 | 2,0xD | 16,80 | 40      | 75 | 8,3  | 17,6 | 6,50 | 10    | 3 | 226,00 |
| 232006.10.150.20 | • M 10 | 1,50 | 2,0xD | 20,10 | 45      | 80 | 10,3 | 21,2 | 8,20 | 12    | 3 | 305,00 |
| 232006.12.175.20 | • M 12 | 1,75 | 2,0xD | 25,20 | 45      | 90 | 12,3 | 26,4 | 9,90 | 14    | 4 | 354,00 |

PKD - CVD Gewindefräser kurzfristig lieferbar!

Art. 29.0080 A

Art. 29.0080 B

Vollhartmetall-Hochleistungsbohrer GFK/CFK



- Solid carbide twist drill GFK/CFK
- Taladro de grau potencia de metal duro y macizo GFK/CFK
- Высокопроизводительное сверло сквозной заковки GFK/CFK

MICRO GRAINKARNASCH NORM

SPEZIALForm HA

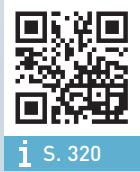
30°

HSCHigh-Speed-Cutting

DCA-06Polished

Air

Schnittdaten  
Cutting data



|        |    |    |     |      | DIAMANT<br>DCA-06<br>29.0080 A |        | POLIERT<br>POLISHED<br>29.0080 B |        |
|--------|----|----|-----|------|--------------------------------|--------|----------------------------------|--------|
| d1 +   | l3 | l2 | l1  | d2h5 | Art.                           | €      | Art.                             | €      |
| • 3,0  | 12 | 16 | 45  | 3,0  | 290080A.0300.012               | 44,00  | 290080B.0300.012                 | 25,00  |
| • 3,2  | 14 | 18 | 50  | 3,2  | 290080A.0320.014               | 57,00  | 290080B.0320.014                 | 25,00  |
| • 3,3  | 14 | 18 | 50  | 3,2  | -                              | -      | 290080B.0330.014                 | 25,00  |
| • 3,5  | 15 | 20 | 50  | 3,5  | 290080A.0350.015               | 57,00  | 290080B.0350.015                 | 25,00  |
| • 3,7  | 15 | 20 | 52  | 3,7  | -                              | -      | 290080B.0370.015                 | 25,00  |
| • 4,0  | 17 | 22 | 55  | 4,0  | 290080A.0400.017               | 57,00  | 290080B.0400.017                 | 25,00  |
| • 4,2  | 17 | 22 | 55  | 4,2  | -                              | -      | 290080B.0420.017                 | 29,00  |
| • 4,5  | 18 | 25 | 57  | 4,5  | 290080A.0450.018               | 75,00  | 290080B.0450.018                 | 29,00  |
| • 4,7  | 18 | 24 | 58  | 4,7  | -                              | -      | 290080B.0470.018                 | 36,00  |
| • 5,0  | 20 | 25 | 62  | 5,0  | 290080A.0500.020               | 81,00  | 290080B.0500.020                 | 36,00  |
| • 5,3  | 20 | 26 | 62  | 5,3  | -                              | -      | 290080B.0530.020                 | 36,00  |
| • 5,5  | 20 | 28 | 65  | 5,5  | 290080A.0550.020               | 87,00  | 290080B.0550.020                 | 42,00  |
| • 5,8  | 20 | 28 | 66  | 5,8  | -                              | -      | 290080B.0580.020                 | 42,00  |
| • 6,0  | 20 | 28 | 65  | 6,0  | 290080A.0600.020               | 87,00  | 290080B.0600.020                 | 42,00  |
| • 6,5  | 22 | 30 | 70  | 6,5  | 290080A.0650.022               | 108,00 | 290080B.0650.022                 | 46,00  |
| • 7,0  | 25 | 33 | 75  | 7,0  | 290080A.0700.025               | 113,00 | 290080B.0700.025                 | 51,00  |
| • 7,5  | 25 | 33 | 74  | 7,5  | -                              | -      | 290080B.0750.025                 | 51,00  |
| • 8,0  | 27 | 36 | 80  | 8,0  | 290080A.0800.027               | 123,00 | 290080B.0800.027                 | 61,00  |
| • 8,5  | 27 | 36 | 80  | 8,5  | 290080A.0850.027               | 139,00 | 290080B.0850.027                 | 67,00  |
| • 9,0  | 30 | 40 | 85  | 9,0  | 290080A.0900.030               | 142,00 | 290080B.0900.030                 | 71,00  |
| • 9,5  | 30 | 37 | 84  | 9,5  | -                              | -      | 290080B.0950.030                 | 78,00  |
| • 10,0 | 32 | 42 | 90  | 10,0 | 290080A.1000.032               | 154,00 | 290080B.1000.032                 | 82,00  |
| • 10,5 | 32 | 42 | 90  | 10,5 | -                              | -      | 290080B.1050.032                 | 93,00  |
| • 11,0 | 34 | 47 | 95  | 11,0 | -                              | -      | 290080B.1100.034                 | 106,00 |
| • 11,5 | 34 | 47 | 95  | 11,5 | -                              | -      | 290080B.1150.034                 | 117,00 |
| • 12,0 | 35 | 50 | 100 | 12,0 | 290080A.1200.035               | 200,00 | 290080B.1200.035                 | 117,00 |
| • 13,0 | 35 | 50 | 100 | 13,0 | -                              | -      | 290080B.1300.035                 | 117,00 |
| • 14,0 | 37 | 54 | 105 | 14,0 | -                              | -      | 290080B.1400.037                 | 117,00 |
| • 15,0 | 38 | 56 | 110 | 15,0 | -                              | -      | 290080B.1500.038                 | 117,00 |
| • 16,0 | 38 | 58 | 115 | 16,0 | -                              | -      | 290080B.1600.038                 | 117,00 |

| 29.0080 A |                                   | 29.0080 B                         |  |
|-----------|-----------------------------------|-----------------------------------|--|
| d1 tol.   | Bohrertoleranz<br>Drill tolerance | Bohrertoleranz<br>Drill tolerance |  |
| > 3,0     | + 0,005                           | + 0,000                           |  |
| 6,0       | - 0,008                           | - 0,012                           |  |
| > 6,0     | + 0,005                           | + 0,000                           |  |
| 10,0      | - 0,010                           | - 0,015                           |  |
| >10,0     | + 0,005                           | + 0,000                           |  |
| 14,0      | - 0,012                           | - 0,018                           |  |



CFK-Bohrertest  
CFK drill test



Karnasch Art. 29.0120 – 6,0 mm  
Bohrungseintritt / drill entry  
Material: CFK / CFRP

Schnittdaten / cutting data  
Vc = 160 m/min  
Vf = 850 mm/min  
n(s) = 8493 min<sup>-1</sup>  
fz = 0,1 mm  
ap = 20 mm



Karnasch Art. 29.0120 – 6,0 mm  
Bohrungsaustritt / drill exit  
Material: CFK / CFRP

Vergrößerung / Magnification: 30x



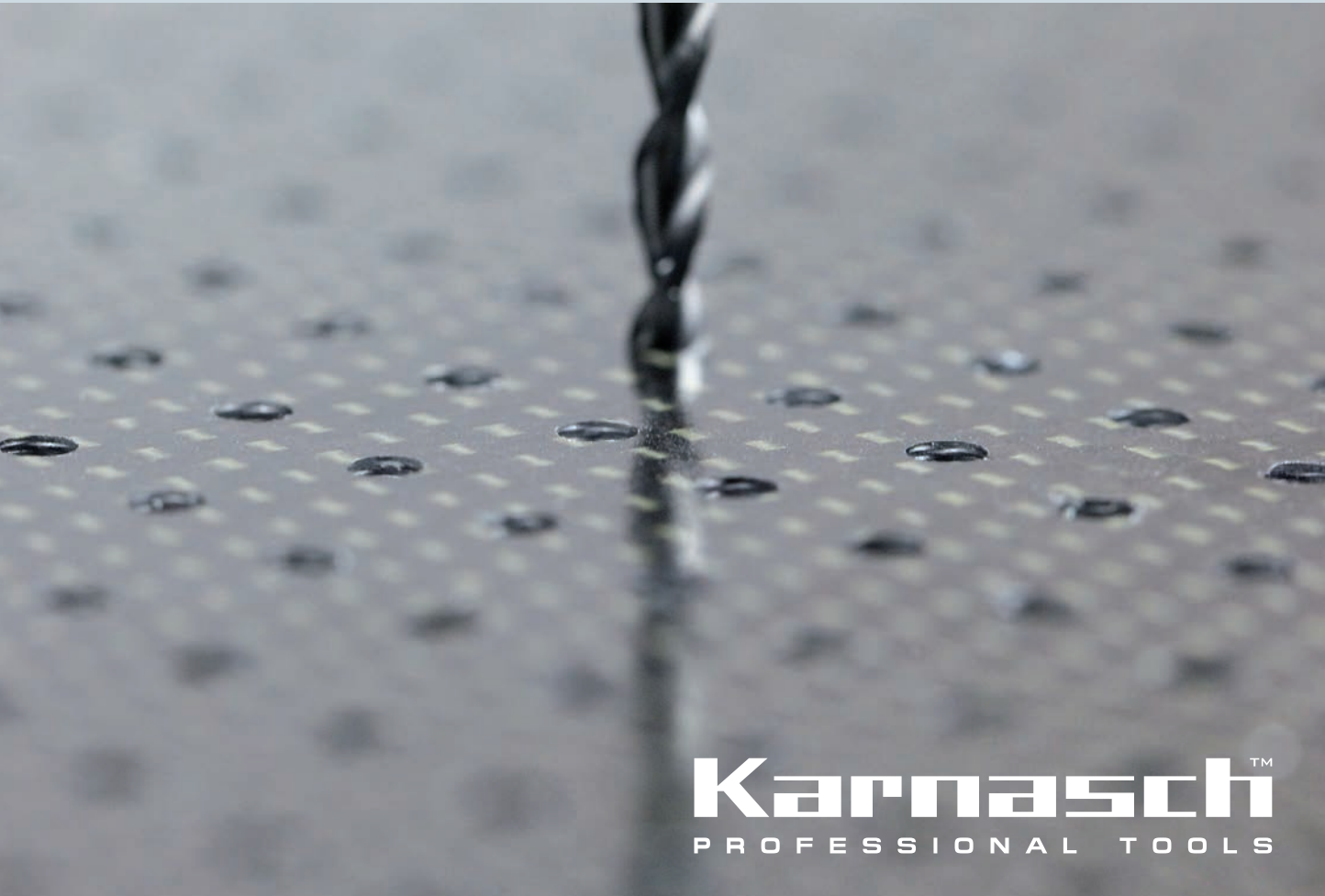
CVD Bohrer 6,0 mm  
Mitbewerber / competitor  
Bohrungseintritt / drill entry  
Material: CFK / CFRP

Schnittdaten / cutting data  
Vc = 160 m/min  
Vf = 850 mm/min  
n(s) = 8493 min<sup>-1</sup>  
fz = 0,1 mm  
ap = 20 mm



CVD Bohrer 6,0 mm  
Mitbewerber / competitor  
Bohrungsaustritt / drill exit  
Material: CFK / CFRP

Vergrößerung / Magnification: 30x



Art. 29.0120

Diamantbeschichtete VHM-Hochleistungsbohrer für CFK/GFK – multidirektional mit 90° Spitzwinkel vermeidet Delamination

- GRAPHIT  
graphite
- COMPO-SITES
- CFK
- GFK
- PEEK  
CF30
- PEEK  
GF30
- GF  
GF25
- PVDF  
GF25
- zirkon  
oxid



Diamond-coated solid-carbide drill for CFK/GFK material/multidirectional, with 90° tip angle, Prevents delamination



Broca de metal duro y macizo recubierta de diamante para CFK/GFK Material/ multidireccional, con ángulo de punta de 90°, Evita la deslaminación



Твердосплавные сверла с алмазным покрытием для углеродного волокна/ стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.

MICRO  
GRAIN

KARNASCH  
NORM

MF

DIN 6535  
Form HA



Composites



DCC  
0318

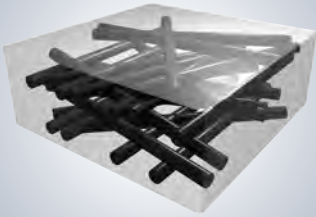


Schnittdaten  
Cutting data

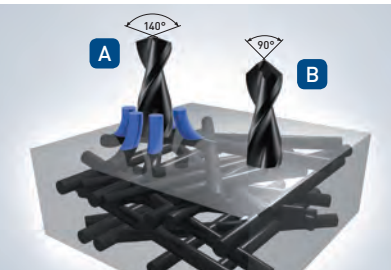


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MULTIDIREKTIONAL



Chaotische Ausrichtung des Faserverlaufs  
Chaotic alignment of fibre progress  
Orientación caótica de la distribución de fibras  
Хаотическое направление волокна



**A** Delamination und Gradbildung mit konventionellen Bohrern.  
**B** Sauberer Bohrungsaustritt durch optimierte Führungsfase des Bohrwerkzeuges.

|     | Art.             | d1 m7   | l3  | l2  | l1 | d2 h6 | €      |
|-----|------------------|---------|-----|-----|----|-------|--------|
| NEU | 290120.0050.0045 | • 0,5   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0060.0045 | • 0,6   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0070.0045 | • 0,7   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0080.0045 | • 0,8   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0090.0045 | • 0,9   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| NEU | 290120.0100.005  | • 1,0   | 5   | 8   | 55 | 3     | 59,00  |
| NEU | 290120.0110.008  | • 1,1   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0120.008  | • 1,2   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0130.008  | • 1,3   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0140.008  | • 1,4   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0150.008  | • 1,5   | 8   | 12  | 55 | 3     | 59,00  |
| NEU | 290120.0160.011  | • 1,6   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0170.011  | • 1,7   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0180.011  | • 1,8   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0190.011  | • 1,9   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0200.011  | • 2,0   | 11  | 16  | 68 | 3     | 62,00  |
| NEU | 290120.0210.014  | • 2,1   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0220.014  | • 2,2   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0230.014  | • 2,3   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0240.014  | • 2,4   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0250.014  | • 2,5   | 14  | 20  | 74 | 3     | 64,00  |
| NEU | 290120.0260.016  | • 2,6   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0270.016  | • 2,7   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0280.016  | • 2,8   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0290.016  | • 2,9   | 16  | 23  | 81 | 3     | 66,00  |
| NEU | 290120.0300.023  | • 3,0   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0310.023  | • 3,1   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.03175.023 | • 3,175 | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0320.023  | • 3,2   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0330.023  | • 3,3   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0340.023  | • 3,4   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0350.023  | • 3,5   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0360.023  | • 3,6   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0370.023  | • 3,7   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0380.023  | • 3,8   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0390.023  | • 3,9   | 23  | 28  | 66 | 6     | 110,00 |
| NEU | 290120.0400.029  | • 4,0   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0410.029  | • 4,1   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0420.029  | • 4,2   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0430.029  | • 4,3   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0440.029  | • 4,4   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0450.029  | • 4,5   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0460.029  | • 4,6   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0470.029  | • 4,7   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.04763.029 | • 4,763 | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0480.029  | • 4,8   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0490.029  | • 4,9   | 29  | 36  | 74 | 6     | 116,00 |
| NEU | 290120.0500.035  | • 5,0   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0510.035  | • 5,1   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0520.035  | • 5,2   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0530.035  | • 5,3   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0540.035  | • 5,4   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0550.035  | • 5,5   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0560.035  | • 5,6   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0570.035  | • 5,7   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0580.035  | • 5,8   | 35  | 44  | 82 | 6     | 116,00 |
| NEU | 290120.0590.035  | • 5,9   | 35  | 44  | 82 | 6     | 116,00 |

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |

|     | Art.             | d1 m7    | l3 | l2 | l1  | d2 h6 | €      |
|-----|------------------|----------|----|----|-----|-------|--------|
|     | 290120.0600.035  | • 6,0    | 35 | 44 | 82  | 6     | 116,00 |
| NEU | 290120.0610.043  | • 6,1    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0620.043  | • 6,2    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0630.043  | • 6,3    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0635.043  | • 6,350  | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0640.043  | • 6,4    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0650.043  | • 6,5    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0660.043  | • 6,6    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0670.043  | • 6,7    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0680.043  | • 6,8    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0690.043  | • 6,9    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0700.043  | • 7,0    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0710.043  | • 7,1    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0720.043  | • 7,2    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0730.043  | • 7,3    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0740.043  | • 7,4    | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0750.043  | • 7,5    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0760.043  | • 7,6    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0770.043  | • 7,7    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0780.043  | • 7,8    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0790.043  | • 7,9    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.07938.043 | • 7,938  | 43 | 53 | 91  | 8     | 174,00 |
|     | 290120.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 174,00 |
| NEU | 290120.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.09525.049 | • 9,525  | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 208,00 |
|     | 290120.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 208,00 |
| NEU | 290120.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 225,00 |
| NEU | 290120.11111.056 | • 11,111 | 56 | 71 | 118 | 12    | 225,00 |
|     | 290120.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 225,00 |

Material: CFK/CFRP Multidirectional  
Bohrer/Drill: 29.0120 Ø 8 mm

Art. 29.0121

Diamantbeschichtete VHM-Hochleistungsbohrer für CFK/GFK – unidirektional mit 90° Spitzwinkel vermeidet Delamination

- GRAPHIT graphite
- COMPOSITES
- CFK
- GFK
- PEEK CF30
- PEEK GF30
- GF GF25
- PVDF GF25
- zirkon oxid



Diamond-coated solid-carbide drill for CFK/GFK material/ unidirectional, with 90° tip angle, Prevents delamination

Broca de metal duro y macizo recubierta de diamante para CFK/GFK Material/unidireccional, con ángulo de punta de 90°, Evita la deslaminación

Твердосплавные сверла с алмазным покрытием для углеродного волокна/стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.

**MICRO GRAIN**

**KARNASCH NORM**

**MF**

**DIN 6535 Form HA**

**Composites**

**DCC 0318**

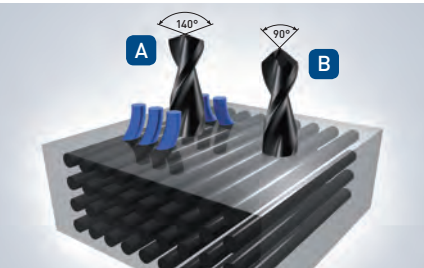
**Air**

Schnittdaten  
Cutting data

**i S. 170**



Faserverlauf in eine Richtung  
Fibre progress in one direction  
Distribución de fibras en una dirección  
Волокна в одном направлении



**A** Delamination und Grabbildung mit konventionellen Bohren.  
**B** Sauberer Bohrungsaustritt durch optimierte Führungsfase des Bohrwerkzeuges.

| Art.             | d1 m7   | l3 | l2 | l1 | d2 h6 | €      |
|------------------|---------|----|----|----|-------|--------|
| 290121.0280.019  | • 2,8   | 19 | 24 | 66 | 6     | 153,00 |
| 290121.0290.019  | • 2,9   | 19 | 24 | 66 | 6     | 153,00 |
| 290121.0300.023  | • 3,0   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0310.023  | • 3,1   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.03175.023 | • 3,175 | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0320.023  | • 3,2   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0330.023  | • 3,3   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0340.023  | • 3,4   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0350.023  | • 3,5   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0360.023  | • 3,6   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0370.023  | • 3,7   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0380.023  | • 3,8   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0390.023  | • 3,9   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0400.029  | • 4,0   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0410.029  | • 4,1   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0420.029  | • 4,2   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0430.029  | • 4,3   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0440.029  | • 4,4   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0450.029  | • 4,5   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0460.029  | • 4,6   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0470.029  | • 4,7   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.04763.029 | • 4,763 | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0480.029  | • 4,8   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0490.029  | • 4,9   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0500.035  | • 5,0   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0510.035  | • 5,1   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0520.035  | • 5,2   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0530.035  | • 5,3   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0540.035  | • 5,4   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0550.035  | • 5,5   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0560.035  | • 5,6   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0570.035  | • 5,7   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0580.035  | • 5,8   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0590.035  | • 5,9   | 35 | 44 | 82 | 6     | 165,00 |

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |



Diamantbeschichtete VHM-Hochleistungsbohrer mit Innenkühlung für CFK/GFK – unidirektional mit 90° Spitzwinkel vermeidet Delamination

Art. 29.0122

GRAPHIT  
graphite

COMPO-  
SITES

CFK

GFK

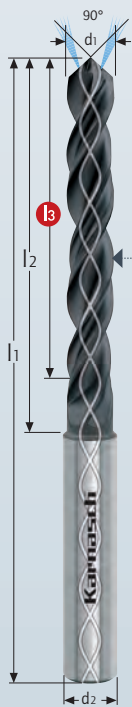
PEEK  
CF30

PEEK  
GF30

GF  
GF25

PVDF  
GF25

zirkon  
oxid



Diamond-coated solid-carbide drill with interior cooling for CFK/GFK material/ unidirectional, with 90° tip angle, Prevents delamination



Broca de metal duro y macizo con refrigeración recubierta de diamante para CFK/ GFK Material/unidireccional, con ángulo de punta de 90°, Evita la deslaminación



Твердосплавные сверла с алмазным покрытием для углеродного волокна/ стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.



Durch 2 Führungsphasen ist eine sehr hohe Präzision der Bohrungen möglich, bei gleichzeitiger Vermeidung von Delamination.

With 2 guide chamfer is a very high precision of the hols possible, by avoiding of delamination.

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |

MICRO  
GRAIN

KARNASCH  
NORM

MF

DIN 6535  
Form HAK



Composites



DCC  
0318



Schnittdaten  
Cutting data

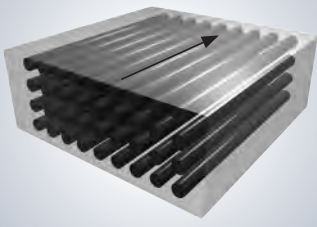


i S. 171

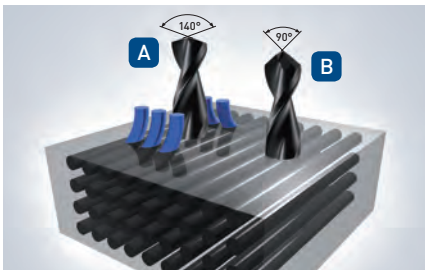
| Art.             | d1 m7         | l3 | l2 | l1  | d2 h6 | €      |
|------------------|---------------|----|----|-----|-------|--------|
| 290122.0600.035  | • 6,00        | 35 | 44 | 82  | 6     | 207,00 |
| 290122.0610.043  | • 6,10        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0620.043  | • 6,20        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0630.043  | • 6,30        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0635.043  | • 6,350 1/4"  | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0640.043  | • 6,40        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0650.043  | • 6,50        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0660.043  | • 6,60        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0670.043  | • 6,70        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0680.043  | • 6,80        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0690.043  | • 6,90        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0700.043  | • 7,00        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0710.043  | • 7,10        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0720.043  | • 7,20        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0730.043  | • 7,30        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0740.043  | • 7,40        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0750.043  | • 7,50        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0760.043  | • 7,60        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0770.043  | • 7,70        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0780.043  | • 7,80        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0790.043  | • 7,90        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.07938.043 | • 7,938 5/16" | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0800.043  | • 8,00        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0810.049  | • 8,10        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0820.049  | • 8,20        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0830.049  | • 8,30        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0840.049  | • 8,40        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0850.049  | • 8,50        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0860.049  | • 8,60        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0870.049  | • 8,70        | 49 | 61 | 103 | 10    | 313,00 |

| Art.             | d1 m7          | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------------|----|----|-----|-------|--------|
| 290122.0880.049  | • 8,80         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0890.049  | • 8,90         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0900.049  | • 9,00         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0910.049  | • 9,10         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0920.049  | • 9,20         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0930.049  | • 9,30         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0940.049  | • 9,40         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0950.049  | • 9,50         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.09525.049 | • 9,525 3/8"   | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0960.049  | • 9,60         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0970.049  | • 9,70         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0980.049  | • 9,80         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0990.049  | • 9,90         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.1000.049  | • 10,00        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.1010.056  | • 10,10        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1020.056  | • 10,20        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1030.056  | • 10,30        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1040.056  | • 10,40        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1050.056  | • 10,50        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1060.056  | • 10,60        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1070.056  | • 10,70        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1080.056  | • 10,80        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1090.056  | • 10,90        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1100.056  | • 11,00        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1111.056  | • 11,111 7/16" | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1150.056  | • 11,50        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1180.056  | • 11,8         | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1200.056  | • 12,0         | 56 | 71 | 118 | 12    | 349,00 |

UNIDIREKTIONAL



Faserverlauf in eine Richtung  
Fibre progress in one direction  
Distribución de fibras en una dirección  
Волокна в одном направлении



A Delamination und  
Gradbildung mit  
konventionellen  
Bohrern.

B Sauberer  
Bohrungsaustritt  
durch optimierte  
Führungsphase des  
Bohrwerkzeuges.

Art. 29.0200 CNC-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/ALU – ALU/CFK

C

A

CFK/GFK - CFRP/GFRP

A

C

Aluminium

A

C

Aluminium

C

A

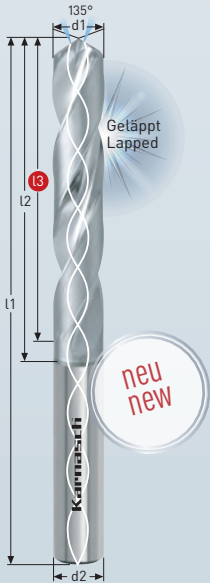
CFK/GFK - CFRP/GFRP



Solid carbide SUPER-Stack-drill with interior cooling for CFRP/GFRP-Alu – Alu-CFRP/GFRP

VHM-CNC-Stack-Drill con refrigeración interna para el tratamiento de PRFC/PRFV-Aluminio y Aluminio-PRFC/PRFV

стек дрель для станка с кчпу, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/алюминий



Für den Einsatz auf CNC-Maschinen.  
For the use on CNC-machines.

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK

34°

135°

HSC HPC

GELÄPPT LAPPED

MMKS

Schnittdaten  
Cutting data

i S. 319

MOVIE

| Art.             | d1 h7   | l3 | l2 | l1 | d2 h6 | €      |
|------------------|---------|----|----|----|-------|--------|
| 290200.0300.023  | • 3,0   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0310.023  | • 3,1   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0320.023  | • 3,2   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0330.023  | • 3,3   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0340.023  | • 3,4   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0350.023  | • 3,5   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0360.023  | • 3,6   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0370.023  | • 3,7   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0380.029  | • 3,8   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0390.029  | • 3,9   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0400.029  | • 4,0   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0410.029  | • 4,1   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.04176.029 | • 4,176 | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0420.029  | • 4,2   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0430.029  | • 4,3   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0440.029  | • 4,4   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0450.029  | • 4,5   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0460.029  | • 4,6   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0470.029  | • 4,7   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0480.029  | • 4,8   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.04837.029 | • 4,837 | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0490.035  | • 4,9   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0500.035  | • 5,0   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0510.035  | • 5,1   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0520.035  | • 5,2   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0530.035  | • 5,3   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0540.035  | • 5,4   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0550.035  | • 5,5   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.05550.035 | • 5,55  | 35 | 44 | 82 | 6     | 99,00  |
| 290200.05565.035 | • 5,565 | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0560.035  | • 5,6   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0570.035  | • 5,7   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0580.035  | • 5,8   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0590.035  | • 5,9   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0600.035  | • 6,0   | 35 | 44 | 82 | 6     | 106,00 |
| 290200.0610.043  | • 6,1   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0620.043  | • 6,2   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0630.043  | • 6,3   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.06365.043 | • 6,365 | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0640.043  | • 6,4   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0650.043  | • 6,5   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0660.043  | • 6,6   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0670.043  | • 6,7   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0680.043  | • 6,8   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0690.043  | • 6,9   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0700.043  | • 7,0   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0710.043  | • 7,1   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0720.043  | • 7,2   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0730.043  | • 7,3   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0740.043  | • 7,4   | 43 | 53 | 91 | 8     | 106,00 |

| Art.             | d1 h7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290200.0750.043  | • 7,5    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0760.043  | • 7,6    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0770.043  | • 7,7    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0780.043  | • 7,8    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0790.043  | • 7,9    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.07953.043 | • 7,953  | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.09540.049 | • 9,540  | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 154,00 |
| 290200.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1110.056  | • 11,1   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.11133.056 | • 11,133 | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1120.056  | • 11,2   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1130.056  | • 11,3   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1140.056  | • 11,4   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1150.056  | • 11,5   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1160.056  | • 11,6   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1170.056  | • 11,7   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1180.056  | • 11,8   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1190.056  | • 11,9   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 213,00 |

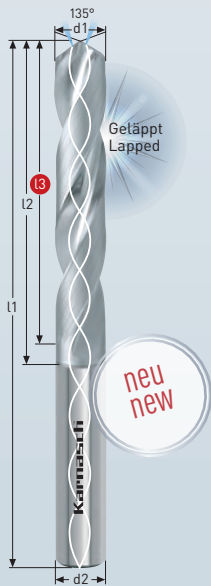
CNC-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/TITAN – TITAN/CFK

Art. 29.0210

|                                                                                  |                     |
|----------------------------------------------------------------------------------|---------------------|
|  | CFK/GFK - CFRP/GFRP |
|  | Titan - Titanium    |
|  | Titan - Titanium    |
|  | CFK/GFK - CFRP/GFRP |



-  Solid carbide SUPER-Stack-drill with interior cooling for CFRP/GFRP-Titan – Titan-CFRP/GFRP
-  VHM-CNC-Stack-Drill con refrigeración interna para el tratamiento PRFC/PRFV-Titanio y Titanio-PRFC/PRFV
-  стек дреель для станка с кчпу, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/титан



Für den Einsatz auf CNC-Maschinen.  
For the use on CNC-machines.

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK







HSC HPC



GELÄPPT LAPPED



MMKS

Schnittdaten  
Cutting data



i S. 319



MOVIE

| Art.             | d1 h7   | l3 | l2 | l1 | d2 h6 | €      |
|------------------|---------|----|----|----|-------|--------|
| 290210.0300.023  | • 3,0   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0310.023  | • 3,1   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0320.023  | • 3,2   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0330.023  | • 3,3   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0340.023  | • 3,4   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0350.023  | • 3,5   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0360.023  | • 3,6   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0370.023  | • 3,7   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0380.029  | • 3,8   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0390.029  | • 3,9   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0400.029  | • 4,0   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0410.029  | • 4,1   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.04176.029 | • 4,176 | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0420.029  | • 4,2   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0430.029  | • 4,3   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0440.029  | • 4,4   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0450.029  | • 4,5   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0460.029  | • 4,6   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0470.029  | • 4,7   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0480.029  | • 4,8   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.04837.029 | • 4,837 | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0490.035  | • 4,9   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0500.035  | • 5,0   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0510.035  | • 5,1   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0520.035  | • 5,2   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0530.035  | • 5,3   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0540.035  | • 5,4   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0550.035  | • 5,5   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0555.035  | • 5,55  | 35 | 44 | 82 | 6     | 104,00 |
| 290210.05565.035 | • 5,565 | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0560.035  | • 5,6   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0570.035  | • 5,7   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0580.035  | • 5,8   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0590.035  | • 5,9   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0600.035  | • 6,0   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0610.043  | • 6,1   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0620.043  | • 6,2   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0630.043  | • 6,3   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.06365.043 | • 6,365 | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0640.043  | • 6,4   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0650.043  | • 6,5   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0660.043  | • 6,6   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0670.043  | • 6,7   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0680.043  | • 6,8   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0690.043  | • 6,9   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0700.043  | • 7,0   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0710.043  | • 7,1   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0720.043  | • 7,2   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0730.043  | • 7,3   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0740.043  | • 7,4   | 43 | 53 | 91 | 8     | 112,00 |

| Art.             | d1 h7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290210.0750.043  | • 7,5    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0760.043  | • 7,6    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0770.043  | • 7,7    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0780.043  | • 7,8    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0790.043  | • 7,9    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.07953.043 | • 7,953  | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.09540.049 | • 9,54   | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 160,00 |
| 290210.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1110.056  | • 11,1   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.11133.056 | • 11,133 | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1120.056  | • 11,2   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1130.056  | • 11,3   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1140.056  | • 11,4   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1150.056  | • 11,5   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1160.056  | • 11,6   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1170.056  | • 11,7   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1180.056  | • 11,8   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1190.056  | • 11,9   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 224,00 |



Art. 29.0250 ROBO-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/ALU – ALU/CFK

C

A

CFK/GFK - CFRP/GFRP

A

C

Aluminium

A

C

Aluminium

C

A

CFK/GFK - CFRP/GFRP



Solid carbide ROBO-Stack-drill with interior cooling for CFRP/GFRP-Alu – Alu-CFRP/GFRP

VHM-ROBO-Stack-Drill con refrigeración interna para el tratamiento PRFC/PRFV-Aluminio y Aluminio-PRFC/PRFV

стек дреель для робот, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/алюминий

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK

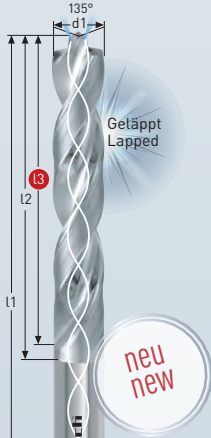
34°

135°

HSC HPC

GELÄPPT LAPPED

MMKS



Schnittdaten  
Cutting data

i S. 319

| Art.             | d1 h7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290250.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 118,00 |
| 290250.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0954.049  | • 9,54   | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 169,00 |
| 290250.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1110.056  | • 11,1   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.11133.056 | • 11,133 | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1120.056  | • 11,2   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1130.056  | • 11,3   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1140.056  | • 11,4   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1150.056  | • 11,5   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1160.056  | • 11,6   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1170.056  | • 11,7   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1180.056  | • 11,8   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1190.056  | • 11,9   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1210.060  | • 12,1   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1220.060  | • 12,2   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1230.060  | • 12,3   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1240.060  | • 12,4   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1250.060  | • 12,5   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1260.060  | • 12,6   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1270.060  | • 12,7   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1272.060  | • 12,72  | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1280.060  | • 12,8   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1290.060  | • 12,9   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1300.060  | • 13,0   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1310.060  | • 13,1   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1320.060  | • 13,2   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1330.060  | • 13,3   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1340.060  | • 13,4   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1350.060  | • 13,5   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1360.060  | • 13,6   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1370.060  | • 13,7   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1380.060  | • 13,8   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1390.060  | • 13,9   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1400.060  | • 14,0   | 60 | 77 | 124 | 14    | 318,00 |

| Art.             | d1 h7    | l3 | l2  | l1  | d2 h6 | €      |
|------------------|----------|----|-----|-----|-------|--------|
| 290250.1410.063  | • 14,1   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1420.063  | • 14,2   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.14295.063 | • 14,295 | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1430.063  | • 14,3   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1440.063  | • 14,4   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1450.063  | • 14,5   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1460.063  | • 14,6   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1470.063  | • 14,7   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1480.063  | • 14,8   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1490.063  | • 14,9   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1500.063  | • 15,0   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1510.063  | • 15,1   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1520.063  | • 15,2   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1530.063  | • 15,3   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1540.063  | • 15,4   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1550.063  | • 15,5   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1560.063  | • 15,6   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1570.063  | • 15,7   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1580.063  | • 15,8   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.15882.063 | • 15,882 | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1590.063  | • 15,9   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1600.063  | • 16,0   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1610.071  | • 16,1   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1620.071  | • 16,2   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1630.071  | • 16,3   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1640.071  | • 16,4   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1650.071  | • 16,5   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1660.071  | • 16,6   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1670.071  | • 16,7   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1680.071  | • 16,8   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1690.071  | • 16,9   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1700.071  | • 17,0   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1710.071  | • 17,1   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1720.071  | • 17,2   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1730.071  | • 17,3   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1740.071  | • 17,4   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1750.071  | • 17,5   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1760.071  | • 17,6   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1770.071  | • 17,7   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1780.071  | • 17,8   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1790.071  | • 17,9   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1800.071  | • 18,0   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1810.077  | • 18,1   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1820.077  | • 18,2   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1830.077  | • 18,3   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1840.077  | • 18,4   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1850.077  | • 18,5   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1860.077  | • 18,6   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1870.077  | • 18,7   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1880.077  | • 18,8   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1890.077  | • 18,9   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1900.077  | • 19,0   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.19065.077 | • 19,065 | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1910.077  | • 19,1   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1920.077  | • 19,2   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1930.077  | • 19,3   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1940.077  | • 19,4   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1950.077  | • 19,5   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1960.077  | • 19,6   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1970.077  | • 19,7   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1980.077  | • 19,8   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1990.077  | • 19,9   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.2000.077  | • 20,0   | 77 | 101 | 153 | 20    | 661,00 |



ROBO-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/TITAN – TITAN/CFK

Art. 29.0260

CFK/GFK - CFRP/GFRP

Titan - Titanium

Titan - Titanium

CFK/GFK - CFRP/GFRP



Solid carbide ROBO-Stack-drill with interior cooling for CFRP/GFRP-Titan – Titan-CFRP/GFRP

VHM-ROBO-Stack-Drill con refrigeración interna para el tratamiento PRFC/PRFV-Titanio y Titanio-PRFC/PRFV

стек дреель для робот, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/ титан

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK

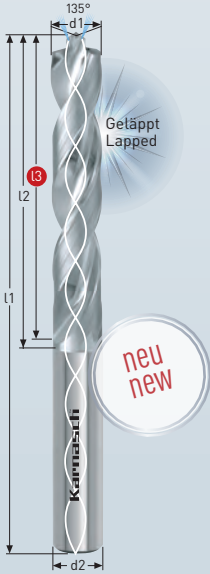


HSC HPC

HSC HPC

GELÄPPT LAPPED

GELÄPPT LAPPED



Für den Einsatz auf Roboter.  
For the use on Robot.

Schnittdaten  
Cutting data



S. 319

| Art.            | d1 h7   | <b>l3</b> | L2 | L1  | d2 h6 | €      |
|-----------------|---------|-----------|----|-----|-------|--------|
| 290260.0800.043 | • 8,0   | 43        | 53 | 91  | 8     | 125,00 |
| 290260.0810.049 | • 8,1   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0820.049 | • 8,2   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0830.049 | • 8,3   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0840.049 | • 8,4   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0850.049 | • 8,5   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0860.049 | • 8,6   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0870.049 | • 8,7   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0880.049 | • 8,8   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0890.049 | • 8,9   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0900.049 | • 9,0   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0910.049 | • 9,1   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0920.049 | • 9,2   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0930.049 | • 9,3   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0940.049 | • 9,4   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0950.049 | • 9,5   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0954.049 | • 9,54  | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0960.049 | • 9,6   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0970.049 | • 9,7   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0980.049 | • 9,8   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.0990.049 | • 9,8   | 49        | 61 | 103 | 10    | 177,00 |
| 290260.1000.049 | • 10,0  | 49        | 61 | 103 | 10    | 177,00 |
| 290260.1010.056 | • 10,1  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1020.056 | • 10,2  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1030.056 | • 10,3  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1040.056 | • 10,4  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1050.056 | • 10,5  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1060.056 | • 10,6  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1070.056 | • 10,7  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1080.056 | • 10,8  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1090.056 | • 10,9  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1100.056 | • 11,0  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1110.056 | • 11,1  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1113.056 | • 11,13 | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1120.056 | • 11,2  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1130.056 | • 11,3  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1140.056 | • 11,4  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1150.056 | • 11,5  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1160.056 | • 11,6  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1170.056 | • 11,7  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1180.056 | • 11,8  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1190.056 | • 11,9  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1200.056 | • 12,0  | 56        | 71 | 118 | 12    | 247,00 |
| 290260.1210.060 | • 12,1  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1220.060 | • 12,2  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1230.060 | • 12,3  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1240.060 | • 12,4  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1250.060 | • 12,5  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1260.060 | • 12,6  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1270.060 | • 12,7  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1272.060 | • 12,72 | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1280.060 | • 12,8  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1290.060 | • 12,9  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1300.060 | • 13,0  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1310.060 | • 13,1  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1320.060 | • 13,2  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1330.060 | • 13,3  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1340.060 | • 13,4  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1350.060 | • 13,5  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1360.060 | • 13,6  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1370.060 | • 13,7  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1380.060 | • 13,8  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1390.060 | • 13,9  | 60        | 77 | 124 | 14    | 333,00 |
| 290260.1400.060 | • 14,0  | 60        | 77 | 124 | 14    | 333,00 |

| Art.             | d1 h7    | <b>l3</b> | L2  | L1  | d2 h6 | €      |
|------------------|----------|-----------|-----|-----|-------|--------|
| 290260.1410.063  | • 14,1   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1420.063  | • 14,2   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.14295.063 | • 14,295 | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1430.063  | • 14,3   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1440.063  | • 14,4   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1450.063  | • 14,5   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1460.063  | • 14,6   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1470.063  | • 14,7   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1480.063  | • 14,8   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1490.063  | • 14,9   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1500.063  | • 15,0   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1510.063  | • 15,1   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1520.063  | • 15,2   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1530.063  | • 15,3   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1540.063  | • 15,4   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1550.063  | • 15,5   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1560.063  | • 15,6   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1570.063  | • 15,7   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1580.063  | • 15,8   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.15882.063 | • 15,882 | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1590.063  | • 15,9   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1600.063  | • 16,0   | 63        | 83  | 133 | 16    | 418,00 |
| 290260.1610.071  | • 16,1   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1620.071  | • 16,2   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1630.071  | • 16,3   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1640.071  | • 16,4   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1650.071  | • 16,5   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1660.071  | • 16,6   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1670.071  | • 16,7   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1680.071  | • 16,8   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1690.071  | • 16,9   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1700.071  | • 17,0   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1710.071  | • 17,1   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1720.071  | • 17,2   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1730.071  | • 17,3   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1740.071  | • 17,4   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1750.071  | • 17,5   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1760.071  | • 17,6   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1770.071  | • 17,7   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1780.071  | • 17,8   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1790.071  | • 17,9   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1800.071  | • 18,0   | 71        | 93  | 143 | 18    | 553,00 |
| 290260.1810.077  | • 18,1   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1820.077  | • 18,2   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1830.077  | • 18,3   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1840.077  | • 18,4   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1850.077  | • 18,5   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1860.077  | • 18,6   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1870.077  | • 18,7   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1880.077  | • 18,8   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1890.077  | • 18,9   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1900.077  | • 19,0   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.19065.077 | • 19,065 | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1910.077  | • 19,1   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1920.077  | • 19,2   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1930.077  | • 19,3   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1940.077  | • 19,4   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1950.077  | • 19,5   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1960.077  | • 19,6   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1970.077  | • 19,7   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1980.077  | • 19,8   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.1990.077  | • 19,9   | 77        | 101 | 153 | 20    | 692,00 |
| 290260.2000.077  | • 20,0   | 77        | 101 | 153 | 20    | 692,00 |



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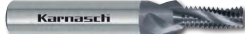
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**P R O F E S S I O N A L   T O O L S**

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|----------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Art.                                   | VHM-Gewindewirbler / solid carbide thread mill |                                                                                   |                                                                                   | Material                                                                          |  |  |  |  |  |  |  |
| 23.1760                                | M1 - M3                                        |  |  |  | 180                                                                               |  |  |  |  |  |  |
| 23.1764                                | M1 - M3                                        |  |  |  | 180                                                                               |  |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 23.1768                                | M1 - M3                                        |  |  |  | 181                                                                               |  |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

|         |          |                                                                                   |  | Material                                                                          |  |  |  |  |  |  |  |
|---------|----------|-----------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 23.2005 | M4 - M12 |  |  |  | 182                                                                               |                                                                                   |  |  |  |  |  |
| 23.2006 | M4 - M12 |  |  |  | 182                                                                               |                                                                                   |  |  |  |  |  |



| GOLD<br>gold | NE<br>non-ferrous | STAHL<br>steel | STAHL<br>steel<br>< 1400 N/mm | HRC<br>< 52 | HRC<br>< 70 | INOX<br>stainless<br>steel | INCONEL<br>HASTELLOY<br>TITAN | GJL | GJS | GTW<br>GTS | GRAPHIT<br>graphite | Kunststoff<br>plastic | COMPO-<br>SITES | DIN 6535<br>Form HA |
|--------------|-------------------|----------------|-------------------------------|-------------|-------------|----------------------------|-------------------------------|-----|-----|------------|---------------------|-----------------------|-----------------|---------------------|
| ✓            | ✓                 |                |                               |             |             |                            | ✓                             |     |     |            |                     | ✓                     |                 | ✓                   |
|              |                   | ✓              | ✓                             | ✓           | ✓           | ✓                          | ✓                             | ✓   | ✓   | ✓          |                     |                       |                 | ✓                   |
|              |                   |                |                               |             |             |                            |                               |     |     |            | ✓                   |                       | ✓               | ✓                   |

| POM<br>GF25 | PF-31 | PA-66 | PE-HD | Kevlar | Gold<br>Silber<br>Kupfer | Schicht-<br>stoffe<br>Laminat | DIN 6535<br>Form HA |
|-------------|-------|-------|-------|--------|--------------------------|-------------------------------|---------------------|
| ✓           | ✓     | ✓     | ✓     |        | ✓                        | ✓                             | ✓                   |
| ✓           | ✓     | ✓     | ✓     |        | ✓                        | ✓                             | ✓                   |

- Stock/Lagerware  
stock-tools

○ Keine Lagerware, Lieferzeit und Preis auf Anfrage  
No stock-tool. Price and delivery on request
- ◼ Lieferzeit kurzfristig da Rohlinglager vorhanden

▲ Lieferbar solange Vorrat oder auf Anfrage  
Article be discontinued. Delivery possible until sold out. After sold out delivery possible on request.
- △ Lieferbar solange Vorrat.  
Nachfolgewerkzeug vorhanden  
Be discontinued. Replacement  
article available.
- 179

Art. 23.1760

VHM-Gewindewirbler, LogTop Poliert  
Keine Gratbildung da überschneidend, Logarithmisch hinterschliffen

ALU  
aluminium

ALU  
< 6% Si

ALU  
< 12% Si

MESSING  
brass

KUPFER  
copper

INCONEL  
HASTELLOY  
TITAN

GOLD  
gold

Kunststoff  
plastic



- Solid-carbide thread mill, LogTop polished. No burr formation. Logarithmical relief ground, because of intersecting.
- Fresa giratoria metal duro, LogTop poliert. No hay rebabas por superposición, corte logarítmico.
- твердосплавный нитеобрезатель, логтоп полированный нет гребеня из-за перекрытия, логарифмическое затыловочное шлифование

| Art.       | M       | Stg  | x D | l2  | l1 | d1<br>±0,03 | d3   | d2 h5 | Z | Gewindegröße<br>Threat milling size | €     |
|------------|---------|------|-----|-----|----|-------------|------|-------|---|-------------------------------------|-------|
| 231760.010 | • M 1   | 0,25 | 2,6 | 2,7 | 45 | 0,72        | 0,34 | 4     | 4 | M 1 M 1.1                           | 76,00 |
| 231760.012 | • M 1.2 | 0,25 | 2,2 | 2,7 | 45 | 0,92        | 0,54 | 4     | 4 | M 1.2                               | 76,00 |
| 231760.014 | • M 1.4 | 0,30 | 2,2 | 3,2 | 45 | 1,05        | 0,60 | 4     | 4 | M 1.4                               | 76,00 |
| 231760.016 | • M 1.6 | 0,35 | 2,3 | 3,8 | 45 | 1,20        | 0,68 | 4     | 4 | M 1.6                               | 76,00 |
| 231760.017 | • M 1.7 | 0,35 | 2,1 | 3,8 | 45 | 1,30        | 0,78 | 4     | 4 | M 1.7 M 1.8                         | 76,00 |
| 231760.020 | • M 2   | 0,40 | 2,5 | 5,1 | 45 | 1,50        | 0,90 | 4     | 6 | M 2 M 2.3                           | 82,00 |
| 231760.025 | • M 2.5 | 0,45 | 2,2 | 5,7 | 45 | 1,95        | 1,26 | 4     | 6 | M 2.5 M 2.6                         | 82,00 |
| 231760.030 | • M 3   | 0,50 | 2,1 | 6,3 | 45 | 2,36        | 1,60 | 4     | 6 | M 3                                 | 84,00 |

| Gewinde<br>Thread | Ø Kernbohrung<br>Ø Core hole |
|-------------------|------------------------------|
| M 1.0 x 0,25      | 0,75                         |
| M 1.1 x 0,25      | 0,80                         |
| M 1.2 x 0,25      | 0,95                         |
| M 1.4 x 0,30      | 1,10                         |
| M 1.6 x 0,35      | 1,25                         |
| M 1.7 x 0,35      | 1,35                         |
| M 1.8 x 0,35      | 1,45                         |
| M 2.0 x 0,40      | 1,60                         |
| M 2.3 x 0,40      | 1,90                         |
| M 2.5 x 0,45      | 2,05                         |
| M 2.6 x 0,45      | 2,15                         |
| M 3.0 x 0,50      | 2,50                         |

MICRO  
GRAIN

KARNASCH  
NORM

M

DIN 6535  
Form HA

30°

60°

HSC  
High-Speed-Cutting

NHC  
7000

Oil Emul  
MMKS

Schnittdaten  
Cutting data



i S. 338

Art. 23.1764

VHM-Gewindewirbler, LogTop Stahl  
Keine Gratbildung da überschneidend, Logarithmisch hinterschliffen

HRC  
< 70

STAHL  
steel  
< 1400 N/mm

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

INCONEL  
HASTELLOY  
TITAN

GTW  
GTS

GJL

GJS



- Solid-carbide thread mill, LogTop steel. No burr formation. Logarithmical relief ground, because of intersecting.
- Fresa giratoria metal duro, LogTop Stahl. No hay rebabas por superposición, corte logarítmico.
- твердосплавный нитеобрезатель, логтоп сталь нет гребеня из-за перекрытия, логарифмическое затыловочное шлифование

| Art.       | M       | Stg  | x D | l2  | l1 | d1<br>±0,03 | d3   | d2 h5 | Z | Gewindegröße<br>Threat milling size | €     |
|------------|---------|------|-----|-----|----|-------------|------|-------|---|-------------------------------------|-------|
| 231764.010 | • M 1   | 0,25 | 2,6 | 2,7 | 45 | 0,72        | 0,34 | 4     | 4 | M 1 M 1.1                           | 78,00 |
| 231764.012 | • M 1.2 | 0,25 | 2,2 | 2,7 | 45 | 0,92        | 0,54 | 4     | 4 | M 1.2                               | 78,00 |
| 231764.014 | • M 1.4 | 0,30 | 2,2 | 3,2 | 45 | 1,05        | 0,60 | 4     | 4 | M 1.4                               | 78,00 |
| 231764.016 | • M 1.6 | 0,35 | 2,3 | 3,8 | 45 | 1,20        | 0,68 | 4     | 4 | M 1.6                               | 78,00 |
| 231764.017 | • M 1.7 | 0,35 | 2,1 | 3,8 | 45 | 1,30        | 0,78 | 4     | 4 | M 1.7 M 1.8                         | 78,00 |
| 231764.020 | • M 2   | 0,40 | 2,5 | 5,1 | 45 | 1,50        | 0,90 | 4     | 6 | M 2 M 2.3                           | 85,00 |
| 231764.025 | • M 2.5 | 0,45 | 2,2 | 5,7 | 45 | 1,95        | 1,26 | 4     | 6 | M 2.5 M 2.6                         | 85,00 |
| 231764.030 | • M 3   | 0,50 | 2,1 | 6,3 | 45 | 2,36        | 1,60 | 4     | 6 | M 3                                 | 85,00 |

| Gewinde<br>Thread | Ø Kernbohrung<br>Ø Core hole |
|-------------------|------------------------------|
| M 1.0 x 0,25      | 0,75                         |
| M 1.1 x 0,25      | 0,80                         |
| M 1.2 x 0,25      | 0,95                         |
| M 1.4 x 0,30      | 1,10                         |
| M 1.6 x 0,35      | 1,25                         |
| M 1.7 x 0,35      | 1,35                         |
| M 1.8 x 0,35      | 1,45                         |
| M 2.0 x 0,40      | 1,60                         |
| M 2.3 x 0,40      | 1,90                         |
| M 2.5 x 0,45      | 2,05                         |
| M 2.6 x 0,45      | 2,15                         |
| M 3.0 x 0,50      | 2,50                         |

MICRO  
GRAIN

KARNASCH  
NORM

M

DIN 6535  
Form HA

30°

60°

HSC  
High-Speed-Cutting

NANO  
Spin

Oil Emul  
MMKS

Schnittdaten  
Cutting data



i S. 338

VHM-Gewindewirbler, LogTop Dia  
Keine Gratbildung da überschneidend, Logarithmisch hinterschliften

Art. **23.1768**

COMPO-SITES

TI-CFK

GRAPHIT  
graphite

PA66  
GF30

GFK

PVDF  
GF30

CFK

PEEK  
GF30

Hybrid-  
stoffe

PEEK  
CF30

CFK-ALU  
Composite

zirkon  
oxid

Schicht-  
stoffe  
Laminat



- Solid-carbide thread mill, LogTop diamond. No burr formation. Logarithmical relief ground, because of intersecting.
- Fresa giratoria metal duro, Log Top Dia. No hay rebabas por superposición, corte logarítmico.
- твердосплавный нитеобрезатель, логтоп сталь диа нет гребенья из-за перекрытия, логарифмическое затыловочное шлифование

| Art.       | M       | Stg  | x D | l2  | l1 | d1<br>±0,02 | d3   | d2 h5 | Z | Gewindegröße<br>Threat milling size | €      |
|------------|---------|------|-----|-----|----|-------------|------|-------|---|-------------------------------------|--------|
| 231768.010 | • M 1   | 0,25 | 2,6 | 2,7 | 45 | 0,72        | 0,34 | 4     | 4 | M 1 M 1.1                           | 93,00  |
| 231768.012 | • M 1.2 | 0,25 | 2,2 | 2,7 | 45 | 0,92        | 0,54 | 4     | 4 | M 1.2                               | 93,00  |
| 231768.014 | • M 1.4 | 0,30 | 2,2 | 3,2 | 45 | 1,05        | 0,60 | 4     | 4 | M 1.4                               | 95,00  |
| 231768.016 | • M 1.6 | 0,35 | 2,3 | 3,8 | 45 | 1,20        | 0,68 | 4     | 4 | M 1.6                               | 95,00  |
| 231768.017 | • M 1.7 | 0,35 | 2,1 | 3,8 | 45 | 1,30        | 0,78 | 4     | 4 | M 1.7 M 1.8                         | 95,00  |
| 231768.020 | • M 2   | 0,40 | 2,5 | 5,1 | 45 | 1,50        | 0,90 | 4     | 6 | M 2 M 2.3                           | 102,00 |
| 231768.025 | • M 2.5 | 0,45 | 2,2 | 5,7 | 45 | 1,95        | 1,26 | 4     | 6 | M 2.5 M 2.6                         | 102,00 |
| 231768.030 | • M 3   | 0,50 | 2,1 | 6,3 | 45 | 2,36        | 1,60 | 4     | 6 | M 3                                 | 102,00 |

| Gewinde<br>Thread | Ø Kernbohrung<br>Ø Core hole |
|-------------------|------------------------------|
| M 1.0 x 0,25      | 0,75                         |
| M 1.1 x 0,25      | 0,80                         |
| M 1.2 x 0,25      | 0,95                         |
| M 1.4 x 0,30      | 1,10                         |
| M 1.6 x 0,35      | 1,25                         |
| M 1.7 x 0,35      | 1,35                         |
| M 1.8 x 0,35      | 1,45                         |
| M 2.0 x 0,40      | 1,60                         |
| M 2.3 x 0,40      | 1,90                         |
| M 2.5 x 0,45      | 2,05                         |
| M 2.6 x 0,45      | 2,15                         |
| M 3.0 x 0,50      | 2,50                         |

MICRO  
GRAIN

KARNASCH  
NORM

M

DIN 6535  
Form HA

30°

60°

HSC  
High-Speed-  
Cutting

DCC  
G

ÖL

Emul

MMKS

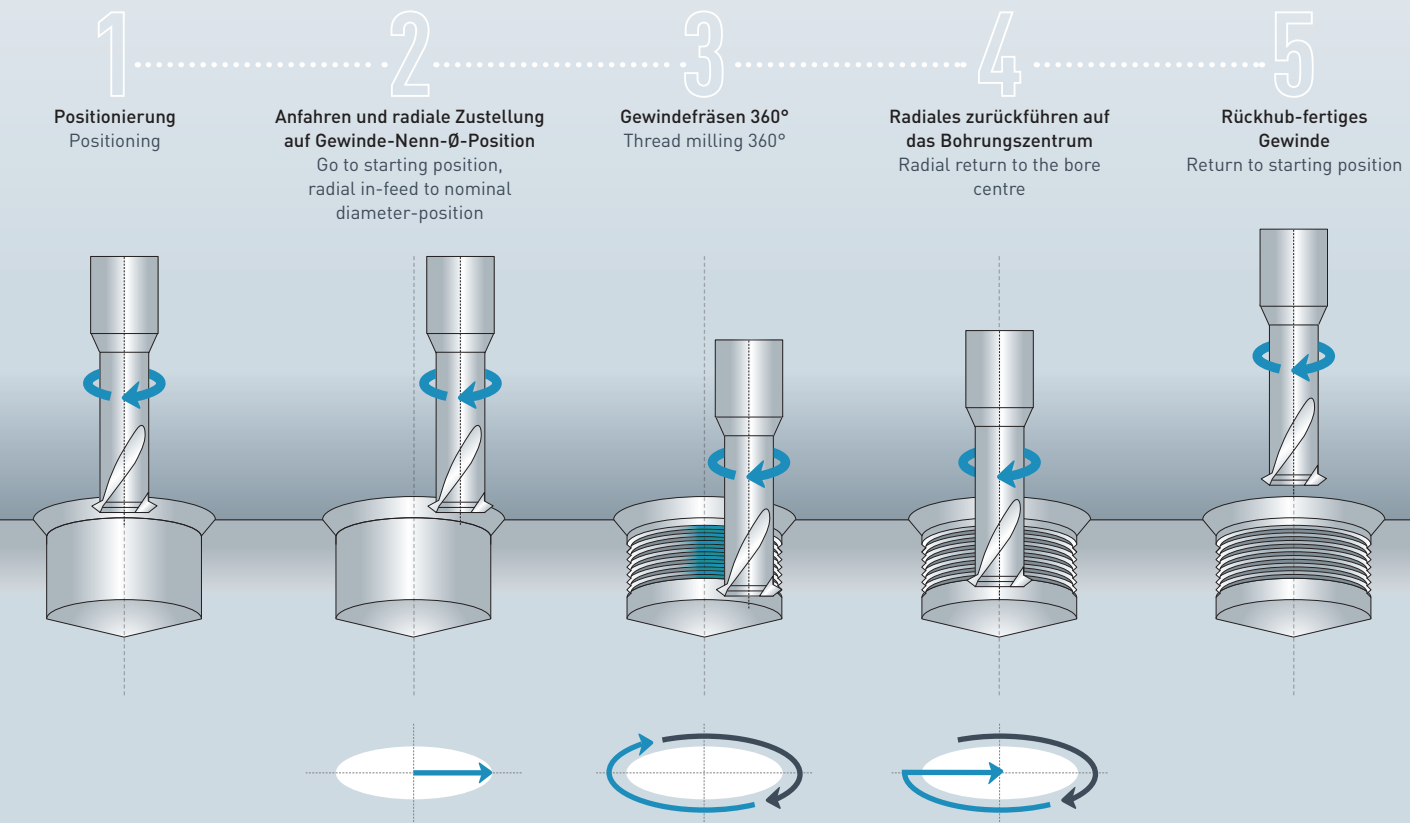
Schnittdaten  
Cutting data



i S. 338

Bearbeitungsfolge Einzahn-Gewindefräser  
Processing sequence for single tooth thread milling cutter

Art. **23.1760 23.1764 23.1768**



Art. 23.2005

Diamantbeschichteter Vollhartmetall Gewindefräser, spiralisiert 30° für Innengewinde ohne Innenkühlung, ohne Senkstufe, metrisches ISO-Gewinde DIN 13 – 2,5 x D

|                        |             |
|------------------------|-------------|
| COMPO-SITES            | TI-CFK      |
| GRAPHIT graphite       | PA66 GF30   |
| GFK                    | PVDF GF30   |
| CFK                    | PEEK GF30   |
| Hybrid-stoffe          | PEEK CF30   |
| CFK-ALU Composite      | zirkon oxid |
| Schicht-stoffe Laminat |             |



Diamond coated solid carbide thread milling cutter, 30° spiral for internal threads, without internal cooling

Fresa de roscas recubierta de diamante, de metal duro y macizo, espiral de 30° – para rosca interior, sin refrigeración interior

Цельно-твердосплавная резьбовая фреза с алмазным слоем, спираль 30° – для внутренней резьбы, без внутреннего охлаждения

|                 |                        |
|-----------------|------------------------|
| DIAMANT DIAMOND | DIN 13                 |
| M               | DIN 6535 Form HA       |
|                 |                        |
|                 | HSC High-Speed-Cutting |
|                 | DCC 0318               |
|                 |                        |

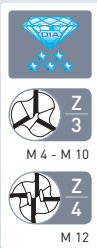
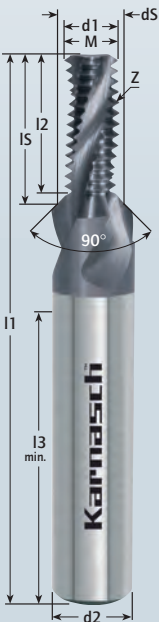
| Art.             | M      | Stg  | x D   | l2    | l1 | d1   | d2 h5 | Z | €      |
|------------------|--------|------|-------|-------|----|------|-------|---|--------|
| 232005.04.070.25 | • M 4  | 0,7  | 2,5xD | 10,85 | 55 | 3,15 | 6     | 3 | 156,00 |
| 232005.05.080.25 | • M 5  | 0,8  | 2,5xD | 13,15 | 55 | 4,00 | 6     | 3 | 159,00 |
| 232005.06.100.25 | • M 6  | 1,0  | 2,5xD | 16,50 | 55 | 4,80 | 6     | 3 | 164,00 |
| 232005.08.125.25 | • M 8  | 1,25 | 2,5xD | 21,80 | 55 | 6,00 | 6     | 3 | 174,00 |
| 232005.10.150.25 | • M 10 | 1,50 | 2,5xD | 26,20 | 65 | 8,00 | 8     | 3 | 208,00 |
| 232005.12.175.25 | • M 12 | 1,75 | 2,5xD | 30,60 | 75 | 9,90 | 10    | 4 | 245,00 |

PKD - CVD Gewindefräser kurzfristig lieferbar!  
PCD - CVD thread mills deliverable in short term!

Art. 23.2006

Diamantbeschichteter Vollhartmetall-Gewindefräser, spiralisiert für Innengewinde ohne Innenkühlung, mit 90° Senkstufe, metrisches ISO-Gewinde DIN 13 – 2,0 x D

|                        |             |
|------------------------|-------------|
| COMPO-SITES            | TI-CFK      |
| GRAPHIT graphite       | PA66 GF30   |
| GFK                    | PVDF GF30   |
| CFK                    | PEEK GF30   |
| Hybrid-stoffe          | PEEK CF30   |
| CFK-ALU Composite      | zirkon oxid |
| Schicht-stoffe Laminat |             |



Diamond coated solid carbide thread milling cutter, 30° spiral for internal threads, without internal cooling with 90° counter sunk stage

Fresa de roscas recubierta de diamante, de metal duro y macizo, espiral de 30° - para rosca interior, sin refrigeración interior, con descenso de 90°

Цельно-твердосплавная резьбовая фреза с алмазным слоем, спираль 30° – для внутренней резьбы, без внутреннего охлаждения, со ступенью снижения 90°

|                 |                        |
|-----------------|------------------------|
| DIAMANT DIAMOND | DIN 13                 |
| M               | DIN 6535 Form HA       |
|                 |                        |
|                 | HSC High-Speed-Cutting |
|                 | DCC 0318               |
|                 |                        |

| Art.             | M      | Stg  | x D   | l2    | l3/min. | l1 | ds   | ls   | d1   | d2 h5 | Z | €      |
|------------------|--------|------|-------|-------|---------|----|------|------|------|-------|---|--------|
| 232006.04.070.20 | • M 4  | 0,7  | 2,0xD | 8,75  | 36      | 55 | 4,2  | 9,3  | 3,14 | 6     | 3 | 162,00 |
| 232006.05.080.20 | • M 5  | 0,8  | 2,0xD | 10,75 | 36      | 55 | 5,3  | 11,3 | 4,00 | 6     | 3 | 169,00 |
| 232006.06.100.20 | • M 6  | 1,0  | 2,0xD | 12,40 | 36      | 65 | 6,3  | 13,1 | 4,80 | 8     | 3 | 186,00 |
| 232006.08.125.20 | • M 8  | 1,25 | 2,0xD | 16,80 | 40      | 75 | 8,3  | 17,6 | 6,50 | 10    | 3 | 226,00 |
| 232006.10.150.20 | • M 10 | 1,50 | 2,0xD | 20,10 | 45      | 80 | 10,3 | 21,2 | 8,20 | 12    | 3 | 305,00 |
| 232006.12.175.20 | • M 12 | 1,75 | 2,0xD | 25,20 | 45      | 90 | 12,3 | 26,4 | 9,90 | 14    | 4 | 354,00 |

PKD - CVD Gewindefräser kurzfristig lieferbar!  
PCD - CVD thread mills deliverable in short term!



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Siemensstraße 1  
D-68542 Heddesheim  
info@karnasch.de

**+49 (0) 6203 - 40390**

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**P R O F E S S I O N A L   T O O L S**

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|----------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|
| Art.                                   | Vollhartmetall Reibahlen / Solid carbide reamers |                                                                                   |                                                                                   | Material       |  |  |  | HSC<br>High-Speed-Cutting                                                           | HRC<br>< 45                                                                         | HRC<br>< 50 |
| 22.1450                                | Ø 0,200 - 0,595                                  |  |  | MICRO<br>GRAIN | 184                                                                                 |                                                                                     |  |  |  |             |
| 22.1452                                | Ø 0,60 - 3,50                                    |  |  | MICRO<br>GRAIN | 185                                                                                 |                                                                                     |  |  |  |             |
| 22.1490                                | Ø 1,0 - 12,0                                     |  |                                                                                   | MICRO<br>GRAIN | 186                                                                                 |  |                                                                                     |                                                                                     |                                                                                     |             |

- Lagerware  
stock-tools
- Keine Lagerware, Lieferzeit und Preis auf Anfrage  
No stock-tool. Price and delivery on request
- Lieferzeit kurzfristig da Rohlinglager vorhanden  
Short delivery deadline possible then blanks are on stock available
- ▲ Lieferbar solange Vorrat oder auf Anfrage  
Article be discontinued. Delivery possible until sold out. After sold out delivery possible on request.
- △ Lieferbar solange Vorrat. Nachfolgewerkzeug vorhanden  
Be discontinued. Replacement article available.
- 2-3

 2-3 Arbeitstage Lieferzeit  
2-3 work days delivery time

| HRC < 55 | HRC < 60 | HRC < 65 | HRC < 70 | STAHL<br>steel<br>< 800 N/mm | INOX<br>stainless<br>steel | INCONEL<br>HASTELLOY<br>TITAN | GJL | GJS | GTW<br>GTS | NE<br>non-ferrous | kurz-<br>spanend<br>short chip | lang-<br>spanend<br>long chip | MIT INNEN-<br>KÜHLUNG<br>with interior<br>cooling | OHNE INNEN-<br>KÜHLUNG<br>without interior<br>cooling | DIN 6535<br>Form HA | DIN 6535<br>Form HE | DIN 6535<br>Form HAK | DIN 6535<br>Form HEK |
|----------|----------|----------|----------|------------------------------|----------------------------|-------------------------------|-----|-----|------------|-------------------|--------------------------------|-------------------------------|---------------------------------------------------|-------------------------------------------------------|---------------------|---------------------|----------------------|----------------------|
|          |          |          |          | ✓                            | ✓                          | ✓                             | ✓   | ✓   |            | ✓                 | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
|          |          |          |          | ✓                            | ✓                          |                               | ✓   | ✓   |            | ✓                 | ✓                              | ✓                             |                                                   | ✓                                                     | ✓                   |                     |                      |                      |
| ✓        | ✓        | ✓        | ✓        |                              |                            |                               | ✓   | ✓   |            |                   | ✓                              |                               |                                                   | ✓                                                     | ✓                   |                     |                      |                      |

Art. 22.1450

Miniatur-Vollhartmetall-High-Speed-Präzisionsreibahlen HSR  
linksspirale, rechtsschneidend

HRC < 45

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

GG/G  
cast iron

TITAN  
< 1100  
N/mm

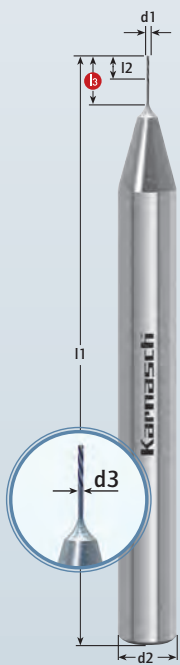
ALU  
aluminium

MESSING  
brass

KUPFER  
copper

kurz-  
spanend  
short chip

lang-  
spanend  
long chip



Miniature Micro Grain High-Speed Reamers / HSR. Left hand spiral  
fluted, right-handed.



Escariador de metal duro de velocidad rápida de tecnología / HSR  
(High-Temperature Smelt Redox) / hélice izquierda, corte a derecha.



микро-высокоскоростная прецизионная развёртка из  
металла сквозной закалки HSR / праворежущая,  
левоспиральная.

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HSR  
HIGH SPEED  
REAMERS



POLIERT  
POLISHED



Schnittdaten  
Cutting data



i S. 327

| Art.        | d1 ± 0,001 | l3  | d2<br>h6 | l1 | l2 / - 0,1 | d3/-<br>0,001 | Z | €      |
|-------------|------------|-----|----------|----|------------|---------------|---|--------|
| 221450.0200 | • 0,200    | 2,0 | 3,0      | 40 | 1,0        | 0,199         | 4 | 115,50 |
| 221450.0205 | • 0,205    | 2,0 | 3,0      | 40 | 1,0        | 0,204         | 4 | 115,50 |
| 221450.0210 | • 0,210    | 2,0 | 3,0      | 40 | 1,0        | 0,209         | 4 | 115,50 |
| 221450.0215 | • 0,215    | 2,0 | 3,0      | 40 | 1,0        | 0,214         | 4 | 115,50 |
| 221450.0220 | • 0,220    | 2,0 | 3,0      | 40 | 1,0        | 0,219         | 4 | 115,50 |
| 221450.0225 | • 0,225    | 2,0 | 3,0      | 40 | 1,0        | 0,224         | 4 | 115,50 |
| 221450.0230 | • 0,230    | 2,0 | 3,0      | 40 | 1,0        | 0,229         | 4 | 115,50 |
| 221450.0235 | • 0,235    | 2,0 | 3,0      | 40 | 1,0        | 0,234         | 4 | 115,50 |
| 221450.0240 | • 0,240    | 2,0 | 3,0      | 40 | 1,0        | 0,239         | 4 | 115,50 |
| 221450.0245 | • 0,245    | 2,0 | 3,0      | 40 | 1,0        | 0,244         | 4 | 115,50 |
| 221450.0250 | • 0,250    | 2,5 | 3,0      | 40 | 1,2        | 0,249         | 4 | 114,50 |
| 221450.0255 | • 0,255    | 2,5 | 3,0      | 40 | 1,2        | 0,254         | 4 | 114,50 |
| 221450.0260 | • 0,260    | 2,5 | 3,0      | 40 | 1,2        | 0,259         | 4 | 114,50 |
| 221450.0265 | • 0,265    | 2,5 | 3,0      | 40 | 1,2        | 0,264         | 4 | 114,50 |
| 221450.0270 | • 0,270    | 2,5 | 3,0      | 40 | 1,2        | 0,269         | 4 | 114,50 |
| 221450.0275 | • 0,275    | 2,5 | 3,0      | 40 | 1,2        | 0,274         | 4 | 114,50 |
| 221450.0280 | • 0,280    | 2,5 | 3,0      | 40 | 1,2        | 0,279         | 4 | 114,50 |
| 221450.0285 | • 0,285    | 2,5 | 3,0      | 40 | 1,2        | 0,284         | 4 | 114,50 |
| 221450.0290 | • 0,290    | 2,5 | 3,0      | 40 | 1,2        | 0,289         | 4 | 114,50 |
| 221450.0295 | • 0,295    | 2,5 | 3,0      | 40 | 1,2        | 0,294         | 4 | 114,50 |
| 221450.0300 | • 0,300    | 3,0 | 3,0      | 40 | 1,5        | 0,299         | 4 | 113,00 |
| 221450.0305 | • 0,305    | 3,0 | 3,0      | 40 | 1,5        | 0,304         | 4 | 113,00 |
| 221450.0310 | • 0,310    | 3,0 | 3,0      | 40 | 1,5        | 0,309         | 4 | 113,00 |
| 221450.0315 | • 0,315    | 3,0 | 3,0      | 40 | 1,5        | 0,314         | 4 | 113,00 |
| 221450.0320 | • 0,320    | 3,0 | 3,0      | 40 | 1,5        | 0,319         | 4 | 113,00 |
| 221450.0325 | • 0,325    | 3,0 | 3,0      | 40 | 1,5        | 0,324         | 4 | 113,00 |
| 221450.0330 | • 0,330    | 3,0 | 3,0      | 40 | 1,5        | 0,329         | 4 | 113,00 |
| 221450.0335 | • 0,335    | 3,0 | 3,0      | 40 | 1,5        | 0,334         | 4 | 113,00 |
| 221450.0340 | • 0,340    | 3,0 | 3,0      | 40 | 1,5        | 0,339         | 4 | 113,00 |
| 221450.0345 | • 0,345    | 3,0 | 3,0      | 40 | 1,5        | 0,344         | 4 | 113,00 |
| 221450.0350 | • 0,350    | 3,5 | 3,0      | 40 | 1,8        | 0,349         | 4 | 112,00 |
| 221450.0355 | • 0,355    | 3,5 | 3,0      | 40 | 1,8        | 0,354         | 4 | 112,00 |
| 221450.0360 | • 0,360    | 3,5 | 3,0      | 40 | 1,8        | 0,359         | 4 | 112,00 |
| 221450.0365 | • 0,365    | 3,5 | 3,0      | 40 | 1,8        | 0,364         | 4 | 112,00 |
| 221450.0370 | • 0,370    | 3,5 | 3,0      | 40 | 1,8        | 0,369         | 4 | 112,00 |
| 221450.0375 | • 0,375    | 3,5 | 3,0      | 40 | 1,8        | 0,374         | 4 | 112,00 |
| 221450.0380 | • 0,380    | 3,5 | 3,0      | 40 | 1,8        | 0,379         | 4 | 112,00 |
| 221450.0385 | • 0,385    | 3,5 | 3,0      | 40 | 1,8        | 0,384         | 4 | 112,00 |
| 221450.0390 | • 0,390    | 3,5 | 3,0      | 40 | 1,8        | 0,389         | 4 | 112,00 |
| 221450.0395 | • 0,395    | 3,5 | 3,0      | 40 | 1,8        | 0,394         | 4 | 112,00 |

| Art.        | d1 ± 0,001 | l3  | d2<br>h6 | l1 | l2 / - 0,1 | d3/-<br>0,001 | Z | €      |
|-------------|------------|-----|----------|----|------------|---------------|---|--------|
| 221450.0400 | • 0,400    | 4,0 | 3,0      | 40 | 2,0        | 0,399         | 4 | 111,00 |
| 221450.0405 | • 0,405    | 4,0 | 3,0      | 40 | 2,0        | 0,404         | 4 | 111,00 |
| 221450.0410 | • 0,410    | 4,0 | 3,0      | 40 | 2,0        | 0,409         | 4 | 111,00 |
| 221450.0415 | • 0,415    | 4,0 | 3,0      | 40 | 2,0        | 0,414         | 4 | 111,00 |
| 221450.0420 | • 0,420    | 4,0 | 3,0      | 40 | 2,0        | 0,419         | 4 | 111,00 |
| 221450.0425 | • 0,425    | 4,0 | 3,0      | 40 | 2,0        | 0,424         | 4 | 111,00 |
| 221450.0430 | • 0,430    | 4,0 | 3,0      | 40 | 2,0        | 0,429         | 4 | 111,00 |
| 221450.0435 | • 0,435    | 4,0 | 3,0      | 40 | 2,0        | 0,434         | 4 | 111,00 |
| 221450.0440 | • 0,440    | 4,0 | 3,0      | 40 | 2,0        | 0,439         | 4 | 111,00 |
| 221450.0445 | • 0,445    | 4,0 | 3,0      | 40 | 2,0        | 0,444         | 4 | 111,00 |
| 221450.0450 | • 0,450    | 4,0 | 3,0      | 40 | 2,0        | 0,449         | 4 | 111,00 |
| 221450.0455 | • 0,455    | 4,0 | 3,0      | 40 | 2,0        | 0,454         | 4 | 111,00 |
| 221450.0460 | • 0,460    | 4,0 | 3,0      | 40 | 2,0        | 0,459         | 4 | 111,00 |
| 221450.0465 | • 0,465    | 4,0 | 3,0      | 40 | 2,0        | 0,464         | 4 | 111,00 |
| 221450.0470 | • 0,470    | 4,0 | 3,0      | 40 | 2,0        | 0,469         | 4 | 111,00 |
| 221450.0475 | • 0,475    | 4,0 | 3,0      | 40 | 2,0        | 0,474         | 4 | 111,00 |
| 221450.0480 | • 0,480    | 4,0 | 3,0      | 40 | 2,0        | 0,479         | 4 | 111,00 |
| 221450.0485 | • 0,485    | 4,0 | 3,0      | 40 | 2,0        | 0,484         | 4 | 111,00 |
| 221450.0490 | • 0,490    | 4,0 | 3,0      | 40 | 2,0        | 0,489         | 4 | 111,00 |
| 221450.0495 | • 0,495    | 4,0 | 3,0      | 40 | 2,0        | 0,494         | 4 | 111,00 |
| 221450.0500 | • 0,500    | 5,0 | 3,0      | 40 | 2,4        | 0,499         | 4 | 110,00 |
| 221450.0505 | • 0,505    | 5,0 | 3,0      | 40 | 2,4        | 0,504         | 4 | 110,00 |
| 221450.0510 | • 0,510    | 5,0 | 3,0      | 40 | 2,4        | 0,509         | 4 | 110,00 |
| 221450.0515 | • 0,515    | 5,0 | 3,0      | 40 | 2,4        | 0,514         | 4 | 110,00 |
| 221450.0520 | • 0,520    | 5,0 | 3,0      | 40 | 2,4        | 0,519         | 4 | 110,00 |
| 221450.0525 | • 0,525    | 5,0 | 3,0      | 40 | 2,4        | 0,524         | 4 | 110,00 |
| 221450.0530 | • 0,530    | 5,0 | 3,0      | 40 | 2,4        | 0,529         | 4 | 110,00 |
| 221450.0535 | • 0,535    | 5,0 | 3,0      | 40 | 2,4        | 0,534         | 4 | 110,00 |
| 221450.0540 | • 0,540    | 5,0 | 3,0      | 40 | 2,4        | 0,539         | 4 | 110,00 |
| 221450.0545 | • 0,545    | 5,0 | 3,0      | 40 | 2,4        | 0,544         | 4 | 110,00 |
| 221450.0550 | • 0,550    | 5,0 | 3,0      | 40 | 2,4        | 0,549         | 4 | 110,00 |
| 221450.0555 | • 0,555    | 5,0 | 3,0      | 40 | 2,4        | 0,554         | 4 | 110,00 |
| 221450.0560 | • 0,560    | 5,0 | 3,0      | 40 | 2,4        | 0,559         | 4 | 110,00 |
| 221450.0565 | • 0,565    | 5,0 | 3,0      | 40 | 2,4        | 0,564         | 4 | 110,00 |
| 221450.0570 | • 0,570    | 5,0 | 3,0      | 40 | 2,4        | 0,569         | 4 | 110,00 |
| 221450.0575 | • 0,575    | 5,0 | 3,0      | 40 | 2,4        | 0,574         | 4 | 110,00 |
| 221450.0580 | • 0,580    | 5,0 | 3,0      | 40 | 2,4        | 0,579         | 4 | 110,00 |
| 221450.0585 | • 0,585    | 5,0 | 3,0      | 40 | 2,4        | 0,584         | 4 | 110,00 |
| 221450.0590 | • 0,590    | 5,0 | 3,0      | 40 | 2,4        | 0,589         | 4 | 110,00 |
| 221450.0595 | • 0,595    | 5,0 | 3,0      | 40 | 2,4        | 0,594         | 4 | 110,00 |

• ab Lager / stock

□ Alle Abmessungen in µm-Abstufung lieferbar / Lieferzeit unbeschichtet ca. 5 Arbeitstage / beschichtet ca. 8 Tage

□ All dimensions available in µm-steps / Delivery time without coating 5 working days / with coating 8 working days



Miniatur- Vollhartmetall- Präzisionsreibahlen HPC  
linksspirale, rechtsschneidend

Art. **22.1452**

HRC  
< 45

INOX  
stainless steel  
< 900 N/mm  
ferritic

INOX  
stainless steel  
> 900 N/mm  
martensitic

INOX  
stainless steel  
< 900 N/mm  
austenitic

GG/G  
cast iron

ALU  
aluminium

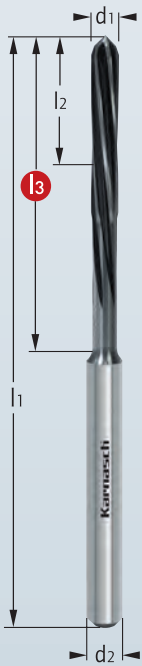
MESSING  
brass

KUPFER  
copper

GOLD  
gold

kurz-  
spanend  
short chip

lang-  
spanend  
long chip



MICRO  
TOOL

Z 3

Z 4

Z 6

Miniature Micro Grain High-Speed Reamers / HPC. Left hand spiral  
fluted, right-handed.

Alesatore in metallo duro / HPC / rotazione sinistrorsa delle  
spirale, rotazione destrorsa dei taglienti.

микро-высокоскоростная прецизионная развёртка из  
металла сквозной закалки HSR/праворежущая,  
левоспиральная.

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

Form HA

30°  
7°

HPC

POLIERT  
POLISHED

Schnittdaten  
Cutting data



i s. 327

Zuschläge für Zwischenabmessungen bei  
gleichen Durchmesser und gleicher Toleranz.

Additional charge for intermediate dimensions  
for equal diameter and equal tolerance

| Stück | 0,98 Ø – 3,96 Ø netto per Stück      |
|-------|--------------------------------------|
| 1     | € 25,00                              |
| 2     | € 15,00                              |
| 3     | € 10,00                              |
| 4     | € 9,00                               |
| 5     | € 8,00                               |
| 6-9   | € 7,00                               |
| 10-14 | € 5,00                               |
| 15-19 | € 3,00                               |
| ab 20 | pro Ø und Toleranz<br>ohne Aufschlag |

| Art.        | d1                 | l3 | d2*  | l1 | l2 | Z | €     |
|-------------|--------------------|----|------|----|----|---|-------|
| 221452.0060 | • 0,60 +0,003      | 10 | 0,60 | 34 | 7  | 4 | 85,50 |
| -           | ▣ 0,61-0,69 +0,003 | 10 | =d1  | 34 | 7  | 4 | 85,50 |
| 221452.0070 | • 0,70 +0,003      | 10 | 0,70 | 34 | 7  | 4 | 64,50 |
| -           | ▣ 0,71-0,79 +0,003 | 10 | =d1  | 34 | 7  | 4 | 64,50 |
| 221452.0080 | • 0,80 +0,003      | 10 | 0,80 | 34 | 7  | 4 | 60,00 |
| -           | ▣ 0,81-0,89 +0,003 | 10 | =d1  | 34 | 7  | 4 | 60,00 |
| 221452.0090 | • 0,90 +0,003      | 10 | 0,90 | 34 | 7  | 4 | 60,00 |
| -           | ▣ 0,91-0,97 +0,003 | 10 | =d1  | 34 | 7  | 4 | 60,00 |
| 221452.0098 | • 0,98 +0,004      | 21 | 4,0  | 50 | 6  | 3 | 57,00 |
| 221452.0099 | • 0,99 +0,004      | 21 | 4,0  | 50 | 6  | 3 | 57,00 |
| 221452.0100 | • 1,00 +0,004      | 21 | 4,0  | 50 | 6  | 3 | 57,00 |
| 221452.0101 | • 1,01 +0,004      | 21 | 4,0  | 50 | 6  | 3 | 57,00 |
| 221452.0102 | • 1,02 +0,004      | 21 | 4,0  | 50 | 6  | 3 | 57,00 |
| 221452.0103 | • 1,03 +0,004      | 21 | 4,0  | 50 | 6  | 3 | 57,00 |
| 221452.0148 | • 1,48 +0,004      | 21 | 4,0  | 50 | 9  | 3 | 58,00 |
| 221452.0149 | • 1,49 +0,004      | 21 | 4,0  | 50 | 9  | 3 | 58,00 |
| 221452.0150 | • 1,50 H7          | 21 | 4,0  | 50 | 9  | 3 | 58,00 |
| 221452.0151 | • 1,51 +0,004      | 21 | 4,0  | 50 | 9  | 3 | 58,00 |
| 221452.0152 | • 1,52 +0,004      | 21 | 4,0  | 50 | 9  | 3 | 58,00 |
| 221452.0153 | • 1,53 +0,004      | 21 | 4,0  | 50 | 9  | 3 | 58,00 |
| 221452.0160 | • 1,60 H7          | 21 | 4,0  | 50 | 12 | 3 | 64,00 |
| 221452.0180 | • 1,80 H7          | 21 | 4,0  | 50 | 12 | 4 | 64,00 |
| 221452.0198 | • 1,98 +0,004      | 21 | 4,0  | 50 | 12 | 4 | 58,00 |
| 221452.0199 | • 1,99 +0,004      | 21 | 4,0  | 50 | 12 | 4 | 58,00 |
| 221452.0200 | • 2,00 H7          | 21 | 4,0  | 50 | 12 | 4 | 58,00 |
| 221452.0201 | • 2,01 +0,004      | 21 | 4,0  | 50 | 12 | 4 | 58,00 |
| 221452.0202 | • 2,02 +0,004      | 21 | 4,0  | 50 | 12 | 4 | 58,00 |
| 221452.0203 | • 2,03 +0,004      | 21 | 4,0  | 50 | 12 | 4 | 58,00 |
| 221452.0248 | • 2,48 +0,004      | 31 | 4,0  | 60 | 16 | 4 | 58,00 |
| 221452.0249 | • 2,49 +0,004      | 31 | 4,0  | 60 | 16 | 4 | 58,00 |
| 221452.0250 | • 2,50 H7          | 31 | 4,0  | 60 | 16 | 4 | 58,00 |
| 221452.0251 | • 2,51 +0,004      | 31 | 4,0  | 60 | 16 | 4 | 58,00 |
| 221452.0252 | • 2,52 +0,004      | 31 | 4,0  | 60 | 16 | 4 | 58,00 |
| 221452.0253 | • 2,53 +0,004      | 31 | 4,0  | 60 | 16 | 4 | 58,00 |
| 221452.0280 | • 2,80 H7          | 35 | 4,0  | 63 | 16 | 6 | 66,00 |
| 221452.0297 | • 2,97 +0,004      | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0298 | • 2,98 +0,004      | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0299 | • 2,99 +0,004      | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0300 | • 3,00 H7          | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0301 | • 3,01 +0,004      | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0302 | • 3,02 +0,004      | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0303 | • 3,03 +0,004      | 35 | 4,0  | 63 | 16 | 6 | 59,00 |
| 221452.0320 | • 3,20 H7          | 38 | 4,0  | 65 | 19 | 6 | 52,00 |
| 221452.0350 | • 3,50 H7          | 45 | 4,0  | 70 | 19 | 6 | 52,00 |

Alle Abmessungen in µm-Abstufung lieferbar / Lieferzeit 2-3 Arbeitstage  
All dimensions available in µm-steps / Delivery time 2-3 working days

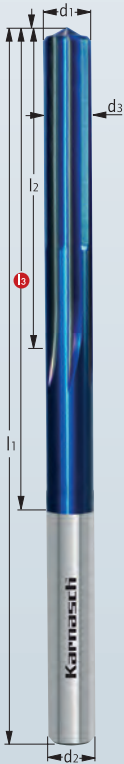
Art. 22.1490

Vollhartmetall Maschinenreibahle für Hartbearbeitung HHC, < 67 HRC  
gerade genutet, rechtsschneidend < 67 HRC

HRC  
55-67

GJL

GJS



- Micro grain machine reamers for high hard material  
HHC < 67 HRC straight fluted, right hand cut
- Alesatori a macchina- M.D. lavorazioni  
HHC < 67 HRC, taglio dritto, elica destra
- Твердосплавная машинная развертка для твердой обработки  
ННС, с прямыми канавками, праворежущая < 67 HRC

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HHC

FX-70

Schnittdaten  
Cutting data



| Art.        | d1 H7   | l3  | d2 h7 | l2 | l1  | Z | €      |
|-------------|---------|-----|-------|----|-----|---|--------|
| 221490.0100 | ▲ 1,00  | 15  | 4     | 6  | 50  | 3 | 58,50  |
| 221490.0200 | ▲ 2,00  | 15  | 4     | 12 | 50  | 4 | 67,50  |
| 221490.0297 | ● 2,97  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0298 | ● 2,98  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0299 | ● 2,99  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0300 | ● 3,00  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0301 | ● 3,01  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0302 | ● 3,02  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0303 | ● 3,03  | 30  | 4     | 16 | 65  | 4 | 85,00  |
| 221490.0397 | ● 3,97  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0398 | ● 3,98  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0399 | ● 3,99  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0400 | ● 4,00  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0401 | ● 4,01  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0402 | ● 4,02  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0403 | ● 4,03  | 40  | 4     | 20 | 75  | 4 | 85,00  |
| 221490.0497 | ● 4,97  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0498 | ● 4,98  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0499 | ● 4,99  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0500 | ● 5,00  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0501 | ● 5,01  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0502 | ● 5,02  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0503 | ● 5,03  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0597 | ● 5,97  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0598 | ● 5,98  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0599 | ● 5,99  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0600 | ● 6,00  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0601 | ● 6,01  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0602 | ● 6,02  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0603 | ● 6,03  | 50  | 6     | 25 | 92  | 6 | 105,00 |
| 221490.0797 | ● 7,97  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0798 | ● 7,98  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0799 | ● 7,99  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0800 | ● 8,00  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0801 | ● 8,01  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0802 | ● 8,02  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0803 | ● 8,03  | 75  | 8     | 30 | 115 | 6 | 131,00 |
| 221490.0997 | ● 9,97  | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.0998 | ● 9,98  | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.0999 | ● 9,99  | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.1000 | ● 10,00 | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.1001 | ● 10,01 | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.1002 | ● 10,02 | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.1003 | ● 10,03 | 85  | 10    | 40 | 130 | 6 | 160,00 |
| 221490.1197 | ● 11,97 | 100 | 12    | 45 | 150 | 6 | 209,00 |
| 221490.1198 | ● 11,98 | 100 | 12    | 45 | 150 | 6 | 209,00 |
| 221490.1199 | ● 11,99 | 100 | 12    | 45 | 150 | 6 | 209,00 |
| 221490.1200 | ● 12,00 | 100 | 12    | 45 | 150 | 6 | 209,00 |
| 221490.1201 | ● 12,01 | 100 | 12    | 45 | 150 | 6 | 209,00 |
| 221490.1202 | ● 12,02 | 100 | 12    | 45 | 150 | 6 | 209,00 |
| 221490.1203 | ● 12,03 | 100 | 12    | 45 | 150 | 6 | 209,00 |

Zwischenabmessungen auf Anfrage lieferbar / Intermediate dimensions available on request

WERKZEUGE FÜR COMPOSITES – CFK / GFK – TITAN – KUNSTSTOFF  
TOOLS FOR COMPOSITES – CFRP / GFRP – TITANIUM – PLASTICS  
HERRAMIENTAS PARA COMPUESTOS – CFRP / GFRP – TITANIO – PLÁSTICO  
ИНСТРУМЕНТЫ ДЛЯ КОМПОЗИТОВ – ЦФК/ГФК – ТИТАН – ПЛАСТМАССА СЕЙЧАС  
ОНЛАЙН ДЛЯ ВАС

HIGH TECHNOLOGY TOOLS  
IN CVD-PCD-MCD-ND



KONTAKT | CONTACT | EL CONTACTO | KOHTAKT

KARNASCH PROFESSIONAL TOOLS<sup>TM</sup>  
CNC TOOLS DIVISION

Siemensstraße 1  
D-68542 Heddesheim  
info@karnasch.de

+49 (0) 6203 - 40390

KARNASCH ONLINE-WEBSHOP

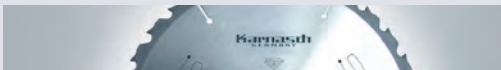
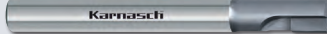


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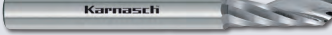
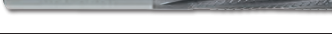
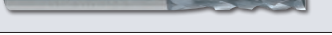
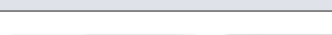


PROFESSIONAL TOOLS

| INHALTSVERZEICHNIS · TABLE OF CONTENTS |                                                                                     |                           |     |   | HSC<br>high-speed-<br>cutting | HPC | COMPO-<br>SITES | INCONEL | AFK<br>Aramid | PVDF<br>GF30 | Honey<br>comb |
|----------------------------------------|-------------------------------------------------------------------------------------|---------------------------|-----|---|-------------------------------|-----|-----------------|---------|---------------|--------------|---------------|
| Art.                                   | Composites Tools                                                                    | Material                  |     |   |                               |     |                 |         |               |              |               |
| 11.1350                                |    | PKD                       | 243 |   | ✓                             | ✓   |                 |         | ✓             | ✓            | ✓             |
| 29.0060                                |    | PKD                       | 196 | ✓ | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.0080A                               |    | MICRO<br>GRAIN            | 198 |   | ✓                             | ✓   |                 |         | ✓             | ✓            | ✓             |
| 29.0080B                               |    | MICRO<br>GRAIN            | 198 |   | ✓                             |     |                 |         |               |              | ✓             |
| 29.0100                                |    | MICRO<br>GRAIN            | 199 |   | ✓                             |     |                 |         |               |              |               |
| 29.0120                                |    | MICRO<br>GRAIN            | 200 |   | ✓                             | ✓   |                 |         |               | ✓            |               |
| 29.0121                                |    | MICRO<br>GRAIN            | 202 |   | ✓                             | ✓   |                 |         |               | ✓            |               |
| 29.0122                                |    | MICRO<br>GRAIN            | 203 |   | ✓                             | ✓   |                 |         |               | ✓            |               |
| 29.0200                                |    | MICRO<br>GRAIN            | 204 |   |                               |     |                 |         |               |              |               |
| 29.0210                                |  | MICRO<br>GRAIN            | 205 |   |                               |     |                 |         |               |              |               |
| 29.0250                                |  | MICRO<br>GRAIN            | 206 |   |                               |     |                 |         |               |              |               |
| 29.0260                                |  | MICRO<br>GRAIN            | 207 |   |                               |     |                 |         |               |              |               |
| 29.0305                                |  | MICRO<br>GRAIN            | 210 |   | ✓                             | ✓   |                 |         | ✓             | ✓            |               |
| 29.0412                                |  | MICRO<br>GRAIN            | 210 |   | ✓                             | ✓   |                 |         | ✓             | ✓            |               |
| 29.0416                                |  | MICRO<br>GRAIN            | 211 |   | ✓                             | ✓   |                 |         | ✓             | ✓            |               |
| 29.0417                                |  | MICRO<br>GRAIN            | 211 |   | ✓                             | ✓   |                 |         | ✓             | ✓            |               |
| 29.6811                                |  | ND<br>MKD                 | 233 | ✓ | ✓                             |     |                 |         |               |              |               |
| 29.6837                                |  | MKD<br>Mono<br>Kristallin | 234 | ✓ | ✓                             |     |                 |         |               |              |               |
| 29.6838                                |  | MKD<br>Mono<br>Kristallin | 235 | ✓ | ✓                             |     |                 |         |               |              |               |
| 29.6839                                |  | MKD<br>Mono<br>Kristallin | 236 | ✓ | ✓                             |     |                 |         |               |              |               |
| 29.6840                                |  | MKD<br>Mono<br>Kristallin | 237 | ✓ | ✓                             |     |                 |         |               |              |               |
| 29.6843                                |  | MKD<br>Mono<br>Kristallin | 238 | ✓ | ✓                             |     |                 |         |               |              |               |

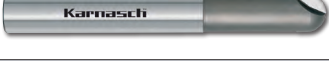
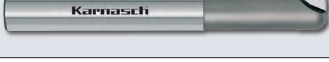
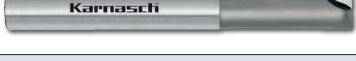
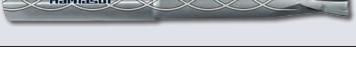


| PA66 GF30 | PTFE CF25 | POM GF25 | PF-31 | PEEK | PA-66 | PE-HD | Kevlar | Gold Silber Kupfer | Schichtstoffe Laminat | Spiegel finish Mirror finish | ALU > 12% Si | MIT INNEN-KÜHLUNG with interior cooling | ZIRKONIUM | TITAN | C T | T C | C A | A C |
|-----------|-----------|----------|-------|------|-------|-------|--------|--------------------|-----------------------|------------------------------|--------------|-----------------------------------------|-----------|-------|-----|-----|-----|-----|
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                              | ✓            |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     | ✓    | ✓     | ✓     | ✓      | ✓                  | ✓                     |                              | ✓            |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    | ✓                     |                              |              |                                         |           |       |     |     |     |     |
|           |           |          |       | ✓    | ✓     |       | ✓      |                    |                       |                              |              |                                         |           |       |     |     |     |     |
|           |           |          |       |      |       |       | ✓      |                    | ✓                     |                              |              |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    |                       |                              |              |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    |                       |                              |              |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    |                       |                              |              | ✓                                       |           |       |     |     |     |     |
|           |           |          |       |      |       |       |        |                    |                       |                              |              |                                         |           |       |     |     | ✓   | ✓   |
|           |           |          |       |      |       |       |        |                    |                       |                              |              |                                         |           |       | ✓   | ✓   |     |     |
|           |           |          |       |      |       |       |        |                    |                       |                              |              |                                         |           |       |     |     | ✓   | ✓   |
|           |           |          |       |      |       |       |        |                    |                       |                              |              |                                         |           |       | ✓   | ✓   |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                              |              |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    | ✓                     |                              |              |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    | ✓                     |                              |              |                                         |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    | ✓                     |                              |              | ✓                                       |           |       |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                            |              |                                         |           |       |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                            |              |                                         |           |       |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                            |              |                                         |           |       |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                            |              |                                         |           |       |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                            |              |                                         |           |       |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                            |              |                                         |           |       |     |     |     |     |

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|----------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------|-----|-----------------|---------|---------------|--------------|---------------|
| Art.                                   | Composites Tools                                                                    | Material                                                                            |  | HSC<br>high-speed-<br>cutting | HPC | COMPO-<br>SITES | INCONEL | AFK<br>Aramid | PVDF<br>GF30 | Honey<br>comb |
| 29.1652                                |    |    | 212                                                                               | ✓                             | ✓   |                 |         |               |              |               |
| 29.1654                                |    |    | 213                                                                               | ✓                             | ✓   |                 |         |               |              |               |
| 29.1658                                |    |    | 214                                                                               | ✓                             | ✓   |                 |         |               |              |               |
| 29.1661                                |    |    | 215                                                                               | ✓                             | ✓   |                 |         |               |              |               |
| 29.1751                                |    |    | 216                                                                               |                               |     |                 |         |               |              |               |
| 29.1752                                |    |    | 216                                                                               |                               |     |                 |         |               |              |               |
| 29.1753                                |    |    | 217                                                                               |                               |     |                 |         |               |              |               |
| 29.1761                                |    |    | 218                                                                               |                               | ✓   | ✓               |         |               |              | ✓             |
| 29.1762                                |    |    | 218                                                                               |                               | ✓   | ✓               |         |               |              | ✓             |
| 29.1763                                |  |  | 219                                                                               |                               | ✓   | ✓               |         |               |              | ✓             |
| 29.1783                                |  |  | 220                                                                               |                               | ✓   | ✓               |         | ✓             | ✓            | ✓             |
| 29.1784                                |  |  | 220                                                                               |                               | ✓   | ✓               |         | ✓             | ✓            | ✓             |
| 29.1790A                               |  |  | 221                                                                               |                               | ✓   | ✓               |         | ✓             | ✓            | ✓             |
| 29.1790C                               |  |  | 221                                                                               |                               |     |                 |         | ✓             |              | ✓             |
| 29.6521                                |  |  | 223                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6522                                |  |  | 224                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6523                                |  |  | 225                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6524                                |  |  | 226                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6525                                |  |  | 226                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6526                                |  |  | 227                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6553                                |  |  | 227                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6562                                |  |  | 228                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |

| PA66<br>GF30 | PTFE<br>CF25 | POM<br>GF25 | PF-31 | PEEK | PA-66 | PE-HD | Kevlar | Gold<br>Silber<br>Kupfer | Schicht-<br>stoffe<br>Laminat | Spiegelfinish<br>Mirror finish | ALU<br>> 12% Si | MIT INNEN-<br>KÜHLUNG<br>with interior<br>cooling | ZIRKO-<br>NIUM | TITAN |  |  |  |  |
|--------------|--------------|-------------|-------|------|-------|-------|--------|--------------------------|-------------------------------|--------------------------------|-----------------|---------------------------------------------------|----------------|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|              |              |             |       | ✓    |       |       |        | ✓                        |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       | ✓    |       |       |        | ✓                        |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       | ✓    |       |       |        | ✓                        |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       | ✓    |       |       |        | ✓                        |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       | ✓    | ✓     | ✓     |        |                          |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       | ✓    | ✓     | ✓     |        |                          |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       | ✓    | ✓     | ✓     |        |                          |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              | ✓            | ✓           |       |      |       |       |        |                          |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              | ✓            | ✓           |       |      |       |       |        |                          |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              | ✓            | ✓           |       |      |       |       |        |                          |                               |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     |        |                          | ✓                             |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     |        |                          | ✓                             |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     |        |                          | ✓                             |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|              |              |             |       |      |       |       | ✓      |                          | ✓                             |                                |                 |                                                   |                |       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| ✓            | ✓            | ✓           | ✓     |      | ✓     | ✓     | ✓      |                          | ✓                             |                                | ✓               |                                                   | ✓              | ✓     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

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| Art.    | Composites Tools                                                                    | Material                |  | HSC<br>high-speed-<br>cutting | HPC | COMPO-<br>SITES | INCONEL | AFK<br>Aramid | PVDF<br>GF30 | Honey<br>comb |
|---------|-------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------|-------------------------------|-----|-----------------|---------|---------------|--------------|---------------|
| 29.6572 |    | CVD                     | 229                                                                               | ✓                             |     | ✓               |         | ✓             | ✓            |               |
| 29.6573 |    | CVD                     | 230                                                                               | ✓                             |     | ✓               |         | ✓             | ✓            |               |
| 29.6574 |    | CVD                     | 230                                                                               | ✓                             |     | ✓               |         | ✓             | ✓            |               |
| 29.6600 |    | CVD                     | 231                                                                               |                               | ✓   | ✓               |         | ✓             | ✓            |               |
| 29.6620 |    | ND<br>Natur-<br>diamant | 232                                                                               |                               | ✓   |                 |         |               |              |               |
| 30.6522 |    | PKD                     | 239                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 30.6523 |    | PKD                     | 240                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 30.6524 |    | PKD                     | 241                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 30.6526 |    | PKD                     | 241                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 30.6528 |  | PKD                     | 240                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 30.6534 |  | PKD                     | 242                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 22.0415 |  | MICRO<br>GRAIN          | 196                                                                               |                               | ✓   |                 |         |               | ✓            |               |
| 23.2005 |  | MICRO<br>GRAIN          | 197                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 23.2006 |  | MICRO<br>GRAIN          | 197                                                                               |                               | ✓   | ✓               |         |               | ✓            |               |
| 29.6510 |  | CVD                     | 223                                                                               | ✓                             | ✓   | ✓               |         | ✓             | ✓            |               |
| 22.0410 |  | MICRO<br>GRAIN          | 208                                                                               |                               |     |                 | ✓       |               |              |               |
| 22.0412 |  | MICRO<br>GRAIN          | 209                                                                               |                               |     |                 |         |               |              |               |

- Lagerware  
Stock-tools
  - Keine Lagerware, Lieferzeit und Preis auf Anfrage  
No stock-tool. Price and delivery on request
  - Lieferzeit kurzfristig da Rohlinglager vorhanden  
Short delivery deadline possible then blanks are on stock available
- ▲ Lieferbar solange Vorrat oder auf Anfrage / Article be discontinued.  
Delivery possible until sold out. After sold out delivery possible on request.
  - △ Lieferbar solange Vorrat. Nachfolgewerkzeug vorhanden  
Be discontinued. Replacement article available.
  - 2-3 2-3 Arbeitstage Lieferzeit  
2-3 work days delivery time



| PA66 GF30 | PTFE CF25 | POM GF25 | PF-31 | PEEK | PA-66 | PE-HD | Kevlar | Gold Silber Kupfer | Schichtstoffe Laminat | Spiegelfinish Mirror finish | ALU > 12% Si | MIT INNENKÜHLUNG with interior cooling | ZIRKONIUM | TITAN | C T | T C | C A | A C |
|-----------|-----------|----------|-------|------|-------|-------|--------|--------------------|-----------------------|-----------------------------|--------------|----------------------------------------|-----------|-------|-----|-----|-----|-----|
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        | ✓         | ✓     |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        | ✓         | ✓     |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        | ✓         | ✓     |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            | ✓                                      | ✓         | ✓     |     |     |     |     |
|           |           |          |       | ✓    |       |       |        | ✓                  |                       | ✓                           |              |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            | ✓                                      |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     |        |                    | ✓                     |                             |              | ✓                                      |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        |           |       |     |     |     |     |
| ✓         | ✓         | ✓        | ✓     |      | ✓     | ✓     | ✓      |                    | ✓                     |                             | ✓            |                                        | ✓         | ✓     |     |     |     |     |
|           |           |          |       |      |       |       |        |                    |                       |                             |              |                                        |           | ✓     |     |     |     |     |

Art. 29.0060 PKD-Vollhartmetall-Micro-Hochleistungsbohrer

COMPO-SITES

Sandwich

Aramid-faser AFK-SFK

GF GF25

Hybrid-stoffe

PVDF GF25

CFK-ALU Composite

GFK

Schicht-stoffe Laminat

CFK

Kevlar

PMMA GS

PA66 GF30

ALU < 12% Si

PVDF GF30

ALU > 12% Si

PEEK GF30

GRAPHIT graphite

PEEK CF30

zirkon oxid



- PCD equipped solid carbide high performance micro drill
- Microbroca de alto rendimiento de metal duro con contenido de PCD
- Твердосплавные высокопроизводительные микросверла с PCD напылением

| Art.            | d1/h7  | l3 | l2 | l1 | d2/h5 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 290060.0060.060 | ▲ 0,60 | 6  | 7  | 38 | 3     | 311,00 |
| 290060.0080.080 | ▲ 0,80 | 8  | 9  | 38 | 3     | 311,00 |
| 290060.0090.080 | ▲ 0,90 | 8  | 9  | 38 | 3     | 311,00 |
| 290060.0100.090 | ▲ 1,00 | 9  | 10 | 38 | 3     | 311,00 |
| 290060.0110.090 | ▲ 1,10 | 9  | 10 | 38 | 3     | 311,00 |
| 290060.0120.090 | ▲ 1,20 | 9  | 10 | 38 | 3     | 324,00 |
| 290060.0130.080 | ▲ 1,30 | 8  | 10 | 38 | 3     | 324,00 |
| 290060.0140.080 | ▲ 1,40 | 8  | 10 | 38 | 3     | 354,00 |
| 290060.0200.080 | ▲ 2,00 | 8  | 10 | 38 | 3     | 354,00 |

PKD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

25°

130°

HSC High-Speed-Cutting

POLIERT POLISHED

OIL Emul MMS

Art. 22.0415 Diamantbeschichtete VHM-Hochleistungsbohrer mit Innenkühlung geeignet für Gewindefräser Art. 23.2005/23.2006

COMPO-SITES

TI-CFK

GRAPHIT graphite

PA66 GF30

GFK

PVDF GF30

CFK

PEEK GF30

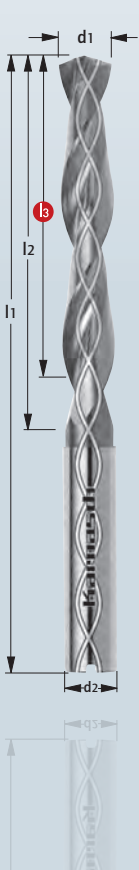
Hybrid-stoffe

PEEK CF30

CFK-ALU Composite

zirkon oxid

Schicht-stoffe Laminat



- Diamond coated solid carbide high performance twist drill with internal cooling suitable for thread milling cutter article 23.2005/23.2006
- Brocas de gran rendimiento recubiertas de diamante, de metal duro y macizo, con refrigeración interior apto para fresa de roscas art. 23.2005/23.2006
- Высокопроизводительное целльно-твердосплавное сверло с алмазным слоем и внутренним охлаждением Подходит для резьбовых фрез арт. 23.2005/23.2006

| Art.            | d1 m7               | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|---------------------|----|----|-----|-------|--------|
| 220415.0330.023 | ▲ 3,3 / M4 x 0,7    | 23 | 28 | 66  | 6     | 83,00  |
| 220415.0420.029 | ▲ 4,2 / M5 x 0,8    | 29 | 36 | 74  | 6     | 83,00  |
| 220415.0500.035 | ▲ 5,0 / M6 x 1,0    | 35 | 44 | 82  | 6     | 89,00  |
| 220415.0680.043 | ▲ 6,8 / M8 x 1,25   | 43 | 53 | 91  | 8     | 118,00 |
| 220415.0850.049 | ▲ 8,5 / M10 x 1,50  | 49 | 61 | 103 | 10    | 137,00 |
| 220415.1030.056 | ▲ 10,3 / M12 x 1,75 | 56 | 71 | 118 | 12    | 178,00 |

Nachfolgewerkzeug 29.0120 + 29.0121 + 29.0122

Richtwerte für den Einsatz von Karnasch diamantbeschichtete Hochleistungsbohrer  
Recommended cutting data for twist drill with diamond coating

| Werkstoffgruppe<br>Material group | Werkstoff<br>Workpiece material | Schnittgeschwindigkeit<br>Vc (m/min.) | VORSCHUB PRO UMDREHUNG (mm) |             |              |
|-----------------------------------|---------------------------------|---------------------------------------|-----------------------------|-------------|--------------|
|                                   |                                 |                                       | Ø 3,0 - 5,0                 | Ø 5,1 - 8,0 | Ø 8,1 - 12,0 |
| 14                                | Graphit < Grad 10               | 250                                   | 0,10 - 0,20                 | 0,15 - 0,25 | 0,30 - 0,45  |

MICRO GRAIN

DIN 6537

W

DIN 6535 Form HA

30°

130°

HSC HPC

DIAMANT DCC 0312

Air

Schnittdaten  
Cutting data

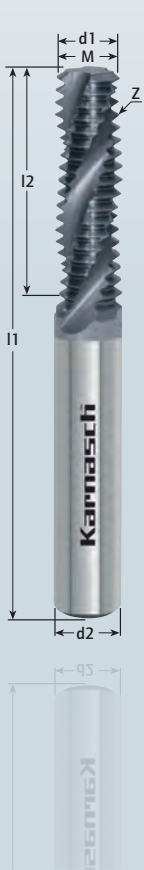


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Diamantbeschichteter Vollhartmetall Gewindefräser, spiralisiert 30° für Innengewinde ohne Innenkühlung, ohne Senkstufe, metrisches ISO-Gewinde DIN 13 – 2,5 x D

Art. 23.2005

- COMPO-SITES
- TI-CFK
- GRAPHIT  
graphite
- PA66  
GF30
- GFK
- PVDF  
GF30
- CFK
- PEEK  
GF30
- Hybrid-  
stoffe
- PEEK  
CF30
- CFK-ALU  
Composite
- zirkon  
oxid
- Schicht-  
stoffe  
Laminat



- Diamond coated solid carbide thread milling cutter, 30° spiral for internal threads, without internal cooling
- Fresa de roscas recubierta de diamante, de metal duro y macizo, espiral de 30° – para rosca interior, sin refrigeración interior
- Цельно-твердосплавная резьбовая фреза с алмазным слоем, спираль 30° – для внутренней резьбы, без внутреннего охлаждения

MICRO GRAIN

DIN 13

M

DIN 6535  
Form HA

30°

HSC  
High-Speed-  
Cutting

DCC  
0318

Air

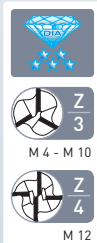
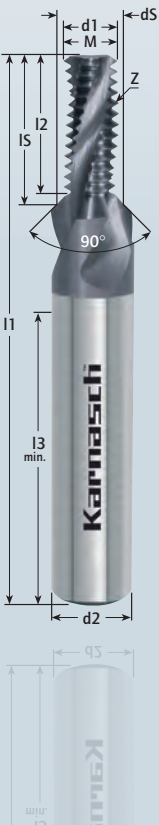
| Art.             | M      | Stg  | x D   | l2    | l1 | d1   | d2 h5 | Z | €      |
|------------------|--------|------|-------|-------|----|------|-------|---|--------|
| 232005.04.070.25 | • M 4  | 0,7  | 2,5xD | 10,85 | 55 | 3,15 | 6     | 3 | 156,00 |
| 232005.05.080.25 | • M 5  | 0,8  | 2,5xD | 13,15 | 55 | 4,00 | 6     | 3 | 159,00 |
| 232005.06.100.25 | • M 6  | 1,0  | 2,5xD | 16,50 | 55 | 4,80 | 6     | 3 | 164,00 |
| 232005.08.125.25 | • M 8  | 1,25 | 2,5xD | 21,80 | 55 | 6,00 | 6     | 3 | 174,00 |
| 232005.10.150.25 | • M 10 | 1,50 | 2,5xD | 26,20 | 65 | 8,00 | 8     | 3 | 208,00 |
| 232005.12.175.25 | • M 12 | 1,75 | 2,5xD | 30,60 | 75 | 9,90 | 10    | 4 | 245,00 |

PKD - CVD Gewindefräser kurzfristig lieferbar!

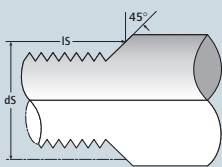
Diamantbeschichteter Vollhartmetall-Gewindefräser, spiralisiert für Innengewinde ohne Innenkühlung, mit 90° Senkstufe, metrisches ISO-Gewinde DIN 13 – 2,0 x D

Art. 23.2006

- COMPO-SITES
- TI-CFK
- GRAPHIT  
graphite
- PA66  
GF30
- GFK
- PVDF  
GF30
- CFK
- PEEK  
GF30
- Hybrid-  
stoffe
- PEEK  
CF30
- CFK-ALU  
Composite
- zirkon  
oxid
- Schicht-  
stoffe  
Laminat



- Diamond coated solid carbide thread milling cutter, 30° spiral for internal threads, without internal cooling with 90° counter sunk stage
- Fresa de roscas recubierta de diamante, de metal duro y macizo, espiral de 30° – para rosca interior, sin refrigeración interior., con descenso de 90°
- Цельно-твердосплавная резьбовая фреза с алмазным слоем, спираль 30° – для внутренней резьбы, без внутреннего охлаждения, со ступенью снижения 90°



| Art.             | M      | Stg  | x D   | l2    | l3/min. | l1 | ds   | ls   | d1   | d2 h5 | Z | €      |
|------------------|--------|------|-------|-------|---------|----|------|------|------|-------|---|--------|
| 232006.04.070.20 | • M 4  | 0,7  | 2,0xD | 8,75  | 36      | 55 | 4,2  | 9,3  | 3,14 | 6     | 3 | 162,00 |
| 232006.05.080.20 | • M 5  | 0,8  | 2,0xD | 10,75 | 36      | 55 | 5,3  | 11,3 | 4,00 | 6     | 3 | 169,00 |
| 232006.06.100.20 | • M 6  | 1,0  | 2,0xD | 12,40 | 36      | 65 | 6,3  | 13,1 | 4,80 | 8     | 3 | 186,00 |
| 232006.08.125.20 | • M 8  | 1,25 | 2,0xD | 16,80 | 40      | 75 | 8,3  | 17,6 | 6,50 | 10    | 3 | 226,00 |
| 232006.10.150.20 | • M 10 | 1,50 | 2,0xD | 20,10 | 45      | 80 | 10,3 | 21,2 | 8,20 | 12    | 3 | 305,00 |
| 232006.12.175.20 | • M 12 | 1,75 | 2,0xD | 25,20 | 45      | 90 | 12,3 | 26,4 | 9,90 | 14    | 4 | 354,00 |

PKD - CVD Gewindefräser kurzfristig lieferbar!

MICRO GRAIN

DIN 13

M

DIN 6535  
Form HA

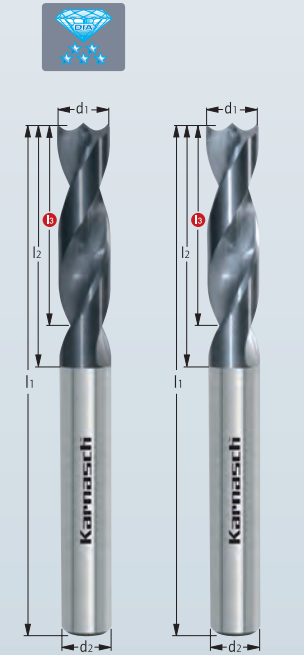
30°

HSC  
High-Speed-  
Cutting

DCC  
0318

Air

Art. 29.0080 A 29.0080 B Vollhartmetall-Hochleistungsbohrer GFK/CFK



- Solid carbide twist drill GFK/CFK
- Taladro de grau potencia de metal duro y macizo GFK/CFK
- Высокопроизводительное сверло сквозной заковки GFK/CFK

MICRO GRAIN

KARNASCH NORM

SPEZIAL

Form HA

30°

HSC High-Speed-Cutting

DCA-06 Polished

Air

Schnittdaten  
Cutting data



|                                         |              |                       |                               |
|-----------------------------------------|--------------|-----------------------|-------------------------------|
| COMPO-SITES                             | AL/TI        | GFK-CFK<br>GFK-CFK    | Schicht-<br>stoffe<br>Laminat |
| GFK-CFK<br>GFK-CFK                      | TI-CFK       | Kunststoff<br>plastic | Kevlar                        |
| THERMO-<br>PLAST<br>THERMO-<br>PLASTICS | PA66<br>GF30 | CFK-ALU<br>Composite  | PLEXI-<br>GLAS                |
| DURO-<br>PLASTE<br>DURO-<br>PLASTICS    | PVDF<br>GF30 |                       |                               |
| Aramid-<br>faser<br>AFK-SFK             | PEEK<br>GF30 |                       |                               |
| Hybrid-<br>stoffe                       | PEEK<br>CF30 |                       |                               |
| CFK-ALU<br>Composite                    | GF<br>GF25   |                       |                               |
| Schicht-<br>stoffe<br>Laminat           | PVDF<br>GF25 |                       |                               |
| Kevlar                                  |              |                       |                               |

|        |    |    |     |      | DIAMANT<br>DCA-06<br>29.0080 A |        | POLIERT<br>POLISHED<br>29.0080 B |        |
|--------|----|----|-----|------|--------------------------------|--------|----------------------------------|--------|
| d1 +   | l3 | l2 | l1  | d2h5 |                                | €      |                                  | €      |
| • 3,0  | 12 | 16 | 45  | 3,0  | 290080A.0300.012               | 44,00  | 290080B.0300.012                 | 25,00  |
| • 3,2  | 14 | 18 | 50  | 3,2  | 290080A.0320.014               | 57,00  | 290080B.0320.014                 | 25,00  |
| • 3,3  | 14 | 18 | 50  | 3,2  |                                | -      | 290080B.0330.014                 | 25,00  |
| • 3,5  | 15 | 20 | 50  | 3,5  | 290080A.0350.015               | 57,00  | 290080B.0350.015                 | 25,00  |
| • 3,7  | 15 | 20 | 52  | 3,7  |                                | -      | 290080B.0370.015                 | 25,00  |
| • 4,0  | 17 | 22 | 55  | 4,0  | 290080A.0400.017               | 57,00  | 290080B.0400.017                 | 25,00  |
| • 4,2  | 17 | 22 | 55  | 4,2  |                                | -      | 290080B.0420.017                 | 29,00  |
| • 4,5  | 18 | 25 | 57  | 4,5  | 290080A.0450.018               | 75,00  | 290080B.0450.018                 | 29,00  |
| • 4,7  | 18 | 24 | 58  | 4,7  |                                | -      | 290080B.0470.018                 | 36,00  |
| • 5,0  | 20 | 25 | 62  | 5,0  | 290080A.0500.020               | 81,00  | 290080B.0500.020                 | 36,00  |
| • 5,3  | 20 | 26 | 62  | 5,3  |                                | -      | 290080B.0530.020                 | 36,00  |
| • 5,5  | 20 | 28 | 65  | 5,5  | 290080A.0550.020               | 87,00  | 290080B.0550.020                 | 42,00  |
| • 5,8  | 20 | 28 | 66  | 5,8  |                                | -      | 290080B.0580.020                 | 42,00  |
| • 6,0  | 20 | 28 | 65  | 6,0  | 290080A.0600.020               | 87,00  | 290080B.0600.020                 | 42,00  |
| • 6,5  | 22 | 30 | 70  | 6,5  | 290080A.0650.022               | 108,00 | 290080B.0650.022                 | 46,00  |
| • 7,0  | 25 | 33 | 75  | 7,0  | 290080A.0700.025               | 113,00 | 290080B.0700.025                 | 51,00  |
| • 7,5  | 25 | 33 | 74  | 7,5  |                                | -      | 290080B.0750.025                 | 51,00  |
| • 8,0  | 27 | 36 | 80  | 8,0  | 290080A.0800.027               | 123,00 | 290080B.0800.027                 | 61,00  |
| • 8,5  | 27 | 36 | 80  | 8,5  | 290080A.0850.027               | 139,00 | 290080B.0850.027                 | 67,00  |
| • 9,0  | 30 | 40 | 85  | 9,0  | 290080A.0900.030               | 142,00 | 290080B.0900.030                 | 71,00  |
| • 9,5  | 30 | 37 | 84  | 9,5  |                                | -      | 290080B.0950.030                 | 78,00  |
| • 10,0 | 32 | 42 | 90  | 10,0 | 290080A.1000.032               | 154,00 | 290080B.1000.032                 | 82,00  |
| • 10,5 | 32 | 42 | 90  | 10,5 |                                | -      | 290080B.1050.032                 | 93,00  |
| • 11,0 | 34 | 47 | 95  | 11,0 |                                | -      | 290080B.1100.034                 | 106,00 |
| • 11,5 | 34 | 47 | 95  | 11,5 |                                | -      | 290080B.1150.034                 | 117,00 |
| • 12,0 | 35 | 50 | 100 | 12,0 | 290080A.1200.035               | 200,00 | 290080B.1200.035                 | 117,00 |
| • 13,0 | 35 | 50 | 100 | 13,0 |                                | -      | 290080B.1300.035                 | 117,00 |
| • 14,0 | 37 | 54 | 105 | 14,0 |                                | -      | 290080B.1400.037                 | 117,00 |
| • 15,0 | 38 | 56 | 110 | 15,0 |                                | -      | 290080B.1500.038                 | 117,00 |
| • 16,0 | 38 | 58 | 115 | 16,0 |                                | -      | 290080B.1600.038                 | 117,00 |

| 29.0080 A |                                   | 29.0080 B                         |  |
|-----------|-----------------------------------|-----------------------------------|--|
| d1 tol. + | Bohrertoleranz<br>Drill tolerance | Bohrertoleranz<br>Drill tolerance |  |
| > 3,0     | + 0,005                           | + 0,000                           |  |
| 6,0       | - 0,008                           | - 0,012                           |  |
| > 6,0     | + 0,005                           | + 0,000                           |  |
| 10,0      | - 0,010                           | - 0,015                           |  |
| >10,0     | + 0,005                           | + 0,000                           |  |
| 14,0      | - 0,012                           | - 0,018                           |  |



Kombi-Fräser mit Bohrspitze für Faser-Verbundwerkstoffe

Art. **29.0100**

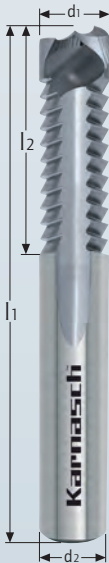
Honey  
comb

Kevlar

Aramid-  
faser  
AFK-SFK

Schicht-  
stoffe  
Laminat

Kunststoff  
plastic



- Combination milling cutter with drill bit for composites
- Fresa combinada con punta de broca para compuestos
- Комбинированная фреза со сверлильным наконечником для композитов

| Art.        | d1      | Inches | l2 | l1 | €      |
|-------------|---------|--------|----|----|--------|
| 290100.0476 | • 4,76  | 3/16"  | 25 | 75 | 106,00 |
| 290100.0500 | • 5,00  |        | 25 | 75 | 140,00 |
| 290100.0600 | • 6,00  |        | 30 | 75 | 140,00 |
| 290100.0635 | • 6,35  | 1/4"   | 30 | 75 | 141,00 |
| 290100.0800 | • 8,00  |        | 30 | 75 | 155,00 |
| 290100.0952 | • 9,52  | 3/8"   | 30 | 75 | 176,00 |
| 290100.1000 | • 10,00 |        | 30 | 75 | 191,00 |
| 290100.1200 | • 12,00 |        | 30 | 75 | 228,00 |
| 290100.1270 | • 12,70 | 1/2"   | 30 | 75 | 248,00 |

**Bearbeitungshinweise:** Die Arbeitstemperatur darf 60° Celsius nicht überschreiten um ein Erweichen der Harzbindung zu vermeiden. Ideal ist Pressluftkühlung mit Absaugung.

**Processing instruction:** The work temperature must not exceed 60° Celsius in order to avoid the resin melting.

**MICRO  
GRAIN**

KARNASCH  
NORM

**SPEZIAL**

DIN 6535  
Form HA



**HPC**

**HPC**



**POLIERT  
POLISHED**



Schnittdaten  
Cutting data

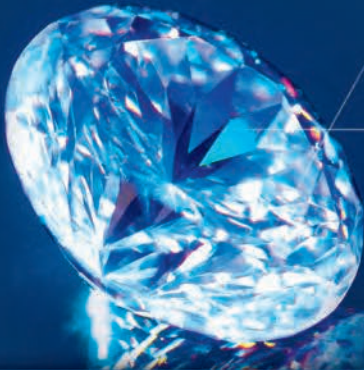


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| Werkstoffgruppe | Werkstoff       | Vc Bohren / Drill | f Bohren / Drill | Vf Fräsen / Mill | Vc Fräsen / Mill |
|-----------------|-----------------|-------------------|------------------|------------------|------------------|
| 11.3            | AFK / BFK / GFK | 125 m/min         | 0,08 - 0,15 mm   | 600 - 1500 m/min | 250 - 400 m/min  |
|                 | CFK / KEFLAR    | 150 m/min         | 0,10 - 0,18 mm   | 800 - 2000 m/min | 300 - 500 m/min  |

**Karnasch**<sup>TM</sup>  
PROFESSIONAL TOOLS

DIAMOND TOOLS



CBN



PKD  
PCD



Naturdiamant  
ND



Monokristallin  
Diamant  
MCD



CVD /  
Diamant coated

PKD/PCD **EXTREME**

Art. 29.0120

Diamantbeschichtete VHM-Hochleistungsbohrer für CFK/GFK – multidirektional mit 90° Spitzwinkel vermeidet Delamination

- GRAPHIT  
graphite
- COMPO-  
SITES
- CFK
- GFK
- PEEK  
CF30
- PEEK  
GF30
- GF  
GF25
- PVDF  
GF25
- zirkon  
oxid



- Diamond-coated solid-carbide drill for CFK/GFK material/multidirectional, with 90° tip angle, Prevents delamination
- Broca de metal duro y macizo recubierta de diamante para CFK/GFK Material/ multidireccional, con ángulo de punta de 90°, Evita la deslaminación
- Твердосплавные сверла с алмазным покрытием для углеродного волокна/ стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.

| Art.             | d1 m7   | l3  | l2  | l1 | d2 h6 | €      |
|------------------|---------|-----|-----|----|-------|--------|
| 290120.0050.0045 | • 0,5   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| 290120.0060.0045 | • 0,6   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| 290120.0070.0045 | • 0,7   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| 290120.0080.0045 | • 0,8   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| 290120.0090.0045 | • 0,9   | 4,5 | 5,5 | 55 | 3     | 59,00  |
| 290120.0100.005  | • 1,0   | 5   | 8   | 55 | 3     | 59,00  |
| 290120.0110.008  | • 1,1   | 8   | 12  | 55 | 3     | 59,00  |
| 290120.0120.008  | • 1,2   | 8   | 12  | 55 | 3     | 59,00  |
| 290120.0130.008  | • 1,3   | 8   | 12  | 55 | 3     | 59,00  |
| 290120.0140.008  | • 1,4   | 8   | 12  | 55 | 3     | 59,00  |
| 290120.0150.008  | • 1,5   | 8   | 12  | 55 | 3     | 59,00  |
| 290120.0160.011  | • 1,6   | 11  | 16  | 68 | 3     | 62,00  |
| 290120.0170.011  | • 1,7   | 11  | 16  | 68 | 3     | 62,00  |
| 290120.0180.011  | • 1,8   | 11  | 16  | 68 | 3     | 62,00  |
| 290120.0190.011  | • 1,9   | 11  | 16  | 68 | 3     | 62,00  |
| 290120.0200.011  | • 2,0   | 11  | 16  | 68 | 3     | 62,00  |
| 290120.0210.014  | • 2,1   | 14  | 20  | 74 | 3     | 64,00  |
| 290120.0220.014  | • 2,2   | 14  | 20  | 74 | 3     | 64,00  |
| 290120.0230.014  | • 2,3   | 14  | 20  | 74 | 3     | 64,00  |
| 290120.0240.014  | • 2,4   | 14  | 20  | 74 | 3     | 64,00  |
| 290120.0250.014  | • 2,5   | 14  | 20  | 74 | 3     | 64,00  |
| 290120.0260.016  | • 2,6   | 16  | 23  | 81 | 3     | 66,00  |
| 290120.0270.016  | • 2,7   | 16  | 23  | 81 | 3     | 66,00  |
| 290120.0280.016  | • 2,8   | 16  | 23  | 81 | 3     | 66,00  |
| 290120.0290.016  | • 2,9   | 16  | 23  | 81 | 3     | 66,00  |
| 290120.0300.023  | • 3,0   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0310.023  | • 3,1   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.03175.023 | • 3,175 | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0320.023  | • 3,2   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0330.023  | • 3,3   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0340.023  | • 3,4   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0350.023  | • 3,5   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0360.023  | • 3,6   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0370.023  | • 3,7   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0380.023  | • 3,8   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0390.023  | • 3,9   | 23  | 28  | 66 | 6     | 110,00 |
| 290120.0400.029  | • 4,0   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0410.029  | • 4,1   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0420.029  | • 4,2   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0430.029  | • 4,3   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0440.029  | • 4,4   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0450.029  | • 4,5   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0460.029  | • 4,6   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0470.029  | • 4,7   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.04763.029 | • 4,763 | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0480.029  | • 4,8   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0490.029  | • 4,9   | 29  | 36  | 74 | 6     | 116,00 |
| 290120.0500.035  | • 5,0   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0510.035  | • 5,1   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0520.035  | • 5,2   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0530.035  | • 5,3   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0540.035  | • 5,4   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0550.035  | • 5,5   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0560.035  | • 5,6   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0570.035  | • 5,7   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0580.035  | • 5,8   | 35  | 44  | 82 | 6     | 116,00 |
| 290120.0590.035  | • 5,9   | 35  | 44  | 82 | 6     | 116,00 |

MICRO  
GRAIN

KARNASCH  
NORM

MF

DIN 6535  
Form HA

Composites

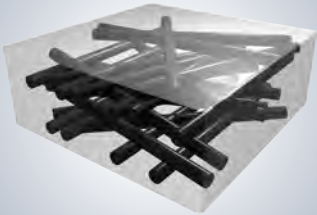
DCC  
0318

Schnittdaten  
Cutting data

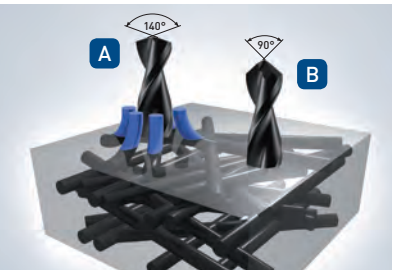


i S. 200

MULTIDIREKTIONAL



Chaotische Ausrichtung des Faserverlaufs  
Chaotic alignment of fibre progress  
Orientación caótica de la distribución de fibras  
Хаотическое направление волокна



- A** Delamination und Gradbildung mit konventionellen Bohrern.
- B** Sauberer Bohrsaustritt durch optimierte Führungsfase des Bohrwerkzeuges.

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |

Diamantbeschichtete VHM-Hochleistungsbohrer für CFK/GFK – multidirektional mit 90° Spitzwinkel vermeidet Delamination

Art. 29.0120

| Art.             | d1 m7   | l3 | l2 | l1  | d2 h6 | €      |
|------------------|---------|----|----|-----|-------|--------|
| 290120.0600.035  | • 6,0   | 35 | 44 | 82  | 6     | 116,00 |
| 290120.0610.043  | • 6,1   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0620.043  | • 6,2   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0630.043  | • 6,3   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0635.043  | • 6,350 | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0640.043  | • 6,4   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0650.043  | • 6,5   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0660.043  | • 6,6   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0670.043  | • 6,7   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0680.043  | • 6,8   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0690.043  | • 6,9   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0700.043  | • 7,0   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0710.043  | • 7,1   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0720.043  | • 7,2   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0730.043  | • 7,3   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0740.043  | • 7,4   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0750.043  | • 7,5   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0760.043  | • 7,6   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0770.043  | • 7,7   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0780.043  | • 7,8   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0790.043  | • 7,9   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.07938.043 | • 7,938 | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0800.043  | • 8,0   | 43 | 53 | 91  | 8     | 174,00 |
| 290120.0810.049  | • 8,1   | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0820.049  | • 8,2   | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0830.049  | • 8,3   | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0840.049  | • 8,4   | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0850.049  | • 8,5   | 49 | 61 | 103 | 10    | 208,00 |

| Art.             | d1 m7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290120.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.09525.049 | • 9,525  | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 208,00 |
| 290120.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 208,00 |
| 290120.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 225,00 |
| 290120.11111.056 | • 11,111 | 56 | 71 | 118 | 12    | 225,00 |
| 290120.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 225,00 |

CFK-Bohrertest  
CFK drill test



Karnasch Art. 29.0120 – 6,0 mm  
Bohrungseintritt / drill entry  
Material: CFK / CFRP

Schnittdaten / cutting data  
Vc = 160 m/min  
Vf = 850 mm/min  
n(s) = 8493 min<sup>-1</sup>  
fz = 0,1 mm  
ap = 20 mm

Karnasch  
Bohrungseintritt  
drill entry

Karnasch Art. 29.0120 – 6,0 mm  
Bohrungsaustritt / drill exit  
Material: CFK / CFRP

Vergrößerung / Magnification: 30x

Karnasch  
Bohrungsaustritt  
drill exit

CVD Bohrer 6,0 mm  
Mitbewerber / competitor  
Bohrungseintritt / drill entry  
Material: CFK / CFRP

Schnittdaten / cutting data  
Vc = 160 m/min  
Vf = 850 mm/min  
n(s) = 8493 min<sup>-1</sup>  
fz = 0,1 mm  
ap = 20 mm

Competitor  
Bohrungseintritt  
drill entry

CVD Bohrer 6,0 mm  
Mitbewerber / competitor  
Bohrungsaustritt / drill exit  
Material: CFK / CFRP

Vergrößerung / Magnification: 30x

Competitor  
Bohrungsaustritt  
drill exit

Art. 29.0121

Diamantbeschichtete VHM-Hochleistungsbohrer für CFK/GFK – unidirektional mit 90° Spitzwinkel vermeidet Delamination

GRAPHIT  
graphite

COMPO-  
SITES

CFK

GFK

PEEK  
CF30

PEEK  
GF30

GF  
GF25

PVDF  
GF25

zirkon  
oxid



Diamond-coated solid-carbide drill for CFK/GFK material/ unidirectional, with 90° tip angle, Prevents delamination

Broca de metal duro y macizo recubierta de diamante para CFK/GFK Material/unidireccional, con ángulo de punta de 90°, Evita la deslaminación

Твердосплавные сверла с алмазным покрытием для углеродного волокна/стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.

MICRO  
GRAIN

KARNASCH  
NORM

MF

DIN 6535  
Form HA



Composites



DCC  
0318

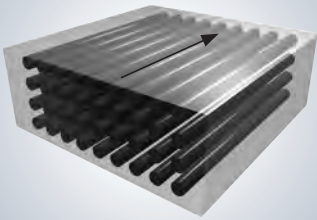


Schnittdaten  
Cutting data

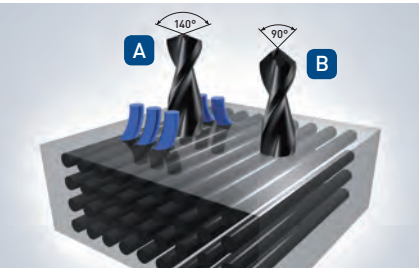


i S. 202

UNIDIREKTIONAL



Faserverlauf in eine Richtung  
Fibre progress in one direction  
Distribución de fibras en una dirección  
Волокна в одном направлении



**A** Delamination und  
Gradbildung mit  
konventionellen  
Bohrern.

**B** Sauberer  
Bohrungsaustritt  
durch optimierte  
Führungsflase des  
Bohrwerkzeuges.

| Art.             | d1 m7   | l3 | l2 | l1 | d2 h6 | €      |
|------------------|---------|----|----|----|-------|--------|
| 290121.0280.019  | • 2,8   | 19 | 24 | 66 | 6     | 153,00 |
| 290121.0290.019  | • 2,9   | 19 | 24 | 66 | 6     | 153,00 |
| 290121.0300.023  | • 3,0   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0310.023  | • 3,1   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.03175.023 | • 3,175 | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0320.023  | • 3,2   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0330.023  | • 3,3   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0340.023  | • 3,4   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0350.023  | • 3,5   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0360.023  | • 3,6   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0370.023  | • 3,7   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0380.023  | • 3,8   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0390.023  | • 3,9   | 23 | 28 | 66 | 6     | 153,00 |
| 290121.0400.029  | • 4,0   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0410.029  | • 4,1   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0420.029  | • 4,2   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0430.029  | • 4,3   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0440.029  | • 4,4   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0450.029  | • 4,5   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0460.029  | • 4,6   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0470.029  | • 4,7   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.04763.029 | • 4,763 | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0480.029  | • 4,8   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0490.029  | • 4,9   | 29 | 36 | 74 | 6     | 155,00 |
| 290121.0500.035  | • 5,0   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0510.035  | • 5,1   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0520.035  | • 5,2   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0530.035  | • 5,3   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0540.035  | • 5,4   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0550.035  | • 5,5   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0560.035  | • 5,6   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0570.035  | • 5,7   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0580.035  | • 5,8   | 35 | 44 | 82 | 6     | 165,00 |
| 290121.0590.035  | • 5,9   | 35 | 44 | 82 | 6     | 165,00 |

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |



Diamantbeschichtete VHM-Hochleistungsbohrer mit Innenkühlung für CFK/GFK – unidirektional mit 90° Spitzwinkel vermeidet Delamination

Art. **29.0122**

GRAPHIT  
graphite

COMPO-  
SITES

CFK

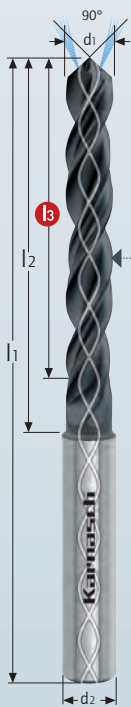
GFK

PEEK  
CF30

PEEK  
GF30

GF  
GF25

PVDF  
GF25



- Diamond-coated solid-carbide drill with interior cooling for CFK/GFK material/ unidirectional, with 90° tip angle, Prevents delamination
- Broca de metal duro y macizo con refrigeración recubierta de diamante para CFK/ GFK Material/unidireccional, con ángulo de punta de 90°, Evita la deslaminación
- Твердосплавные сверла с алмазным покрытием для углеродного волокна/ стеклоткани/разнонаправленные, угол при вершине 90° Предотвращает расслоение.



Durch 2 Führungsphasen ist eine sehr hohe Präzision der Bohrungen möglich, bei gleichzeitiger Vermeidung von Delamination.

With 2 guide chamfer is a very high precision of the hols possible, by avoiding of delamination.

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE<br>MATERIAL | vc m/min | f mm/U      |             |             |               |
|-----------------------------------|------------------------------------|----------|-------------|-------------|-------------|---------------|
|                                   |                                    |          | Ø 3,0 - 4,9 | Ø 5,0 - 7,9 | Ø 8,0 - 9,9 | Ø 10,0 - 12,0 |
| 8.3                               | GFK / CFK<br>Composites            | 160      | 0,04        | 0,05        | 0,07        | 0,1           |

MICRO  
GRAIN

KARNASCH  
NORM

MF

DIN 6535  
Form HAK



Composites



DCC  
0318



Schnittdaten  
Cutting data

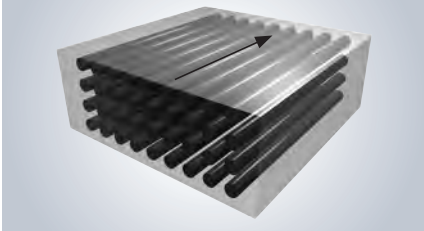


i S. 203

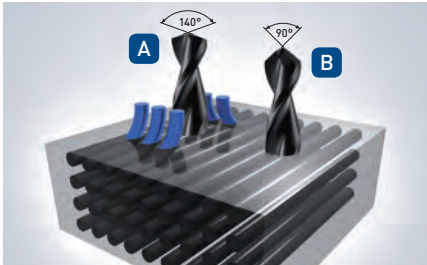
| Art.             | d1 m7         | l3 | l2 | l1  | d2 h6 | €      |
|------------------|---------------|----|----|-----|-------|--------|
| 290122.0600.035  | • 6,00        | 35 | 44 | 82  | 6     | 207,00 |
| 290122.0610.043  | • 6,10        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0620.043  | • 6,20        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0630.043  | • 6,30        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0635.043  | • 6,350 1/4"  | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0640.043  | • 6,40        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0650.043  | • 6,50        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0660.043  | • 6,60        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0670.043  | • 6,70        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0680.043  | • 6,80        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0690.043  | • 6,90        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0700.043  | • 7,00        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0710.043  | • 7,10        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0720.043  | • 7,20        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0730.043  | • 7,30        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0740.043  | • 7,40        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0750.043  | • 7,50        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0760.043  | • 7,60        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0770.043  | • 7,70        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0780.043  | • 7,80        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0790.043  | • 7,90        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.07938.043 | • 7,938 5/16" | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0800.043  | • 8,00        | 43 | 53 | 91  | 8     | 257,00 |
| 290122.0810.049  | • 8,10        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0820.049  | • 8,20        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0830.049  | • 8,30        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0840.049  | • 8,40        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0850.049  | • 8,50        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0860.049  | • 8,60        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0870.049  | • 8,70        | 49 | 61 | 103 | 10    | 313,00 |

| Art.             | d1 m7          | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------------|----|----|-----|-------|--------|
| 290122.0880.049  | • 8,80         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0890.049  | • 8,90         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0900.049  | • 9,00         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0910.049  | • 9,10         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0920.049  | • 9,20         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0930.049  | • 9,30         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0940.049  | • 9,40         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0950.049  | • 9,50         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.09525.049 | • 9,525 3/8"   | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0960.049  | • 9,60         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0970.049  | • 9,70         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0980.049  | • 9,80         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.0990.049  | • 9,90         | 49 | 61 | 103 | 10    | 313,00 |
| 290122.1000.049  | • 10,00        | 49 | 61 | 103 | 10    | 313,00 |
| 290122.1010.056  | • 10,10        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1020.056  | • 10,20        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1030.056  | • 10,30        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1040.056  | • 10,40        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1050.056  | • 10,50        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1060.056  | • 10,60        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1070.056  | • 10,70        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1080.056  | • 10,80        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1090.056  | • 10,90        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1100.056  | • 11,00        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1111.056  | • 11,111 7/16" | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1150.056  | • 11,50        | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1180.056  | • 11,8         | 56 | 71 | 118 | 12    | 349,00 |
| 290122.1200.056  | • 12,0         | 56 | 71 | 118 | 12    | 349,00 |

UNIDIREKTIONAL



Faserverlauf in eine Richtung  
Fibre progress in one direction  
Distribución de fibras en una dirección  
Волокна в одном направлении



- A** Delamination und Grabbildung mit konventionellen Bohrern.
- B** Sauberer Bohrungsaustritt durch optimierte Führungsphase des Bohrwerkzeuges.

Art. 29.0200 CNC-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/ALU – ALU/CFK

C

A

CFK/GFK - CFRP/GFRP

A

C

Aluminium

A

C

Aluminium

C

A

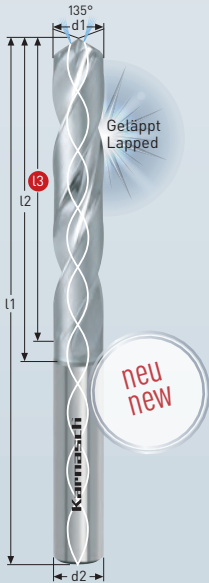
CFK/GFK - CFRP/GFRP



Solid carbide SUPER-Stack-drill with interior cooling for CFRP/GFRP-Alu – Alu-CFRP/GFRP

VHM-CNC-Stack-Drill con refrigeración interna para el tratamiento de PRFC/PRFV-Aluminio y Aluminio-PRFC/PRFV

стек дреель для станка с кчпу, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/алюминий



Für den Einsatz auf CNC-Maschinen.  
For the use on CNC-machines.

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK

34°

135°

HSC HPC

GELÄPPT LAPPED

MMKS

Schnittdaten  
Cutting data

i S. 319

MOVIE

| Art.             | d1 h7   | l3 | l2 | l1 | d2 h6 | €      |
|------------------|---------|----|----|----|-------|--------|
| 290200.0300.023  | • 3,0   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0310.023  | • 3,1   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0320.023  | • 3,2   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0330.023  | • 3,3   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0340.023  | • 3,4   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0350.023  | • 3,5   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0360.023  | • 3,6   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0370.023  | • 3,7   | 23 | 28 | 66 | 6     | 94,00  |
| 290200.0380.029  | • 3,8   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0390.029  | • 3,9   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0400.029  | • 4,0   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0410.029  | • 4,1   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.04176.029 | • 4,176 | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0420.029  | • 4,2   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0430.029  | • 4,3   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0440.029  | • 4,4   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0450.029  | • 4,5   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0460.029  | • 4,6   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0470.029  | • 4,7   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0480.029  | • 4,8   | 29 | 36 | 74 | 6     | 97,00  |
| 290200.04837.029 | • 4,837 | 29 | 36 | 74 | 6     | 97,00  |
| 290200.0490.035  | • 4,9   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0500.035  | • 5,0   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0510.035  | • 5,1   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0520.035  | • 5,2   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0530.035  | • 5,3   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0540.035  | • 5,4   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0550.035  | • 5,5   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.05550.035 | • 5,55  | 35 | 44 | 82 | 6     | 99,00  |
| 290200.05565.035 | • 5,565 | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0560.035  | • 5,6   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0570.035  | • 5,7   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0580.035  | • 5,8   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0590.035  | • 5,9   | 35 | 44 | 82 | 6     | 99,00  |
| 290200.0600.035  | • 6,0   | 35 | 44 | 82 | 6     | 106,00 |
| 290200.0610.043  | • 6,1   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0620.043  | • 6,2   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0630.043  | • 6,3   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.06365.043 | • 6,365 | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0640.043  | • 6,4   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0650.043  | • 6,5   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0660.043  | • 6,6   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0670.043  | • 6,7   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0680.043  | • 6,8   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0690.043  | • 6,9   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0700.043  | • 7,0   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0710.043  | • 7,1   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0720.043  | • 7,2   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0730.043  | • 7,3   | 43 | 53 | 91 | 8     | 106,00 |
| 290200.0740.043  | • 7,4   | 43 | 53 | 91 | 8     | 106,00 |

| Art.             | d1 h7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290200.0750.043  | • 7,5    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0760.043  | • 7,6    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0770.043  | • 7,7    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0780.043  | • 7,8    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0790.043  | • 7,9    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.07953.043 | • 7,953  | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 106,00 |
| 290200.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.09540.049 | • 9,540  | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 154,00 |
| 290200.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 154,00 |
| 290200.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1110.056  | • 11,1   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.11133.056 | • 11,133 | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1120.056  | • 11,2   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1130.056  | • 11,3   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1140.056  | • 11,4   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1150.056  | • 11,5   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1160.056  | • 11,6   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1170.056  | • 11,7   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1180.056  | • 11,8   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1190.056  | • 11,9   | 56 | 71 | 118 | 12    | 213,00 |
| 290200.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 213,00 |

CNC-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/TITAN – TITAN/CFK

Art. 29.0210

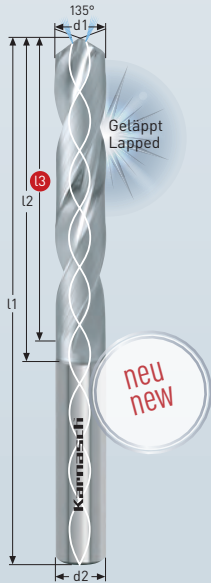
|                                                                                  |                     |
|----------------------------------------------------------------------------------|---------------------|
|  | CFK/GFK - CFRP/GFRP |
|  | Titan - Titanium    |
|  | Titan - Titanium    |
|  | CFK/GFK - CFRP/GFRP |



 Solid carbide SUPER-Stack-drill with interior cooling for CFRP/GFRP-Titan – Titan-CFRP/GFRP

 VHM-CNC-Stack-Drill con refrigeración interna para el tratamiento PRFC/PRFV-Titanio y Titanio-PRFC/PRFV.

 стек дреель для станка с кчпу, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/титан



Für den Einsatz auf CNC-Maschinen.

For the use on CNC-machines.

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK



HSC HPC



GELÄPFT LAPPED



Schnittdaten  
Cutting data



i S. 319

| Art.             | d1 h7   | l3 | l2 | l1 | d2 h6 | €      |
|------------------|---------|----|----|----|-------|--------|
| 290210.0300.023  | • 3,0   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0310.023  | • 3,1   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0320.023  | • 3,2   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0330.023  | • 3,3   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0340.023  | • 3,4   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0350.023  | • 3,5   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0360.023  | • 3,6   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0370.023  | • 3,7   | 23 | 28 | 66 | 6     | 100,00 |
| 290210.0380.029  | • 3,8   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0390.029  | • 3,9   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0400.029  | • 4,0   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0410.029  | • 4,1   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.04176.029 | • 4,176 | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0420.029  | • 4,2   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0430.029  | • 4,3   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0440.029  | • 4,4   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0450.029  | • 4,5   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0460.029  | • 4,6   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0470.029  | • 4,7   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0480.029  | • 4,8   | 29 | 36 | 74 | 6     | 102,00 |
| 290210.04837.029 | • 4,837 | 29 | 36 | 74 | 6     | 102,00 |
| 290210.0490.035  | • 4,9   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0500.035  | • 5,0   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0510.035  | • 5,1   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0520.035  | • 5,2   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0530.035  | • 5,3   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0540.035  | • 5,4   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0550.035  | • 5,5   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.05555.035 | • 5,565 | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0560.035  | • 5,6   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0570.035  | • 5,7   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0580.035  | • 5,8   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0590.035  | • 5,9   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0600.035  | • 6,0   | 35 | 44 | 82 | 6     | 104,00 |
| 290210.0610.043  | • 6,1   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0620.043  | • 6,2   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0630.043  | • 6,3   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.06365.043 | • 6,365 | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0640.043  | • 6,4   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0650.043  | • 6,5   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0660.043  | • 6,6   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0670.043  | • 6,7   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0680.043  | • 6,8   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0690.043  | • 6,9   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0700.043  | • 7,0   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0710.043  | • 7,1   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0720.043  | • 7,2   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0730.043  | • 7,3   | 43 | 53 | 91 | 8     | 112,00 |
| 290210.0740.043  | • 7,4   | 43 | 53 | 91 | 8     | 112,00 |

| Art.             | d1 h7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290210.0750.043  | • 7,5    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0760.043  | • 7,6    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0770.043  | • 7,7    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0780.043  | • 7,8    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0790.043  | • 7,9    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.07953.043 | • 7,953  | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 112,00 |
| 290210.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.09540.049 | • 9,54   | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 160,00 |
| 290210.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 160,00 |
| 290210.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1110.056  | • 11,1   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.11133.056 | • 11,133 | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1120.056  | • 11,2   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1130.056  | • 11,3   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1140.056  | • 11,4   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1150.056  | • 11,5   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1160.056  | • 11,6   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1170.056  | • 11,7   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1180.056  | • 11,8   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1190.056  | • 11,9   | 56 | 71 | 118 | 12    | 224,00 |
| 290210.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 224,00 |



CFK/GFK - CFRP/GFRP

Aluminium

Aluminium

CFK/GFK - CFRP/GFRP

Solid carbide ROBO-Stack-drill with interior cooling for CFRP/GFRP-Alu – Alu-CFRP/GFRP

VHM-ROBO-Stack-Drill con refrigeración interna para el tratamiento PRFC/PRFV-Aluminio y Aluminio-PRFC/PRFV.

стек дреель для робот, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/алюминий

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK

34°

135°

HSC HPC

GELÄPPT LAPPED

MMKS

Schnittdaten  
Cutting data

| Art.             | d1 h7    | l3 | l2 | l1  | d2 h6 | €      |
|------------------|----------|----|----|-----|-------|--------|
| 290250.0800.043  | • 8,0    | 43 | 53 | 91  | 8     | 118,00 |
| 290250.0810.049  | • 8,1    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0820.049  | • 8,2    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0830.049  | • 8,3    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0840.049  | • 8,4    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0850.049  | • 8,5    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0860.049  | • 8,6    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0870.049  | • 8,7    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0880.049  | • 8,8    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0890.049  | • 8,9    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0900.049  | • 9,0    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0910.049  | • 9,1    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0920.049  | • 9,2    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0930.049  | • 9,3    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0940.049  | • 9,4    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0950.049  | • 9,5    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0954.049  | • 9,54   | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0960.049  | • 9,6    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0970.049  | • 9,7    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0980.049  | • 9,8    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.0990.049  | • 9,9    | 49 | 61 | 103 | 10    | 169,00 |
| 290250.1000.049  | • 10,0   | 49 | 61 | 103 | 10    | 169,00 |
| 290250.1010.056  | • 10,1   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1020.056  | • 10,2   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1030.056  | • 10,3   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1040.056  | • 10,4   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1050.056  | • 10,5   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1060.056  | • 10,6   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1070.056  | • 10,7   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1080.056  | • 10,8   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1090.056  | • 10,9   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1100.056  | • 11,0   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1110.056  | • 11,1   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.11133.056 | • 11,133 | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1120.056  | • 11,2   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1130.056  | • 11,3   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1140.056  | • 11,4   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1150.056  | • 11,5   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1160.056  | • 11,6   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1170.056  | • 11,7   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1180.056  | • 11,8   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1190.056  | • 11,9   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1200.056  | • 12,0   | 56 | 71 | 118 | 12    | 236,00 |
| 290250.1210.060  | • 12,1   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1220.060  | • 12,2   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1230.060  | • 12,3   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1240.060  | • 12,4   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1250.060  | • 12,5   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1260.060  | • 12,6   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1270.060  | • 12,7   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1272.060  | • 12,72  | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1280.060  | • 12,8   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1290.060  | • 12,9   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1300.060  | • 13,0   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1310.060  | • 13,1   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1320.060  | • 13,2   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1330.060  | • 13,3   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1340.060  | • 13,4   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1350.060  | • 13,5   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1360.060  | • 13,6   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1370.060  | • 13,7   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1380.060  | • 13,8   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1390.060  | • 13,9   | 60 | 77 | 124 | 14    | 318,00 |
| 290250.1400.060  | • 14,0   | 60 | 77 | 124 | 14    | 318,00 |

| Art.             | d1 h7    | l3 | l2  | l1  | d2 h6 | €      |
|------------------|----------|----|-----|-----|-------|--------|
| 290250.1410.063  | • 14,1   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1420.063  | • 14,2   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.14295.063 | • 14,295 | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1430.063  | • 14,3   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1440.063  | • 14,4   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1450.063  | • 14,5   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1460.063  | • 14,6   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1470.063  | • 14,7   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1480.063  | • 14,8   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1490.063  | • 14,9   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1500.063  | • 15,0   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1510.063  | • 15,1   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1520.063  | • 15,2   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1530.063  | • 15,3   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1540.063  | • 15,4   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1550.063  | • 15,5   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1560.063  | • 15,6   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1570.063  | • 15,7   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1580.063  | • 15,8   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.15882.063 | • 15,882 | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1590.063  | • 15,9   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1600.063  | • 16,0   | 63 | 83  | 133 | 16    | 399,00 |
| 290250.1610.071  | • 16,1   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1620.071  | • 16,2   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1630.071  | • 16,3   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1640.071  | • 16,4   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1650.071  | • 16,5   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1660.071  | • 16,6   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1670.071  | • 16,7   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1680.071  | • 16,8   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1690.071  | • 16,9   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1700.071  | • 17,0   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1710.071  | • 17,1   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1720.071  | • 17,2   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1730.071  | • 17,3   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1740.071  | • 17,4   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1750.071  | • 17,5   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1760.071  | • 17,6   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1770.071  | • 17,7   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1780.071  | • 17,8   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1790.071  | • 17,9   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1800.071  | • 18,0   | 71 | 93  | 143 | 18    | 528,00 |
| 290250.1810.077  | • 18,1   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1820.077  | • 18,2   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1830.077  | • 18,3   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1840.077  | • 18,4   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1850.077  | • 18,5   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1860.077  | • 18,6   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1870.077  | • 18,7   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1880.077  | • 18,8   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1890.077  | • 18,9   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1900.077  | • 19,0   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.19065.077 | • 19,065 | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1910.077  | • 19,1   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1920.077  | • 19,2   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1930.077  | • 19,3   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1940.077  | • 19,4   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1950.077  | • 19,5   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1960.077  | • 19,6   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1970.077  | • 19,7   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1980.077  | • 19,8   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.1990.077  | • 19,9   | 77 | 101 | 153 | 20    | 661,00 |
| 290250.2000.077  | • 20,0   | 77 | 101 | 153 | 20    | 661,00 |

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Weitere Informationen erhalten Sie telefonisch unter +49 6203-4039-0 oder schreiben Sie eine Mail an info@karnasch.de.  
For more informations please call +49 6203-4039-0 send a mail to info@karnasch.de.



ROBO-Stack-Drill, VHM-Hochleistungsbohrer mit Innenkühlung CFK/TITAN – TITAN/CFK

Art. **29.0260**

CFK/GFK - CFRP/GFRP

Titan - Titanium

Titan - Titanium

CFK/GFK - CFRP/GFRP



Solid carbide ROBO-Stack-drill with interior cooling for CFRP/GFRP-Titan – Titan-CFRP/GFRP

VHM-ROBO-Stack-Drill con refrigeración interna para el tratamiento PRFC/PRFV-Titanio y Titanio-PRFC/PRFV

стек дрель для робот, твердосплавное высокопроизводительное сверло с внутренним охлаждением ЦФК/ титан

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

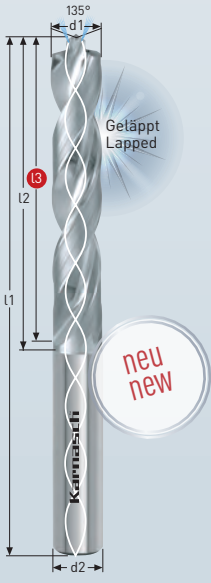
DIN 6535  
Form HAK



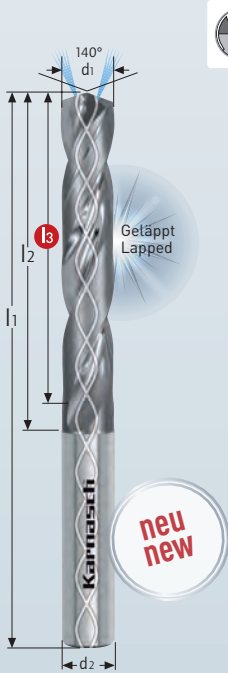
HSC  
HPC



GELÄPPT  
LAPPED



- INCONEL
- HASTELLOY
- MONEL
- NIMONIC
- NI-ALLOYS < 900 N/mm
- NI-CO ALLOYS > 900 N/mm



- Solid carbide high performance twist drill with interior cooling for INCONEL
- Broca de gran potencia de metal duro y enfriamiento interno para INCONEL
- Высокопроизводительное сверло сквозной заправки с внутренним охлаждением, для сплавов INCONEL

MICRO GRAIN

DIN 6537 5xD

SPEZIAL

DIN 6535 Form HAK

30°

140°

HSC HPC

GELÄPPT LAPPED

Schnittdaten  
Cutting data



i S. 208

| Art.            | d1 h7  | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 220410.0300.023 | • 3,0  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0320.023 | • 3,2  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0330.023 | • 3,3  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0340.023 | • 3,4  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0350.023 | • 3,5  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0370.023 | • 3,7  | 23 | 28 | 66 | 6     | 107,50 |
| 220410.0380.029 | • 3,8  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0390.029 | • 3,9  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0400.029 | • 4,0  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0420.029 | • 4,2  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0430.029 | • 4,3  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0450.029 | • 4,5  | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0465.029 | • 4,65 | 29 | 36 | 74 | 6     | 107,50 |
| 220410.0480.035 | • 4,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0500.035 | • 5,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0510.035 | • 5,1  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0520.035 | • 5,2  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0530.035 | • 5,3  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0540.035 | • 5,4  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0550.035 | • 5,5  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0560.035 | • 5,6  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0570.035 | • 5,7  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0580.035 | • 5,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0600.035 | • 6,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220410.0610.043 | • 6,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0620.043 | • 6,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0630.043 | • 6,3  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0640.043 | • 6,4  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0650.043 | • 6,5  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0660.043 | • 6,6  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0670.043 | • 6,7  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0680.043 | • 6,8  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0690.043 | • 6,9  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0700.043 | • 7,0  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0710.043 | • 7,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0720.043 | • 7,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220410.0730.043 | • 7,3  | 43 | 53 | 91 | 8     | 117,50 |

| Art.            | d1 h7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220410.0740.043 | • 7,4  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0750.043 | • 7,5  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0760.043 | • 7,6  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0780.043 | • 7,8  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0790.043 | • 7,9  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0800.043 | • 8,0  | 43 | 53 | 91  | 8     | 117,50 |
| 220410.0810.049 | • 8,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0820.049 | • 8,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0830.049 | • 8,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0840.049 | • 8,4  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0850.049 | • 8,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0860.049 | • 8,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0870.049 | • 8,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0880.049 | • 8,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0890.049 | • 8,9  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0900.049 | • 9,0  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0910.049 | • 9,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0920.049 | • 9,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0930.049 | • 9,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0950.049 | • 9,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0960.049 | • 9,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0970.049 | • 9,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.0980.049 | • 9,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220410.1000.049 | • 10,0 | 49 | 61 | 103 | 10    | 178,00 |
| 220410.1010.056 | • 10,1 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1020.056 | • 10,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1030.056 | • 10,3 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1050.056 | • 10,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1060.056 | • 10,6 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1070.056 | • 10,7 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1080.056 | • 10,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1090.056 | • 10,9 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1100.056 | • 11,0 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1120.056 | • 11,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1150.056 | • 11,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1180.056 | • 11,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220410.1200.056 | • 12,0 | 56 | 69 | 116 | 12    | 242,50 |

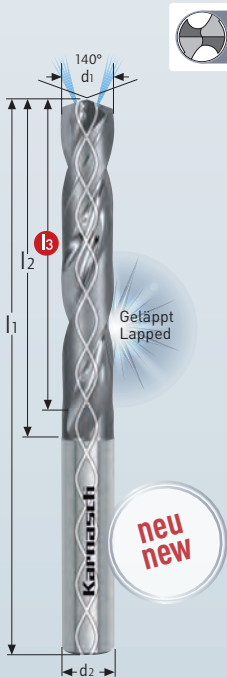
Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                               | Festigkeit<br>Closeness  | Schnittgeschwindigkeit<br>Cutting speed<br>Vc m/min | Vorschub pro Umdrehung<br>Feed per revolution<br>mm |             |             |
|-----------------------------------|-----------------------------------------------------|--------------------------|-----------------------------------------------------|-----------------------------------------------------|-------------|-------------|
|                                   |                                                     |                          |                                                     | Ø3 - Ø5                                             | Ø5 - Ø8     | Ø8 - Ø12    |
| 5.1<br>5.2<br>5.3                 | Nickel 100%<br>Nickel-Legierung<br>Nickel-Legierung | <900 N/mm²<br>>900 N/mm² | 25-35                                               | 0,04 - 0,09                                         | 0,06 - 0,16 | 0,13 - 0,22 |

VHM-Hochleistungsbohrer mit Innenkühlung für TITAN

Art. 22.0412

- TITAN
- TITAN < 1200 N/mm
- TITAN GRADE 1
- TITAN GRADE 2
- TITAN GRADE 3
- TITAN GRADE 4
- TITAN GRADE 5
- TITAN GRADE 12



- Solid carbide high performance twist drill with interior cooling for TITANIUM
- Broca de gran potencia de metal duro y enfriamiento interno para TITANIO
- Высокопроизводительное сверло сквозной заправки с внутренним охлаждением, для титановых сплавов

MICRO GRAIN

DIN 6537 5xD

SPEZIAL

DIN 6535 Form HAK

30°

140°

HSC HPC

GELÄPPT LAPPED

Schnittdaten  
Cutting data



i S. 209

| Art.            | d1 h7  | l3 | l2 | l1 | d2 h6 | €      |
|-----------------|--------|----|----|----|-------|--------|
| 220412.0300.023 | • 3,0  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0320.023 | • 3,2  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0330.023 | • 3,3  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0340.023 | • 3,4  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0350.023 | • 3,5  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0370.023 | • 3,7  | 23 | 28 | 66 | 6     | 107,50 |
| 220412.0380.029 | • 3,8  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0390.029 | • 3,9  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0400.029 | • 4,0  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0420.029 | • 4,2  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0430.029 | • 4,3  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0450.029 | • 4,5  | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0465.029 | • 4,65 | 29 | 36 | 74 | 6     | 107,50 |
| 220412.0480.035 | • 4,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0500.035 | • 5,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0510.035 | • 5,1  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0520.035 | • 5,2  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0530.035 | • 5,3  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0540.035 | • 5,4  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0550.035 | • 5,5  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0555.035 | • 5,55 | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0560.035 | • 5,6  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0570.035 | • 5,7  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0580.035 | • 5,8  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0600.035 | • 6,0  | 35 | 44 | 82 | 6     | 107,50 |
| 220412.0610.043 | • 6,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0620.043 | • 6,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0630.043 | • 6,3  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0640.043 | • 6,4  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0650.043 | • 6,5  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0660.043 | • 6,6  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0670.043 | • 6,7  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0680.043 | • 6,8  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0690.043 | • 6,9  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0700.043 | • 7,0  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0710.043 | • 7,1  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0720.043 | • 7,2  | 43 | 53 | 91 | 8     | 117,50 |
| 220412.0730.043 | • 7,3  | 43 | 53 | 91 | 8     | 117,50 |

| Art.            | d1 h7  | l3 | l2 | l1  | d2 h6 | €      |
|-----------------|--------|----|----|-----|-------|--------|
| 220412.0740.043 | • 7,4  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0750.043 | • 7,5  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0760.043 | • 7,6  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0780.043 | • 7,8  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0790.043 | • 7,9  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0800.043 | • 8,0  | 43 | 53 | 91  | 8     | 117,50 |
| 220412.0810.049 | • 8,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0820.049 | • 8,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0830.049 | • 8,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0840.049 | • 8,4  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0850.049 | • 8,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0860.049 | • 8,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0870.049 | • 8,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0880.049 | • 8,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0890.049 | • 8,9  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0900.049 | • 9,0  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0910.049 | • 9,1  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0920.049 | • 9,2  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0930.049 | • 9,3  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0950.049 | • 9,5  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0960.049 | • 9,6  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0970.049 | • 9,7  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.0980.049 | • 9,8  | 49 | 61 | 103 | 10    | 178,00 |
| 220412.1000.049 | • 10,0 | 49 | 61 | 103 | 10    | 178,00 |
| 220412.1010.056 | • 10,1 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1020.056 | • 10,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1030.056 | • 10,3 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1050.056 | • 10,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1060.056 | • 10,6 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1070.056 | • 10,7 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1080.056 | • 10,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1090.056 | • 10,9 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1100.056 | • 11,0 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1120.056 | • 11,2 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1150.056 | • 11,5 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1180.056 | • 11,8 | 56 | 69 | 116 | 12    | 242,50 |
| 220412.1200.056 | • 12,0 | 56 | 69 | 116 | 12    | 242,50 |

Empfohlene Schnittdaten

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                                     | Festigkeit<br>Closeness  | Schnittgeschwindigkeit<br>Cutting speed<br>Vc m/min | Vorschub pro Umdrehung<br>Feed per revolution<br>mm |             |             |
|-----------------------------------|-----------------------------------------------------------|--------------------------|-----------------------------------------------------|-----------------------------------------------------|-------------|-------------|
|                                   |                                                           |                          |                                                     | Ø3 - Ø5                                             | Ø5 - Ø8     | Ø8 - Ø12    |
| 4.1<br>4.2<br>4.3                 | Reintitan<br>3.7105-3.7115-3.7124<br>3.7154-3.7164-3.7124 | <900 N/mm²<br>>900 N/mm² | 30-45                                               | 0,10 - 0,17                                         | 0,14 - 0,26 | 0,20 - 0,40 |

Art. 29.0305

EXPERT  
★ ★ ★

Diamantbeschichteter Vollhartmetall-Schlichtfräser "UGT"

- COMPO-SITES
- GFK
- CFK
- AFK  
Aramid
- GRAPHIT  
graphite



- Diamond coated solid carbide smooth milling cutter, non symmetrical spirals
- Fresa de acabado de metal duro macizo recubierta de diamante, espiral desigual
- Цельно-твёрдосплавная чистовая фреза с алмазным напылением неравная спираль

| Art.              | d1     | l2 | d2   | l1  | Z | €      |
|-------------------|--------|----|------|-----|---|--------|
| 290305.0300.10.04 | • 3,0  | 10 | 4    | 40  | 4 | 78,00  |
| 290305.0400.15.04 | • 4,0  | 15 | 6    | 50  | 4 | 100,00 |
| 290305.0500.15.04 | • 5,0  | 15 | 6    | 50  | 4 | 113,00 |
| 290305.0600.15.04 | • 6,0  | 15 | 6    | 50  | 4 | 113,00 |
| 290305.0600.25.04 | • 6,0  | 25 | 6    | 64  | 4 | 128,00 |
| 290305.0635.26.04 | • 6,35 | 26 | 6,35 | 64  | 4 | 144,00 |
| 290305.0800.15.04 | • 8,0  | 15 | 8    | 60  | 4 | 144,00 |
| 290305.0800.30.04 | • 8,0  | 30 | 8    | 76  | 4 | 161,00 |
| 290305.0953.30.04 | • 9,53 | 30 | 9,53 | 64  | 4 | 185,00 |
| 290305.1000.20.04 | • 10,0 | 20 | 10   | 73  | 4 | 176,00 |
| 290305.1000.40.04 | • 10,0 | 40 | 10   | 93  | 4 | 200,00 |
| 290305.1200.20.04 | • 12,0 | 20 | 12   | 73  | 4 | 196,00 |
| 290305.1200.40.04 | • 12,0 | 40 | 12   | 96  | 4 | 222,00 |
| 290305.1600.20.04 | • 16,0 | 20 | 16   | 80  | 4 | 276,00 |
| 290305.1600.20.06 | • 16,0 | 20 | 16   | 80  | 6 | 287,00 |
| 290305.1600.40.04 | • 16,0 | 40 | 16   | 100 | 4 | 311,00 |
| 290305.1600.40.06 | • 16,0 | 40 | 16   | 100 | 6 | 323,00 |
| 290305.2000.20.04 | • 20,0 | 20 | 20   | 80  | 4 | 372,00 |
| 290305.2000.20.08 | • 20,0 | 20 | 20   | 80  | 8 | 391,00 |
| 290305.2000.42.04 | • 20,0 | 42 | 20   | 105 | 4 | 427,00 |
| 290305.2000.42.08 | • 20,0 | 42 | 20   | 105 | 8 | 442,00 |

Schnittdaten  
Cutting data



i S. 210

Empfohlene  
Schnittdaten

|           | GFK     | CFK     |
|-----------|---------|---------|
| Vc m/min. | 100-180 | 100-180 |
| f/U mm    | 0,3-0,5 | 0,2-0,4 |

Optimale Bearbeitungsdaten müssen während der Einlaufphase ermittelt werden.

- MICRO GRAIN  
KARNASCH NORM
- SPEZIAL  
DIN 6535 Form HA
- 15°
- HSC HPC
- DCA-06 PLUS
- Air

Art. 29.0412

Diamantbeschichteter Vollhartmetall Typ „V“Fräser für gratfreies Fräsen an Ober- und Unterkante von faserverstärkten Kunststoffen

- COMPO-SITES
- GFK
- PVDF  
GF25
- POM  
GF25
- PA-66
- CFK
- PEEK  
GF30
- PTFE  
CF25
- PEEK  
CF30
- Honey comb



- Diamond-coated solid-carbide type "V" mill for burr-free milling of upper and lower edge of fibre-reinforced plastics
- Fresa tipo "V" de metal duro y macizo recubierta de diamante para fresar sin rebaba las aristas superior e inferior de plásticos reforzados con fibras.
- Твёрдосплавные фрезы типа „V“ с алмазным покрытием для ровного фрезерования верхней и нижней грани армированных волокном пластмасс.

| Art.           | d1 h10 | l2 | d2 h5 | l1  | Z | €      |
|----------------|--------|----|-------|-----|---|--------|
| 290412.0600.16 | • 6    | 16 | 6     | 58  | 4 | 113,00 |
| 290412.0600.21 | • 6    | 21 | 6     | 65  | 4 | 121,00 |
| 290412.0800.22 | • 8    | 22 | 8     | 70  | 6 | 139,00 |
| 290412.0800.28 | • 8    | 28 | 8     | 85  | 6 | 154,00 |
| 290412.1000.25 | • 10   | 25 | 10    | 72  | 6 | 175,00 |
| 290412.1000.32 | • 10   | 32 | 10    | 85  | 6 | 206,00 |
| 290412.1200.28 | • 12   | 28 | 12    | 85  | 6 | 224,00 |
| 290412.1200.36 | • 12   | 36 | 12    | 92  | 6 | 247,00 |
| 290412.1600.35 | • 16   | 35 | 16    | 92  | 6 | 392,00 |
| 290412.1600.48 | • 16   | 48 | 16    | 110 | 6 | 449,00 |

Schnittdaten  
Cutting data



i S. 336

Die gleichzeitig ziehende und schiebende Anordnung der Schneiden verhindert Delamination.  
Concurrent drawing and pushing blade alignment prevents delamination.  
La disposición de las cuchillas que tira y empuja simultáneamente impide la deslaminação.  
Одновременное вытягивающее и сдвигающее положение резки предотвращает расслаивание.

- MICRO GRAIN  
KARNASCH NORM
- SPEZIAL  
DIN 6535 Form HA
- HPC
- DCC031 impuls
- Air



Diamantbeschichteter Vollhartmetall Typ „VR“ Fräser für gratfreies Fräsen an Ober- und Unterseite von faserverstärkten Kunststoffen **ohne Innenkühlung**

Art. **29.0416**

- COMPO-SITES
- CFK
- GFK
- PEEK GF30
- PVDF GF25
- PTFE CF25
- POM GF25
- PEEK CF30
- PA-66
- Honey comb



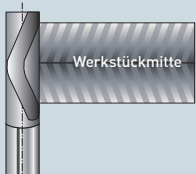
- Diamond-coated solid-carbide type "VR" mill for burr-free milling upper and lower edges if fibre-reinforced plastics without inner cooling
- Fresa tipo "VR" de metal duro y macizo recubierta de diamante para fresar sin rebaba las aristas superior e inferior de plásticos reforzados con fibras, sin refrigeración interna
- Твердосплавные фрезы типа „VR“ с алмазным покрытием для ровного фрезерования верхней и нижней грани армированных волокном пластмасс без внутреннего охлаждения

Schnittdaten  
Cutting data



i S. 336

| Art.           | d1 h10 | l2 | d2 h5 | l1 | Z | €      |
|----------------|--------|----|-------|----|---|--------|
| 290416.0600.16 | • 6    | 16 | 6     | 58 | 4 | 117,00 |
| 290416.0800.22 | • 8    | 22 | 8     | 70 | 6 | 146,00 |
| 290416.1000.25 | • 10   | 25 | 10    | 72 | 6 | 193,00 |
| 290416.1200.28 | • 12   | 28 | 12    | 85 | 6 | 232,00 |



Die gleichzeitig ziehende und schiebende Anordnung der Schneiden verhindert Delamination.  
Concurrent drawing and pushing blade alignment prevents delamination.  
La disposición de las cuchillas que tira y empuja simultáneamente impide la deslaminación.  
Одновременное вытягивающее и сдвигающее положение резки предотвращает расслаивание.

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HPC



DCC031  
impuls



Diamantbeschichteter Vollhartmetall Typ „VRK“ Fräser für gratfreies Fräsen an Ober- und Unterseite von faserverstärkten Kunststoffen **mit Innenkühlung**

Art. **29.0417**

- COMPO-SITES
- CFK
- GFK
- PEEK GF30
- PVDF GF25
- PTFE CF25
- POM GF25
- PEEK CF30
- PA-66
- Honey comb



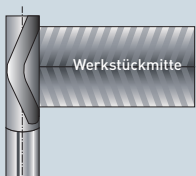
- Diamond-coated solid-carbide type "VRK" mill for burr-free milling upper and lower edges if fibre-reinforced plastics with inner cooling
- Fresa tipo "VRK" de metal duro y macizo recubierta de diamante para fresar sin rebaba las aristas superior e inferior de plásticos reforzados con fibras, con refrigeración interna
- Твердосплавные фрезы типа „VRK“ с алмазным покрытием для ровного фрезерования верхней и нижней грани армированных волокном пластмасс с внутренним охлаждением

Schnittdaten  
Cutting data



i S. 336

| Art.           | d1 h10 | l2 | d2 h5 | l1 | Z | €      |
|----------------|--------|----|-------|----|---|--------|
| 290417.0600.16 | • 6    | 16 | 6     | 58 | 4 | 171,00 |
| 290417.0800.22 | • 8    | 22 | 8     | 70 | 6 | 229,00 |
| 290417.1000.25 | • 10   | 25 | 10    | 72 | 6 | 291,00 |
| 290417.1200.28 | • 12   | 28 | 12    | 85 | 6 | 352,00 |



Die gleichzeitig ziehende und schiebende Anordnung der Schneiden verhindert Delamination.  
Concurrent drawing and pushing blade alignment prevents delamination.  
La disposición de las cuchillas que tira y empuja simultáneamente impide la deslaminación.  
Одновременное вытягивающее и сдвигающее положение резки предотвращает расслаивание.

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HAK



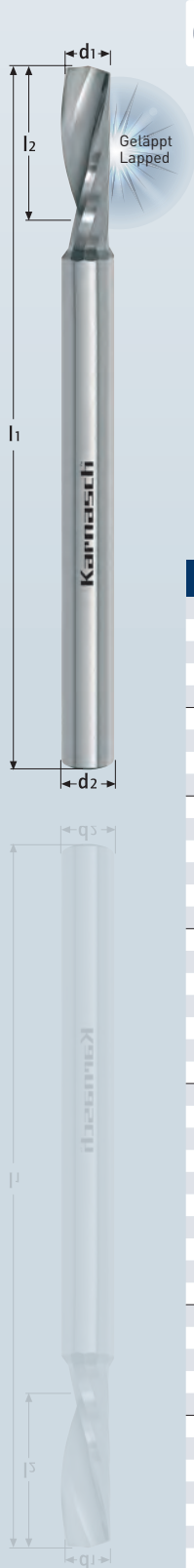
HPC



DCC031  
impuls



- Acryl
- PMMA  
GS
- PE  
PP
- PA
- PS
- ABS
- PC  
PET  
PPE
- PMMA  
XT
- MAKROLON
- Wachs  
Wax



Solid carbide one-tooth end mill, right spiral - right cutting

Fresa MD a codolo ad un dente, elica destra - taglio destro

Твердосплавная однозубая концевая фреза  
Правосторонняя спираль -правозаходная

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

30°

HSC  
High-Speed-  
Cutting

GELÄPPT  
LAPPED

Schnittdaten  
Cutting data



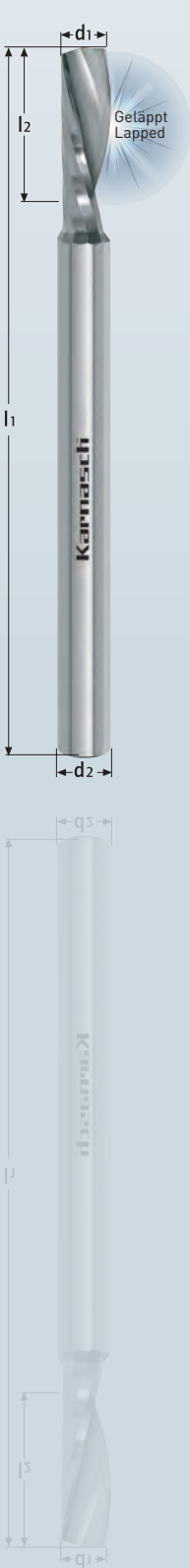
i S. 333

| Art.                   | d1 h10  | l2   | d2 h6 | l1  | Z | €     |
|------------------------|---------|------|-------|-----|---|-------|
| 291652.0010.003.03.030 | • 0,10  | 0,3  | 3     | 30  | 1 | 35,00 |
| 291652.0020.006.03.030 | • 0,20  | 0,6  | 3     | 30  | 1 | 26,00 |
| 291652.0030.010.03.030 | • 0,30  | 1,0  | 3     | 30  | 1 | 23,00 |
| 291652.0040.010.03.030 | • 0,40  | 1,0  | 3     | 30  | 1 | 23,00 |
| 291652.0050.015.03.030 | • 0,50  | 1,5  | 3     | 30  | 1 | 21,00 |
| 291652.0060.030.03.030 | • 0,60  | 3,0  | 3     | 30  | 1 | 21,00 |
| 291652.0080.050.03.030 | • 0,80  | 5,0  | 3     | 30  | 1 | 21,00 |
| 291652.0100.040.03.030 | • 1,00  | 4,0  | 3     | 30  | 1 | 21,00 |
| 291652.0120.050.03.038 | ▲ 1,20  | 5,0  | 3     | 38  | 1 | 21,00 |
| 291652.0150.060.03.030 | • 1,50  | 6,0  | 3     | 30  | 1 | 21,00 |
| 291652.0200.060.03.030 | • 2,00  | 6,0  | 3     | 30  | 1 | 21,00 |
| 291652.0200.060.04.050 | • 2,00  | 6,0  | 4     | 50  | 1 | 26,00 |
| 291652.0200.060.06.050 | • 2,00  | 6,0  | 6     | 50  | 1 | 30,00 |
| 291652.0200.080.03.030 | • 2,00  | 8,0  | 3     | 30  | 1 | 21,00 |
| 291652.0200.110.03.038 | • 2,00  | 11,0 | 3     | 38  | 1 | 26,00 |
| 291652.0300.060.03.030 | • 3,00  | 6,0  | 3     | 30  | 1 | 21,00 |
| 291652.0300.060.06.050 | • 3,00  | 6,0  | 6     | 50  | 1 | 29,00 |
| 291652.0300.110.03.038 | • 3,00  | 11,0 | 3     | 38  | 1 | 26,00 |
| 291652.0300.110.04.050 | • 3,00  | 11,0 | 4     | 50  | 1 | 33,00 |
| 291652.0300.110.06.050 | • 3,00  | 11,0 | 6     | 50  | 1 | 36,00 |
| 291652.0300.220.03.050 | • 3,00  | 22,0 | 3     | 50  | 1 | 29,00 |
| 291652.0300.220.06.060 | • 3,00  | 22,0 | 6     | 60  | 1 | 38,00 |
| 291652.0400.080.04.050 | • 4,00  | 8,0  | 4     | 50  | 1 | 27,00 |
| 291652.0400.080.06.050 | • 4,00  | 8,0  | 6     | 50  | 1 | 32,00 |
| 291652.0400.120.04.050 | • 4,00  | 12,0 | 4     | 50  | 1 | 27,00 |
| 291652.0400.120.06.050 | • 4,00  | 12,0 | 6     | 50  | 1 | 32,00 |
| 291652.0400.140.04.050 | • 4,00  | 14,0 | 4     | 50  | 1 | 27,00 |
| 291652.0400.140.06.050 | • 4,00  | 14,0 | 6     | 50  | 1 | 33,00 |
| 291652.0400.220.04.050 | • 4,00  | 22,0 | 4     | 50  | 1 | 30,00 |
| 291652.0400.220.06.050 | • 4,00  | 22,0 | 6     | 50  | 1 | 35,00 |
| 291652.0400.230.04.060 | ▲ 4,00  | 23,0 | 4     | 60  | 1 | 27,00 |
| 291652.0400.320.04.064 | • 4,00  | 32,0 | 4     | 64  | 1 | 31,00 |
| 291652.0500.120.06.050 | • 5,00  | 12,0 | 6     | 50  | 1 | 34,00 |
| 291652.0500.160.05.050 | ▲ 5,00  | 16,0 | 5     | 50  | 1 | 28,00 |
| 291652.0500.160.06.050 | • 5,00  | 16,0 | 6     | 50  | 1 | 34,00 |
| 291652.0500.220.06.050 | • 5,00  | 22,0 | 6     | 50  | 1 | 34,00 |
| 291652.0500.230.05.060 | ▲ 5,00  | 23,0 | 5     | 60  | 1 | 28,00 |
| 291652.0600.120.06.050 | • 6,00  | 12,0 | 6     | 50  | 1 | 33,00 |
| 291652.0600.160.06.050 | ▲ 6,00  | 16,0 | 6     | 50  | 1 | 28,00 |
| 291652.0600.220.06.050 | • 6,00  | 22,0 | 6     | 50  | 1 | 34,00 |
| 291652.0600.220.06.058 | • 6,00  | 22,0 | 6     | 58  | 1 | 35,00 |
| 291652.0600.230.06.075 | ▲ 6,00  | 23,0 | 6     | 75  | 1 | 41,00 |
| 291652.0600.320.06.064 | • 6,00  | 32,0 | 6     | 64  | 1 | 38,00 |
| 291652.0600.420.06.075 | • 6,00  | 42,0 | 6     | 75  | 1 | 44,00 |
| 291652.0600.320.06.100 | • 6,00  | 32,0 | 6     | 100 | 1 | 45,00 |
| 291652.0800.220.08.064 | • 8,00  | 22,0 | 8     | 64  | 1 | 40,00 |
| 291652.0800.230.08.050 | ▲ 8,00  | 23,0 | 8     | 50  | 1 | 41,00 |
| 291652.0800.320.08.075 | ▲ 8,00  | 32,0 | 8     | 75  | 1 | 41,00 |
| 291652.0800.320.08.064 | • 8,00  | 32,0 | 8     | 64  | 1 | 45,00 |
| 291652.0800.420.08.075 | • 8,00  | 42,0 | 8     | 75  | 1 | 51,00 |
| 291652.0800.420.08.100 | • 8,00  | 42,0 | 8     | 100 | 1 | 57,00 |
| 291652.0800.550.08.100 | • 8,00  | 55,0 | 8     | 100 | 1 | 60,00 |
| 291652.1000.220.10.064 | • 10,00 | 22,0 | 10    | 64  | 1 | 64,00 |
| 291652.1000.320.10.075 | • 10,00 | 32,0 | 10    | 75  | 1 | 70,00 |
| 291652.1000.550.10.100 | • 10,00 | 55,0 | 10    | 100 | 1 | 82,00 |
| 291652.1000.750.10.120 | • 10,00 | 75,0 | 10    | 120 | 1 | 93,00 |
| 291652.1200.320.12.100 | ▲ 12,00 | 32,0 | 12    | 100 | 1 | 89,00 |

Vollhartmetall Einzahnfräser, linksspirale – rechtsschneidend

Art. 29.1654

- Acryl
- PMMA  
GS
- PE  
PP
- PA
- PS
- ABS
- PC  
PET  
PPE
- PMMA  
XT
- MAKROLON
- Wachs  
Wax



Solid carbide one-tooth end mill, left spiral - right cutting

Fresa de mango de punta única de metal duro y macizo  
Espiral a izquierdas - con corte a derechas

Твердосплавная однозубая концевая фреза  
Левосторонняя спираль - правозаходная

MICRO GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

30°

HSC  
High-Speed-Cutting

GELÄPPT  
LAPPED

Schnittdaten  
Cutting data

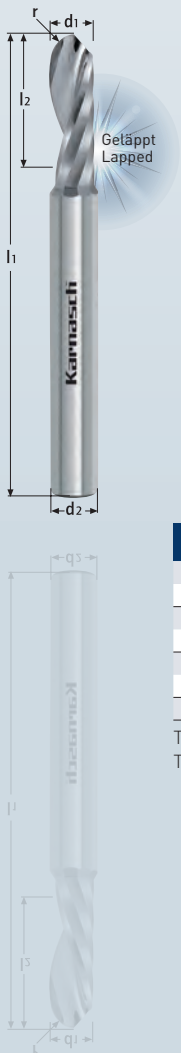


i S. 333

| Art.                  | Ø d1 h10 | l2 | d2 h6 | l3 | l1  | Z | €     |
|-----------------------|----------|----|-------|----|-----|---|-------|
| 291654.0100.04.03.040 | • 1,0    | 4  | 3     | –  | 40  | 1 | 27,00 |
| 291654.0150.06.03.040 | • 1,5    | 6  | 3     | –  | 40  | 1 | 27,00 |
| 291654.0200.03.03.050 | • 2,0    | 3  | 3     | –  | 50  | 1 | 28,00 |
| 291654.0200.06.06.050 | • 2,0    | 6  | 6     | –  | 50  | 1 | 33,00 |
| 291654.0200.08.03.040 | • 2,0    | 8  | 3     | –  | 40  | 1 | 29,00 |
| 291654.0300.04.03.050 | • 3,0    | 4  | 3     | –  | 50  | 1 | 29,00 |
| 291654.0300.06.03.050 | • 3,0    | 6  | 3     | –  | 50  | 1 | 30,00 |
| 291654.0300.10.03.030 | • 3,0    | 10 | 3     | –  | 30  | 1 | 29,00 |
| 291654.0300.10.03.060 | • 3,0    | 10 | 3     | –  | 60  | 1 | 31,00 |
| 291654.0300.12.06.050 | • 3,0    | 12 | 6     | –  | 50  | 1 | 35,00 |
| 291654.0300.15.08.075 | • 3,0    | 15 | 8     | –  | 75  | 1 | 44,00 |
| 291654.0300.18.08.100 | • 3,0    | 18 | 8     | –  | 100 | 1 | 50,00 |
| 291654.0400.05.04.050 | • 4,0    | 5  | 4     | –  | 50  | 1 | 32,00 |
| 291654.0400.08.04.040 | • 4,0    | 8  | 4     | –  | 40  | 1 | 32,00 |
| 291654.0400.14.06.050 | • 4,0    | 14 | 6     | –  | 50  | 1 | 37,00 |
| 291654.0400.18.08.075 | • 4,0    | 18 | 8     | –  | 75  | 1 | 46,00 |
| 291654.0400.20.04.060 | • 4,0    | 20 | 4     | –  | 60  | 1 | 33,00 |
| 291654.0400.22.08.100 | • 4,0    | 22 | 8     | –  | 100 | 1 | 52,00 |
| 291654.0500.06.06.050 | • 5,0    | 6  | 6     | –  | 50  | 1 | 37,00 |
| 291654.0500.10.06.040 | • 5,0    | 10 | 6     | –  | 40  | 1 | 36,00 |
| 291654.0500.16.06.050 | • 5,0    | 16 | 6     | –  | 50  | 1 | 37,00 |
| 291654.0500.22.06.060 | • 5,0    | 22 | 6     | –  | 60  | 1 | 38,00 |
| 291654.0500.23        | ▲ 5,0    | 23 | 6     | –  | 75  | 1 | 48,00 |
| 291654.0500.25.08.075 | • 5,0    | 25 | 8     | –  | 75  | 1 | 47,00 |
| 291654.0500.25.08.100 | • 5,0    | 25 | 8     | –  | 100 | 1 | 57,00 |
| 291654.0500.30.06.070 | • 5,0    | 30 | 6     | –  | 70  | 1 | 38,00 |
| 291654.0600.07.06.050 | • 6,0    | 7  | 6     | –  | 50  | 1 | 32,00 |
| 291654.0600.18.06.050 | • 6,0    | 18 | 6     | –  | 50  | 1 | 33,00 |
| 291654.0600.20.06.060 | • 6,0    | 20 | 6     | –  | 60  | 1 | 34,00 |
| 291654.0600.20.06.100 | • 6,0    | 20 | 6     | 40 | 100 | 1 | 37,00 |
| 291654.0600.25.06.065 | • 6,0    | 25 | 6     | –  | 65  | 1 | 35,00 |
| 291654.0600.25.08.075 | • 6,0    | 25 | 8     | –  | 75  | 1 | 46,00 |
| 291654.0600.40.06.080 | • 6,0    | 40 | 6     | –  | 80  | 1 | 52,00 |
| 291654.0600.30.08.100 | • 6,0    | 30 | 8     | –  | 100 | 1 | 36,00 |
| 291654.0800.10.08.050 | • 8,0    | 10 | 8     | –  | 50  | 1 | 46,00 |
| 291654.0800.20.08.050 | • 8,0    | 20 | 8     | –  | 50  | 1 | 48,00 |
| 291654.0800.20.08.060 | • 8,0    | 20 | 8     | –  | 60  | 1 | 49,00 |
| 291654.0800.20.08.100 | • 8,0    | 20 | 8     | 40 | 100 | 1 | 57,00 |
| 291654.0800.32        | ▲ 8,0    | 32 | 8     | –  | 75  | 1 | 55,00 |
| 291654.0800.35.08.100 | • 8,0    | 35 | 8     | –  | 100 | 1 | 61,00 |
| 291654.1000.25.10.070 | • 10,0   | 25 | 10    | –  | 70  | 1 | 63,00 |
| 291654.1000.25.10.120 | • 10,0   | 25 | 10    | 50 | 120 | 1 | 85,00 |
| 291654.1000.32        | ▲ 10,0   | 32 | 10    | –  | 75  | 1 | 77,00 |
| 291654.1000.35.10.090 | • 10,0   | 35 | 10    | –  | 90  | 1 | 70,00 |

Art. 29.1658 Vollhartmetall Einzahnfräser mit Radius, rechtsspirale – rechtsschneidend, Hochglanz-finish

- Acryl
- PMMA  
GS
- PE  
PP
- PA
- PS
- ABS
- PC  
PET  
PPE
- PMMA  
XT
- MAKROLON
- Wachs  
Wax



- Solid carbide one-tooth end mill with corner radius, right spiral - right cutting, mirror finish
- Fresa metal duro con 1 labio con radio con espiral a derecha, cortante a la derecha, con acabado brillo intenso
- Твердосплавная однозубая фреза с радиусом Правосторонняя спираль – правозаходная зеркальная шлифовка

| Art.           | d1   | r   | l2 | d2 h5 | l1 | €     |
|----------------|------|-----|----|-------|----|-------|
| 291658.0200.06 | • 2  | 1,0 | 6  | 6     | 60 | 49,00 |
| 291658.0300.09 | • 3  | 1,5 | 9  | 6     | 60 | 49,00 |
| 291658.0400.12 | • 4  | 2,0 | 12 | 6     | 60 | 47,00 |
| 291658.0500.15 | • 5  | 2,5 | 15 | 6     | 60 | 55,00 |
| 291658.0600.18 | • 6  | 3,0 | 18 | 6     | 70 | 53,00 |
| 291658.0800.24 | • 8  | 4,0 | 24 | 8     | 80 | 61,00 |
| 291658.1000.30 | • 10 | 5,0 | 30 | 10    | 80 | 70,00 |

Technik: Keine Schartigkeit bei 50-facher Vergrößerung (< Rz 0,5)  
Technology: No chipping at 50-times magnification (< Rz 0,5)

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

30°

Z=1

HSC  
High-Speed-  
Cutting

GELÄPPT  
LAPPED

Air

Schnittdaten  
Cutting data

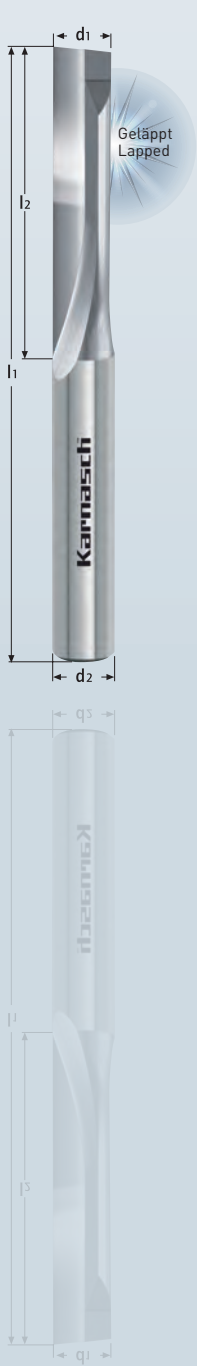




Vollhartmetall Einzahnfräser, gerade genutet, rechtsschneidend

Art. **29.1661**

- Acryl
- PMMA  
GS
- PE  
PP
- PA
- PS
- ABS
- PC  
PET  
PPE
- PMMA  
XT
- MAKROLON
- Wachs  
Wax



- Solid carbide one-tooth end mill, straight fluted - right cutting
- Fresa de mango de punta única de metal duro y macizo, espiral a recto – con corte a derechas
- Однозубая фреза из твердосплавного металла с прямыми стружечными канавками

| Art.               | d1 h10 | l2 | d2 h6 | l1  | €     |
|--------------------|--------|----|-------|-----|-------|
| 291661.0100.04.040 | • 1,0  | 4  | 3     | 40  | 22,00 |
| 291661.0150.06.040 | • 1,5  | 6  | 3     | 40  | 22,00 |
| 291661.0200.03.050 | • 2,0  | 3  | 3     | 50  | 22,00 |
| 291661.0200.06.050 | • 2,0  | 6  | 6     | 50  | 30,00 |
| 291661.0200.08.040 | • 2,0  | 8  | 3     | 40  | 22,00 |
| 291661.0250.09.040 | • 2,5  | 9  | 3     | 40  | 22,00 |
| 291661.0300.06.040 | • 3,0  | 6  | 3     | 40  | 22,00 |
| 291661.0300.10.030 | • 3,0  | 10 | 3     | 30  | 21,00 |
| 291661.0300.10.060 | • 3,0  | 10 | 3     | 60  | 22,00 |
| 291661.0300.12.050 | • 3,0  | 12 | 6     | 50  | 30,00 |
| 291661.0300.15.075 | • 3,0  | 15 | 8     | 75  | 39,00 |
| 291661.0300.18.100 | • 3,0  | 18 | 8     | 100 | 45,00 |
| 291661.0400.05.050 | • 4,0  | 5  | 4     | 50  | 27,00 |
| 291661.0400.08.040 | • 4,0  | 8  | 4     | 40  | 26,00 |
| 291661.0400.14.050 | • 4,0  | 14 | 6     | 50  | 33,00 |
| 291661.0400.18.075 | • 4,0  | 18 | 8     | 75  | 39,00 |
| 291661.0400.20.060 | • 4,0  | 20 | 4     | 60  | 27,00 |
| 291661.0400.22.100 | • 4,0  | 22 | 8     | 100 | 45,00 |
| 291661.0400.30.070 | • 4,0  | 30 | 4     | 70  | 28,00 |
| 291661.0500.06.050 | • 5,0  | 6  | 5     | 50  | 32,00 |
| 291661.0500.10.040 | • 5,0  | 10 | 5     | 40  | 31,00 |
| 291661.0500.16.050 | • 5,0  | 16 | 6     | 50  | 33,00 |
| 291661.0500.22.060 | • 5,0  | 22 | 5     | 60  | 33,00 |
| 291661.0500.25.075 | • 5,0  | 25 | 8     | 75  | 39,00 |
| 291661.0500.25.100 | • 5,0  | 25 | 8     | 100 | 45,00 |
| 291661.0500.30.070 | • 5,0  | 30 | 5     | 70  | 34,00 |
| 291661.0600.07.050 | • 6,0  | 7  | 6     | 50  | 33,00 |
| 291661.0600.18.050 | • 6,0  | 18 | 6     | 50  | 34,00 |
| 291661.0600.20.060 | • 6,0  | 20 | 6     | 60  | 35,00 |
| 291661.0600.25.065 | • 6,0  | 25 | 6     | 65  | 36,00 |
| 291661.0600.25.075 | • 6,0  | 25 | 8     | 75  | 39,00 |
| 291661.0600.30.100 | • 6,0  | 30 | 8     | 100 | 45,00 |
| 291661.0600.40.080 | • 6,0  | 40 | 6     | 80  | 38,00 |
| 291661.0800.09.050 | • 8,0  | 9  | 8     | 50  | 39,00 |
| 291661.0800.20.050 | • 8,0  | 20 | 8     | 50  | 39,00 |
| 291661.0800.20.060 | • 8,0  | 20 | 8     | 60  | 40,00 |
| 291661.0800.30.075 | • 8,0  | 30 | 8     | 75  | 44,00 |
| 291661.0800.35.100 | • 8,0  | 35 | 8     | 100 | 49,00 |
| 291661.1000.25.070 | • 10,0 | 25 | 10    | 70  | 70,00 |
| 291661.1000.35.090 | • 10,0 | 35 | 10    | 90  | 75,00 |

MICRO  
GRAIN

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA



HSC  
High-Speed-  
Cutting



GELÄPPT  
LAPPED



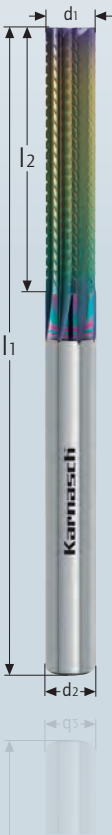
Schnittdaten  
Cutting data



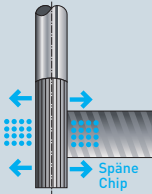
i S. 333

Art. 29.1751 Vollhartmetall-Schrupp- und Schlichtfräser, 8 Frässchneiden / gerade Verzahnung

- COMPO-SITES
- PTFE FEP PVDF
- PA
- PA-66
- PE PP
- PMMA GS
- PMMA XT
- PS
- Honey comb
- PA PE PI



- Solid carbide roughing and finishing cutter for CFRP / GFRP, 8 milling blades / straight teeth
- Fresa de metal duro y macizo para desbastado y acabado para CFK-GFK, 8 cuchillas de fresado / dentado recto
- Твердосплавные фрезы для черновой и чистовой обработки углеродного волокна/стеклоткани, 8 фрезерных режущих кромок кромки/прямые зубья



| Art.           | d1 h10 | l2 | d2 h6 | l1  | Z | €      |
|----------------|--------|----|-------|-----|---|--------|
| 291751.0400.16 | • 4    | 16 | 6     | 60  | 8 | 86,00  |
| 291751.0500.18 | • 5    | 18 | 6     | 60  | 8 | 89,00  |
| 291751.0600.20 | • 6    | 20 | 6     | 60  | 8 | 92,00  |
| 291751.0600.25 | • 6    | 25 | 6     | 65  | 8 | 99,00  |
| 291751.0600.30 | • 6    | 30 | 6     | 75  | 8 | 103,00 |
| 291751.0600.50 | • 6    | 50 | 6     | 100 | 8 | 116,00 |
| 291751.0800.22 | • 8    | 22 | 8     | 63  | 8 | 102,00 |
| 291751.0800.32 | • 8    | 32 | 8     | 75  | 8 | 118,00 |
| 291751.0800.50 | • 8    | 50 | 8     | 100 | 8 | 135,00 |
| 291751.1000.32 | • 10   | 32 | 10    | 72  | 8 | 158,00 |
| 291751.1000.60 | • 10   | 60 | 10    | 120 | 8 | 183,00 |
| 291751.1200.32 | • 12   | 32 | 12    | 82  | 8 | 170,00 |
| 291751.1200.70 | • 12   | 70 | 12    | 120 | 8 | 232,00 |
| 291751.1600.36 | • 16   | 36 | 16    | 92  | 8 | 202,00 |
| 291751.1600.80 | • 16   | 80 | 16    | 150 | 8 | 317,00 |
| 291751.2000.45 | • 20   | 45 | 20    | 104 | 8 | 268,00 |
| 291751.2000.80 | • 20   | 80 | 20    | 150 | 8 | 417,00 |

MICRO GRAIN

KARNASCH NORM

DIN 6535 Form HA

0°

HPC

NHC 7000

Air

Schnittdaten  
Cutting data

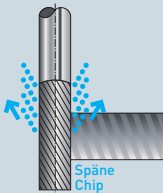


Art. 29.1752 Vollhartmetall-Schrupp- und Schlichtfräser, 8 Frässchneiden / ziehender Schnitt

- COMPO-SITES
- PTFE FEP PVDF
- PA
- PA-66
- PE PP
- PMMA GS
- PMMA XT
- PS
- Honey comb
- PA PE PI



- Solid carbide roughing and finishing cutter for CFRK-GFRK, 8 milling blades / drawing cut
- Fresa de metal duro y macizo para desbastado y acabado para CFK-GFK, 8 cuchillas de fresado / corte tirando
- Твердосплавные фрезы для черновой и чистовой обработки углеродного волокна/стеклоткани, 8 фрезерных режущих кромок кромки/резание "в оттяжку"



| Art.           | d1 h10 | l2 | d2 h6 | l1  | Z | €      |
|----------------|--------|----|-------|-----|---|--------|
| 291752.0400.16 | • 4    | 16 | 6     | 60  | 8 | 86,00  |
| 291752.0500.18 | • 5    | 18 | 6     | 60  | 8 | 89,00  |
| 291752.0600.20 | • 6    | 20 | 6     | 60  | 8 | 92,00  |
| 291752.0600.25 | • 6    | 25 | 6     | 65  | 8 | 99,00  |
| 291752.0600.30 | • 6    | 30 | 6     | 75  | 8 | 103,00 |
| 291752.0600.50 | • 6    | 50 | 6     | 100 | 8 | 116,00 |
| 291752.0800.22 | • 8    | 22 | 8     | 63  | 8 | 102,00 |
| 291752.0800.32 | • 8    | 32 | 8     | 75  | 8 | 118,00 |
| 291752.0800.50 | • 8    | 50 | 8     | 100 | 8 | 135,00 |
| 291752.1000.32 | • 10   | 32 | 10    | 72  | 8 | 158,00 |
| 291752.1000.60 | • 10   | 60 | 10    | 120 | 8 | 183,00 |
| 291752.1200.32 | • 12   | 32 | 12    | 82  | 8 | 170,00 |
| 291752.1200.70 | • 12   | 70 | 12    | 120 | 8 | 232,00 |
| 291752.1600.36 | • 16   | 36 | 16    | 92  | 8 | 202,00 |
| 291752.1600.80 | • 16   | 80 | 16    | 150 | 8 | 317,00 |
| 291752.2000.45 | • 20   | 45 | 20    | 104 | 8 | 268,00 |
| 291752.2000.80 | • 20   | 80 | 20    | 150 | 8 | 417,00 |

MICRO GRAIN

KARNASCH NORM

DIN 6535 Form HA

8°

HPC

NHC 7000

Air

Schnittdaten  
Cutting data



Vollhartmetall-Schrupp- und Schlichtfräser, 8 Frässchneiden / **schiebender Schnitt**

Art. **29.1753**

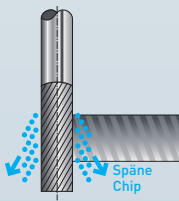
- COMPO-SITES
- PTFE  
FEP  
PVDF
- PA
- PA-66
- PE  
PP
- PMMA  
GS
- PMMA  
XT
- PS
- Honey  
comb
- PA  
PE  
PI



Solid carbide roughing and finishing cutter for CFRL-GFRL, 8 milling blades / pushing cut

Fresa de metal duro y macizo para desbastado y acabado para CFK-GFK, 8 cuchillas de fresado / corte empujando

Твердосплавные фрезы для черновой и чистовой обработки углеродного волокна/стеклоткани, 8 фрезерных режущих кромок кромки/скользящее резание



| Art.           | d1 h10 | l2 | d2 h6 | l1  | Z | €      |
|----------------|--------|----|-------|-----|---|--------|
| 291753.0400.16 | • 4    | 16 | 6     | 60  | 8 | 86,00  |
| 291753.0500.18 | • 5    | 18 | 6     | 60  | 8 | 89,00  |
| 291753.0600.20 | • 6    | 20 | 6     | 60  | 8 | 92,00  |
| 291753.0600.25 | • 6    | 25 | 6     | 65  | 8 | 99,00  |
| 291753.0600.30 | • 6    | 30 | 6     | 75  | 8 | 103,00 |
| 291753.0600.50 | • 6    | 50 | 6     | 100 | 8 | 116,00 |
| 291753.0800.22 | • 8    | 22 | 8     | 63  | 8 | 102,00 |
| 291753.0800.32 | • 8    | 32 | 8     | 75  | 8 | 118,00 |
| 291753.0800.50 | • 8    | 50 | 8     | 100 | 8 | 135,00 |
| 291753.1000.32 | • 10   | 32 | 10    | 72  | 8 | 158,00 |
| 291753.1000.60 | • 10   | 60 | 10    | 120 | 8 | 183,00 |
| 291753.1200.32 | • 12   | 32 | 12    | 82  | 8 | 170,00 |
| 291753.1200.70 | • 12   | 70 | 12    | 120 | 8 | 232,00 |
| 291753.1600.36 | • 16   | 36 | 16    | 92  | 8 | 202,00 |
| 291753.1600.80 | • 16   | 80 | 16    | 150 | 8 | 317,00 |
| 291753.2000.45 | • 20   | 45 | 20    | 104 | 8 | 268,00 |
| 291753.2000.80 | • 20   | 80 | 20    | 150 | 8 | 417,00 |

MICRO  
GRAIN

KARNASCH  
NORM



DIN 6535  
Form HA



HPC



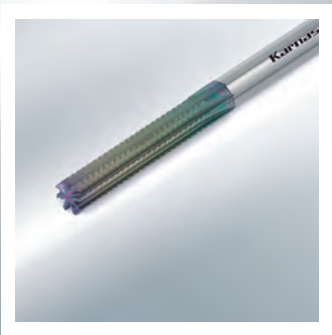
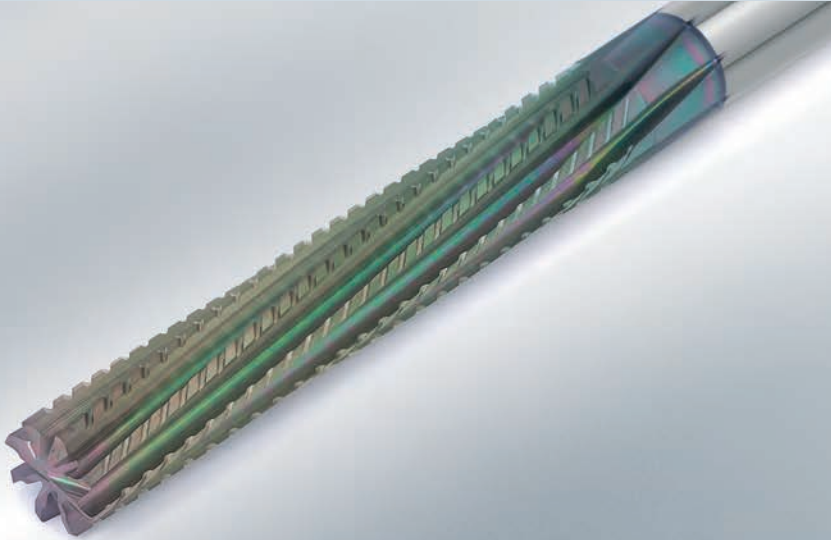
NHC  
7000



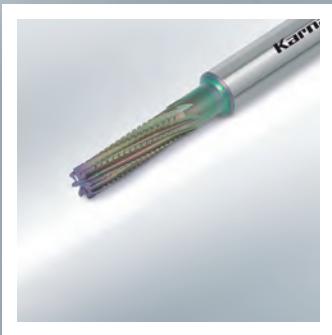
Schnittdaten  
Cutting data



i s. 337



29.1751  
Gerade genutet  
Straight flute



29.1752  
Rechtsspirale, rechtsschneidend  
Rightspiral, rightcutting

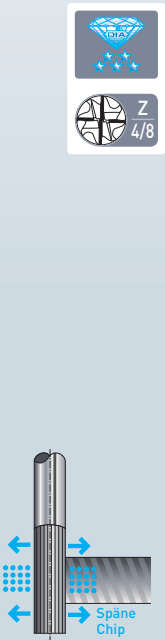


29.1753  
Linksspirale, rechtsschneidend  
Leftspiral, rightcutting

Art. 29.1761

Vollhartmetall-Schrupp- und Schlichtfräser für CFK-GFK, 8 Frässchnitten, 4 Stirnschnitten / gerade Verzahnung

- COMPO-SITES
- CFK
- PVDF GF25
- GF GF25
- PEEK GF30
- PA66 GF30
- POM GF25
- PVDF GF30
- Honey comb
- GRAPHIT graphite



Solid carbide roughing and finishing cutter for CFRP-GFRP, 8 milling blades 4 cutting edges / straight teeth



Fresa de metal duro y macizo para desbastado y acabado para CFK-GFK, 8 cuchillas de fresado 4 cuchillas frontales / dentado recto



Твердосплавные фрезы для черновой и чистовой обработки углеродного волокна/стеклоткани, 8 фрезерных режущих кромок 4 торцевые режущие кромки/прямые зубья

| Art.               | d1 h10 | l2 | d2 h6 | l1  | Z | €      |
|--------------------|--------|----|-------|-----|---|--------|
| 291761.0400.16     | • 4    | 16 | 6     | 60  | 8 | 126,00 |
| 291761.0500.18     | • 5    | 18 | 6     | 60  | 8 | 129,00 |
| 291761.0600.20     | • 6    | 20 | 6     | 60  | 8 | 132,00 |
| 291761.0600.25     | • 6    | 25 | 6     | 65  | 8 | 139,00 |
| 291761.0600.30     | • 6    | 30 | 6     | 75  | 8 | 143,00 |
| NEU 291761.0600.50 | • 6    | 50 | 6     | 100 | 8 | 156,00 |
| 291761.0800.22     | • 8    | 22 | 8     | 63  | 8 | 158,00 |
| 291761.0800.32     | • 8    | 32 | 8     | 75  | 8 | 174,00 |
| NEU 291761.0800.50 | • 8    | 50 | 8     | 100 | 8 | 191,00 |
| 291761.1000.32     | • 10   | 32 | 10    | 72  | 8 | 222,00 |
| NEU 291761.1000.60 | • 10   | 60 | 10    | 120 | 8 | 248,00 |
| 291761.1200.32     | • 12   | 32 | 12    | 82  | 8 | 242,00 |
| NEU 291761.1200.70 | • 12   | 70 | 12    | 120 | 8 | 305,00 |
| 291761.1600.36     | • 16   | 36 | 16    | 92  | 8 | 325,00 |
| NEU 291761.1600.80 | • 16   | 80 | 16    | 150 | 8 | 441,00 |
| 291761.2000.45     | • 20   | 45 | 20    | 104 | 8 | 419,00 |
| NEU 291761.2000.80 | • 20   | 80 | 20    | 150 | 8 | 568,00 |

MICRO GRAIN

KARNASCH NORM



DIN 6535 Form HA



HPC



DCC031 impuls



Schnittdaten  
Cutting data

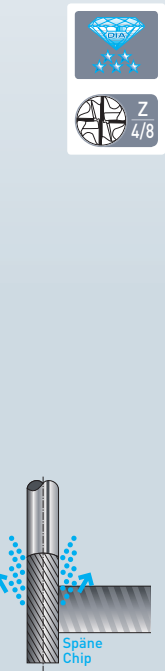


i S. 337

Art. 29.1762

Vollhartmetall-Schrupp- und Schlichtfräser für CFK-GFK, 8 Frässchnitten, 4 Stirnschnitten / ziehender Schnitt

- COMPO-SITES
- CFK
- PVDF GF25
- GF GF25
- PEEK GF30
- PA66 GF30
- POM GF25
- PVDF GF30
- Honey comb
- GRAPHIT graphite



Solid carbide roughing and finishing cutter for CFL-GFK, 8 milling blades 4 cutting edges / drawing cut



Fresa de metal duro y macizo para desbastado y acabado para CFK-GFK, 8 cuchillas de fresado 4 cuchillas frontales / corte tirando



Твердосплавные фрезы для черновой и чистовой обработки углеродного волокна/стеклоткани, 8 фрезерных режущих кромок 4 торцевые режущие кромки/резание "в оттяжку"

| Art.               | d1 h10 | l2 | d2 h6 | l1  | Z | €      |
|--------------------|--------|----|-------|-----|---|--------|
| 291762.0400.16     | • 4    | 16 | 6     | 60  | 8 | 126,00 |
| 291762.0500.18     | • 5    | 18 | 6     | 60  | 8 | 129,00 |
| 291762.0600.20     | • 6    | 20 | 6     | 60  | 8 | 132,00 |
| 291762.0600.25     | • 6    | 25 | 6     | 65  | 8 | 139,00 |
| 291762.0600.30     | • 6    | 30 | 6     | 75  | 8 | 143,00 |
| NEU 291762.0600.50 | • 6    | 50 | 6     | 100 | 8 | 156,00 |
| 291762.0800.22     | • 8    | 22 | 8     | 63  | 8 | 158,00 |
| 291762.0800.32     | • 8    | 32 | 8     | 75  | 8 | 174,00 |
| NEU 291762.0800.50 | • 8    | 50 | 8     | 100 | 8 | 191,00 |
| 291762.1000.32     | • 10   | 32 | 10    | 72  | 8 | 222,00 |
| NEU 291762.1000.60 | • 10   | 60 | 10    | 120 | 8 | 248,00 |
| 291762.1200.32     | • 12   | 32 | 12    | 82  | 8 | 242,00 |
| NEU 291762.1200.70 | • 12   | 70 | 12    | 120 | 8 | 305,00 |
| 291762.1600.36     | • 16   | 36 | 16    | 92  | 8 | 325,00 |
| NEU 291762.1600.80 | • 16   | 80 | 16    | 150 | 8 | 441,00 |
| 291762.2000.45     | • 20   | 45 | 20    | 104 | 8 | 419,00 |
| NEU 291762.2000.80 | • 20   | 80 | 20    | 150 | 8 | 568,00 |

MICRO GRAIN

KARNASCH NORM



DIN 6535 Form HA



HPC



DCC031 impuls



Schnittdaten  
Cutting data



i S. 337



Vollhartmetall-Schrupp- und Schlichtfräser für CFK-GFK, 8 Frässchneiden, 4 Stirnschneiden/*schiebender Schnitt*

Art. **29.1763**

COMPO-SITES

CFK

PVDF  
GF25

GF  
GF25

PEEK  
GF30

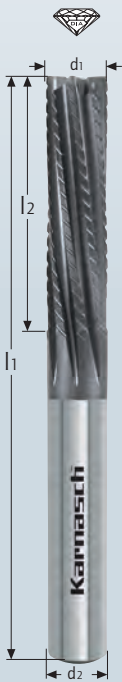
PA66  
GF30

POM  
GF25

PVDF  
GF30

Honey  
comb

GRAPHIT  
graphite

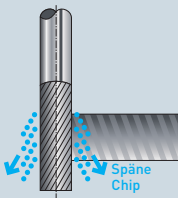


Solid carbide roughing and finishing cutter for CFRP-GFRP, 8 milling blades 4 cutting edges / pushing cut

Fresa de metal duro y macizo para desbastado y acabado para CFK-GFK, 8 cuchillas de fresado 4 cuchillas frontales / corte empujando

Твердосплавные фрезы для черновой и чистовой обработки углеродного волокна/стеклоткани, 8 фрезерных режущих кромок 4 торцевые режущие кромки/скользящее резание

| Art.               | d1 h10 | l2 | d2 h6 | l1  | Z | €      |
|--------------------|--------|----|-------|-----|---|--------|
| 291763.0400.16     | • 4    | 16 | 6     | 60  | 8 | 126,00 |
| 291763.0500.18     | • 5    | 18 | 6     | 60  | 8 | 129,00 |
| 291763.0600.20     | • 6    | 20 | 6     | 60  | 8 | 132,00 |
| 291763.0600.25     | • 6    | 25 | 6     | 65  | 8 | 139,00 |
| 291763.0600.30     | • 6    | 30 | 6     | 75  | 8 | 143,00 |
| NEU 291763.0600.50 | • 6    | 50 | 6     | 100 | 8 | 156,00 |
| 291763.0800.22     | • 8    | 22 | 8     | 63  | 8 | 158,00 |
| 291763.0800.32     | • 8    | 32 | 8     | 75  | 8 | 174,00 |
| NEU 291763.0800.50 | • 8    | 50 | 8     | 100 | 8 | 191,00 |
| 291763.1000.32     | • 10   | 32 | 10    | 72  | 8 | 222,00 |
| NEU 291763.1000.60 | • 10   | 60 | 10    | 120 | 8 | 248,00 |
| 291763.1200.32     | • 12   | 32 | 12    | 82  | 8 | 242,00 |
| NEU 291763.1200.70 | • 12   | 70 | 12    | 120 | 8 | 305,00 |
| 291763.1600.36     | • 16   | 36 | 16    | 92  | 8 | 325,00 |
| 291763.1600.80     | • 16   | 80 | 16    | 150 | 8 | 441,00 |
| NEU 291763.2000.45 | • 20   | 45 | 20    | 104 | 8 | 419,00 |
| NEU 291763.2000.80 | • 20   | 80 | 20    | 150 | 8 | 568,00 |



MICRO  
GRAIN

KARNASCH  
NORM



DIN 6535  
Form HA



HPC



DCC031  
impuls



Schnittdaten  
Cutting data

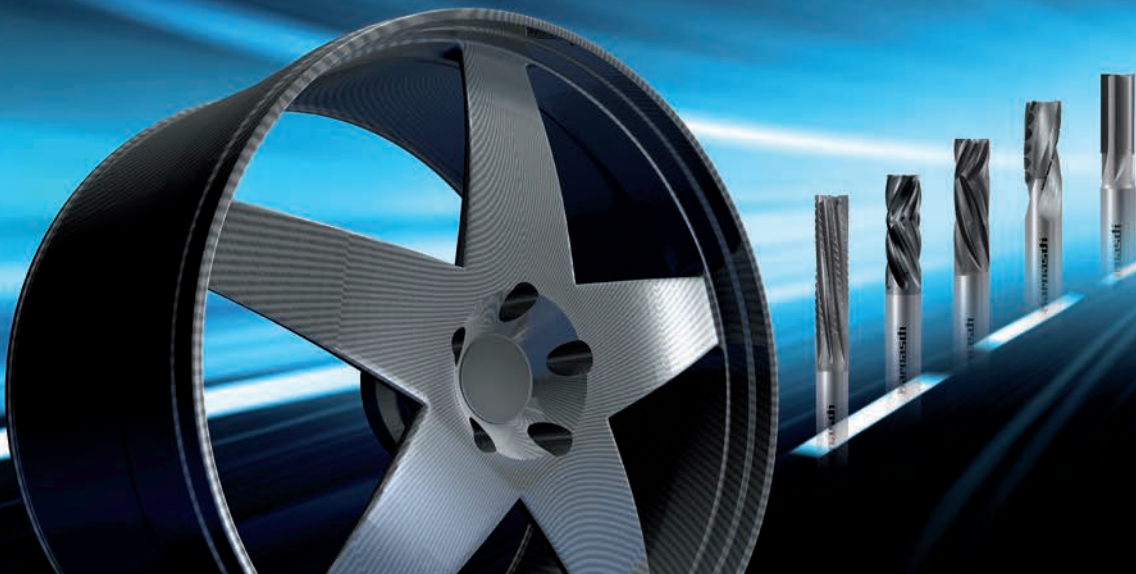


i S. 337

**KARNASCH COMPOSITES-TOOLS** für die Carbonbearbeitung  
in der Automobilindustrie

**KARNASCH COMPOSITES-TOOLS** for machining in carbon at  
the automobile industry

→ **PCD Extreme - CVD - MCD - ND**



Art. **29.1783** Vollhartmetall-Router, Umfang- und Stirnfräser, rechtsschneidend, rechtsdrall, ziehender Schnitt

- COMPO-SITES
- PA
- PVDF GF30
- PEEK GF30
- PEEK CF30
- GF GF25
- PVDF GF25



- Solid carbide-router. circumference and head milling cutter, right-handed cutting, right-handed twist drawing cut.
- Enrutador de metal duro macizo fresa periférica y frontal, de corte a la derecha, torsión a la derecha, corte por tracción
- Цельно-твёрдосплавная фасонная фреза, охватная и торцовая, праворежущая, с правой круткой, проходной шаг

| Art.           | d1 h9  | l2 | l1  | d2 h6 | €      |
|----------------|--------|----|-----|-------|--------|
| 291783.0400.16 | • 4,0  | 16 | 50  | 4     | 22,00  |
| 291783.0500.16 | • 5,0  | 16 | 50  | 5     | 22,00  |
| 291783.0500.20 | • 5,0  | 20 | 75  | 5     | 24,50  |
| 291783.0600.19 | • 6,0  | 19 | 60  | 6     | 32,00  |
| 291783.0600.30 | • 6,0  | 30 | 75  | 6     | 38,00  |
| 291783.0800.25 | • 8,0  | 25 | 63  | 8     | 42,50  |
| 291783.0800.35 | • 8,0  | 35 | 75  | 8     | 50,00  |
| 291783.1000.25 | • 10,0 | 25 | 72  | 10    | 61,50  |
| 291783.1200.32 | • 12,0 | 32 | 83  | 12    | 69,00  |
| 291783.1600.36 | • 16,0 | 36 | 92  | 16    | 109,50 |
| 291783.2000.45 | • 20,0 | 45 | 104 | 20    | 171,50 |

MICRO GRAIN

KARNASCH NORM

DIN 6535 Form HA

Composites

POLIERT POLISHED

Air

Schnittdaten  
Cutting data



Art. **29.1784** Vollhartmetall-Router, Umfangfräser mit Bohrerspitze, rechtsschneidend, rechtsdrall, ziehender Schnitt

- COMPO-SITES
- PA
- PVDF GF30
- PEEK GF30
- PEEK CF30
- GF GF25
- PVDF GF25



- Solid carbide-router circumference milling cutter with drill-point, right handed twist, drawing cut
- Enrutador de metal duro macizo fresa periférica con punta de broca, de corte a la derecha, torsión a la derecha, corte por tracción
- Цельно-твёрдосплавная фасонная фреза, охватная со сверлильной головкой, праворежущая, с правой круткой, проходной шаг

| Art.           | d1 h9  | l2 | l1  | d2 h6 | €      |
|----------------|--------|----|-----|-------|--------|
| 291784.0400.16 | • 4,0  | 16 | 50  | 4     | 23,00  |
| 291784.0500.16 | • 5,0  | 16 | 50  | 5     | 23,00  |
| 291784.0500.20 | • 5,0  | 20 | 75  | 5     | 26,00  |
| 291784.0600.19 | • 6,0  | 19 | 60  | 6     | 33,50  |
| 291784.0600.30 | • 6,0  | 30 | 75  | 6     | 40,50  |
| 291784.0800.25 | • 8,0  | 25 | 60  | 8     | 45,00  |
| 291784.0800.35 | • 8,0  | 35 | 75  | 8     | 52,50  |
| 291784.1000.30 | • 10,0 | 30 | 72  | 10    | 64,50  |
| 291784.1200.32 | • 12,0 | 32 | 83  | 12    | 72,00  |
| 291784.1600.36 | • 16,0 | 36 | 92  | 16    | 115,00 |
| 291784.2000.45 | • 20,0 | 45 | 104 | 20    | 179,00 |

MICRO GRAIN

KARNASCH NORM

DIN 6535 Form HA

135°

Composites

POLIERT POLISHED

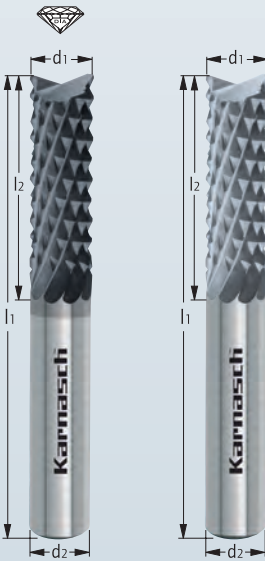
Air

Schnittdaten  
Cutting data



VHM-Carbonfräser, HSC

Art. **29.1790A** **29.1790C**



- Carbon roughing end mills, HSC
- Carbon fresa metal duro de desbastar, HSC
- Carbon Обдирочная фреза, глубина обработки

**MICRO GRAIN**  
KARNASCH NORM

**DIACUT**  
Form HA

**HSC**  
High-Speed-Cutting

**DCA-06**  
Polished

Schnittdaten  
Cutting data



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**COMPO-SITES**  
**GFK**  
**CFK**  
Aramid-faser  
AFK-SFK  
**PA66 GF30**  
**PVDF GF30**  
**PEEK GF30**  
**PEEK CF30**  
**GF GF25**  
**PVDF GF25**  
**ALU**  
> 6% Si  
**GRAPHIT**  
graphite

**COMPO-SITES**  
**GFK**  
**CFK**  
Kunststoff  
plastic  
**CFK-ALU**  
Composite  
**THERMO-PLAST**  
THERMO-PLASTICS  
**DURO-PLASTE**  
DURO-PLASTICS  
**UREOL**  
**GMT**  
**ALU**  
aluminium  
**PLEXI-GLAS**  
**Acryl**  
**PMMA**  
GS

|         |      |     |       | DIAMANT<br>DCA-06 |        | POLIERT<br>POLISHED |       |
|---------|------|-----|-------|-------------------|--------|---------------------|-------|
|         |      |     |       | 29.1790 A         |        | 29.1790 C           |       |
| d1      | l2   | l1  | d2 h5 | Art.              | €      | Art.                | €     |
| • 0,80  | 4,0  | 38  | 3     | 291790A.0080      | 28,00  | 291790C.0080        | 10,00 |
| • 1,00  | 5,0  | 38  | 3     | 291790A.0100      | 28,00  | 291790C.0100        | 10,00 |
| • 1,50  | 8,0  | 38  | 3     | 291790A.0150      | 28,00  | 291790C.0150        | 10,00 |
| • 2,00  | 9,0  | 38  | 3     | 291790A.0200      | 28,00  | 291790C.0200        | 10,00 |
| • 3,00  | 12,0 | 38  | 3     | 291790A.0300      | 30,00  | 291790C.0300        | 10,00 |
| • 4,00  | 15,0 | 40  | 4     | 291790A.0400      | 60,00  | 291790C.0400        | 28,00 |
| • 5,00  | 20,0 | 50  | 5     | 291790A.0500      | 77,00  | 291790C.0500        | 31,00 |
| • 6,00  | 20,0 | 50  | 6     | 291790A.0600      | 82,00  | 291790C.0600        | 37,00 |
| • 8,00  | 25,0 | 60  | 8     | 291790A.0800      | 109,00 | 291790C.0800        | 47,00 |
| • 10,00 | 30,0 | 90  | 10    | 291790A.1000      | 129,00 | 291790C.1000        | 58,00 |
| • 12,00 | 35,0 | 120 | 12    | 291790A.1200      | 180,00 | 291790C.1200        | 98,00 |





Die Schneide macht den Unterschied zwischen CVD, PKD Extreme und Diamantbeschichtung

29.6522      Ø 8,0 CVD-Schneide

CVD

Mit sehr scharfer Schneide, 99,9 % Diamant.  
With a very sharp blade, 99.9 % Diamond.



Ø 8,0 CVD-Schneidkante  
CVD-cutting edge  
Bordo di taglio in CVD  
Режущая кромка CVD

Objektiv Z 250 : 500x

30.6522      Ø 8,0 PKD-Schneide

PCD EXTREME

Poröse Struktur/scharfe Schneide.  
Porous structure / sharp edge.



Ø 8,0 PKD Extreme-Schneidkante  
PCD Extreme-cutting edge  
Bordo di taglio in PCD Extreme  
Режущая кромка PCD

Objektiv Z 250 : 500x

30.6551      Ø 8,0 Diamantbeschichtung

DIAMOND COATED

Schneide ist verrundet.  
Cutting edge is rounded.



Ø 8,0  
Diamantbeschichtete Schneidkante  
Diamond coated cutting edge  
Bordo di taglio diamantato  
Режущая кромка с алмазным слоем

Objektiv Z 250 : 500x



CVD- Einzahnfräser, rechtsspirale – rechtsschneidend

Art. 29.6510

COMPO-SITES

ZIRKO-NIUM

GFK-CFK  
GFK-CFK

GF  
GF25

Aramid-faser  
AFK-SFK

PVDF  
GF25

Hybrid-stoffe

TITAN

CFK-ALU  
Composite

TITAN  
< 1200 N/mm

Schicht-stoffe  
Laminat

ALU  
> 6% Si

PA66  
GF30

MESSING  
brass

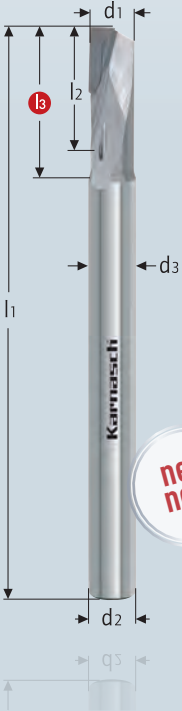
PVDF  
GF30

KUPFER  
copper

PA

Acryl

PE  
PP



- CVD one-tooth end mill, right spiral - right cutting
- Fresa CVD a codolo ad un dente, elica destra - taglio destro
- Твердосплавная однозубая концевая фреза  
Правосторонняя спираль -правозаходная

| Art.           | d1 h7  | l3 | l2 | d2 h6 | d3   | l1 | €      |
|----------------|--------|----|----|-------|------|----|--------|
| 296510.0400.06 | • 4,0  | 12 | 6  | 6     | 3,7  | 60 | 322,00 |
| 296510.0500.07 | • 5,0  | 15 | 7  | 6     | 4,5  | 70 | 336,00 |
| 296510.0600.08 | • 6,0  | 18 | 8  | 6     | 5,5  | 80 | 365,00 |
| 296510.0800.12 | • 8,0  | 25 | 12 | 8     | 7,5  | 80 | 433,00 |
| 296510.1000.16 | • 10,0 | 30 | 16 | 10    | 9,5  | 80 | 598,00 |
| 296510.1200.20 | • 12,0 | 33 | 20 | 12    | 11,5 | 80 | 685,00 |

CVD

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

99,9%  
Diamond

Air

Schnittdaten  
Cutting data



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CVD-3D-Radiusfräser mit Kugelstirn, extra kurz

Art. 29.6521

COMPO-SITES

GF  
GF25

GFK-CFK  
GFK-CFK

PVDF  
GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN  
< 1200 N/mm

CFK-ALU  
Composite

ALU  
> 6% Si

Schicht-stoffe  
Laminat

MESSING  
brass

PA66  
GF30

KUPFER  
copper

PVDF  
GF30

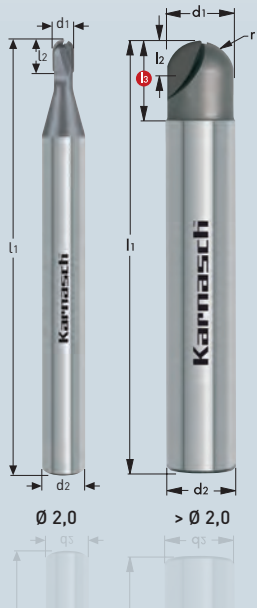
STAHL-  
GRAPHIT

ZIRKO-  
NIUM

KUNST-  
STOFF-  
GRAPHIT

E.MAX  
FOR  
CAD/CAM  
TECHNOLOGY

Ampco



- CVD-3D- ball milling cutter, HSC high-speed-cutting
- CVD-3D- fresa de radio con frente cónico, HSC
- CVD-3D - радиусная фреза с шаровым  
торцом, высокоскоростная резка HSC

| Art.           | d1 h7 | r ± 0,005 | l3 | d2 h6 | l1 | l2  | Z | €      |
|----------------|-------|-----------|----|-------|----|-----|---|--------|
| 296521.0200.04 | • 2   | 1,0       | -  | 4     | 50 | 2,5 | 2 | 176,00 |
| 296521.0200.06 | • 2   | 1,0       | -  | 6     | 50 | 2,5 | 2 | 179,00 |
| 296521.0300.04 | • 3   | 1,5       | -  | 4     | 50 | 2,5 | 2 | 165,00 |
| 296521.0300.06 | • 3   | 1,5       | -  | 6     | 50 | 2,5 | 2 | 165,00 |
| 296521.0300.10 | • 3   | 1,5       | 10 | 6     | 50 | 2,5 | 2 | 165,00 |
| 296521.0400.06 | • 4   | 2,0       | -  | 6     | 50 | 2,5 | 2 | 168,00 |
| 296521.0500.06 | • 5   | 2,5       | -  | 6     | 50 | 3,0 | 2 | 176,00 |
| 296521.0600.06 | • 6   | 3,0       | -  | 6     | 50 | 6,0 | 2 | 222,00 |
| 296521.0800.08 | • 8   | 4,0       | -  | 8     | 60 | 7,0 | 2 | 260,00 |
| 296521.1000.10 | • 10  | 5,0       | -  | 10    | 60 | 8,0 | 2 | 311,00 |
| 296521.1200.12 | • 12  | 6,0       | -  | 12    | 65 | 9,0 | 2 | 360,00 |

Schnittdaten  
Cutting data



i S. 332

CVD

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

99,9%  
Diamond

Air

Art. 29.6522 CVD-3D-Radiusfräser mit Kugelstirn

COMPO-SITES

GFK-CFK  
GFK-CFK

Aramid-faser  
AFK-SFK

Hybrid-stoffe

CFK-ALU  
Composite

Schicht-stoffe  
Laminat

PA66  
GF30

PVDF  
GF30

ZIRKO-NIUM

E.MAX  
FOR  
CAD/CAM  
TECHNOLOGY

GF  
GF25

PVDF  
GF25

TITAN

TITAN  
< 1200  
N/mm

ALU  
> 6% Si

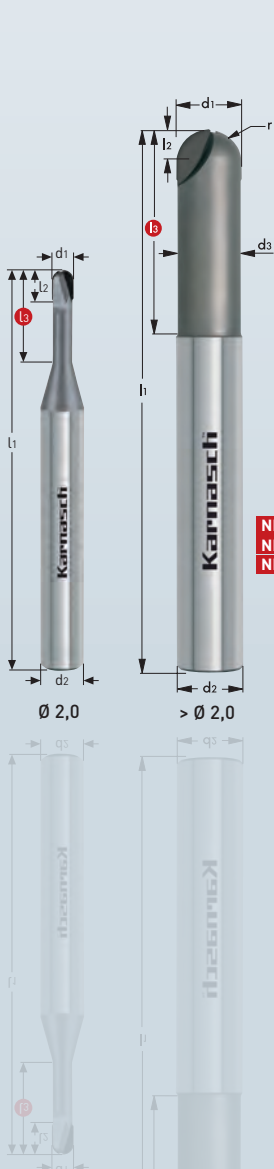
MESSING  
brass

KUPFER  
copper

STAHL-  
GRAPHIT

KUNST-  
STOFF-  
GRAPHIT

Ampco



- CVD-3D- ball milling cutter, HSC high-speed-cutting
- CVD-3D- fresa de radio con frente cónico, HSC
- CVD-3D - радиусная фреза с шаровым торцом, высокоскоростная резка HSC

| Art.                  | d1 h7 | r ± 0,005 | l3 | d2 h6 | d3   | l1  | l2  | Z | €      |
|-----------------------|-------|-----------|----|-------|------|-----|-----|---|--------|
| 296522.0200.06.04     | • 2   | 1,0       | 6  | 4     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296522.0200.08.04     | • 2   | 1,0       | 8  | 4     | 1,92 | 50  | 2,5 | 2 | 203,00 |
| 296522.0200.10.04     | • 2   | 1,0       | 10 | 4     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296522.0200.06.06     | • 2   | 1,0       | 6  | 6     | 1,92 | 50  | 2,5 | 2 | 203,00 |
| 296522.0200.08.06     | • 2   | 1,0       | 8  | 6     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296522.0200.10.06     | • 2   | 1,0       | 10 | 6     | 1,92 | 50  | 2,5 | 2 | 203,00 |
| 296522.0200.12.06     | • 2   | 1,0       | 12 | 6     | 1,92 | 50  | 2,5 | 2 | 203,00 |
| NEU 296522.0300.06.04 | • 3   | 1,5       | 6  | 4     | 1,92 | 50  | 2,5 | 2 | 206,00 |
| NEU 296522.0300.08.04 | • 3   | 1,5       | 8  | 4     | 1,92 | 50  | 2,5 | 2 | 206,00 |
| NEU 296522.0300.10.04 | • 3   | 1,5       | 10 | 4     | 1,92 | 50  | 2,5 | 2 | 206,00 |
| 296522.0300.10.06     | • 3   | 1,5       | 10 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296522.0300.15.06     | • 3   | 1,5       | 15 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296522.0300.20.06     | • 3   | 1,5       | 20 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296522.0400.10.06     | • 4   | 2,0       | 10 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296522.0400.20.06     | • 4   | 2,0       | 20 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296522.0400.30.06     | • 4   | 2,0       | 30 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296522.0500.15.06     | • 5   | 2,5       | 15 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296522.0500.25.06     | • 5   | 2,5       | 25 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296522.0500.35.06     | • 5   | 2,5       | 35 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296522.0600.20.06     | • 6   | 3,0       | 20 | 6     | 5,6  | 100 | 6,0 | 2 | 259,00 |
| 296522.0600.30.06     | • 6   | 3,0       | 30 | 6     | 5,6  | 100 | 6,0 | 2 | 259,00 |
| 296522.0600.40.06     | • 6   | 3,0       | 40 | 6     | 5,6  | 100 | 6,0 | 2 | 259,00 |
| 296522.0800.25.08     | • 8   | 4,0       | 25 | 8     | 7,4  | 100 | 7,0 | 2 | 307,00 |
| 296522.0800.40.08     | • 8   | 4,0       | 40 | 8     | 7,4  | 100 | 7,0 | 2 | 307,00 |
| 296522.1000.30.10     | • 10  | 5,0       | 30 | 10    | 9,6  | 100 | 8,0 | 2 | 367,00 |
| 296522.1000.50.10     | • 10  | 5,0       | 50 | 10    | 9,6  | 100 | 8,0 | 2 | 367,00 |
| 296522.1200.35.12     | • 12  | 6,0       | 35 | 12    | 11,2 | 105 | 9,0 | 2 | 437,00 |
| 296522.1200.60.12     | • 12  | 6,0       | 60 | 12    | 11,2 | 105 | 9,0 | 2 | 437,00 |

CVD

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

0°

HSC  
High-Speed-  
Cutting

99,9%  
Diamond

Schnittdaten  
Cutting data



i S. 332

Material: CFK / CFRP  
Bearbeitet mit / Machined with: 29.0526 Ø8,0x20

Schnittdaten / Cutting data:  
n= 14.000 min<sup>-1</sup>  
Vf= 3.000 mm/min  
ae= 5 mm  
ap= 4 mm

CVD-Schaftfräser mit Eckenradius

Art. 29.6523

COMPO-SITES

GFK-CKF  
GFK-CKF

Aramid-faser  
AFK-SFK

Hybrid-stoffe

CFK-ALU  
Composite

Schicht-stoffe  
Laminat

PA66  
GF30

PVDF  
GF30

ZIRKO-NIUM

E.MAX  
FOR  
CAD/CAM  
TECHNOLOGY

GF  
GF25

PVDF  
GF25

TITAN

TITAN  
< 1200  
N/mm

ALU  
> 6% Si

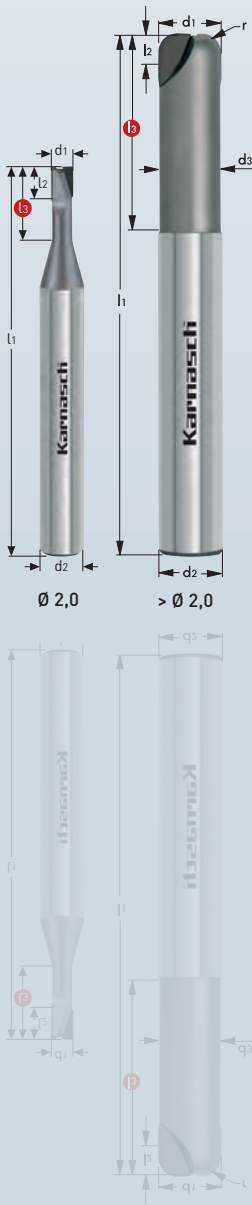
MESSING  
brass

KUPFER  
copper

STAHL-GRAPIT

KUNST-STOFF-GRAPHIT

Ampco



- CVD- end mill with corner radius, HSC high-speed-cutting
- CVD fresa de mango con radio angular, HSC
- CVD-3D - концевая фреза с угловым радиусом, высокоскоростная резка HSC

CVD

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

99,9%  
Diamond

Schnittdaten  
Cutting data



| Art.               | d1 h7 | r ± 0,005 | l3 | d2 h6 | d3   | l1  | l2  | Z | €      |
|--------------------|-------|-----------|----|-------|------|-----|-----|---|--------|
| 296523.0200.020.04 | • 2   | 0,2       | 4  | 4     | 1,92 | 50  | 2,5 | 2 | 197,00 |
| 296523.0200.020.06 | • 2   | 0,2       | 6  | 4     | 1,92 | 50  | 2,5 | 2 | 197,00 |
| 296523.0200.020.08 | • 2   | 0,2       | 8  | 4     | 1,92 | 50  | 2,5 | 2 | 197,00 |
| 296523.0200.020.10 | • 2   | 0,2       | 10 | 4     | 1,92 | 50  | 2,5 | 2 | 197,00 |
| 296523.0300.030.10 | • 3   | 0,3       | 10 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0300.030.15 | • 3   | 0,3       | 15 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0300.030.20 | • 3   | 0,3       | 20 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0300.050.10 | • 3   | 0,5       | 10 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0300.050.15 | • 3   | 0,5       | 15 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0300.050.20 | • 3   | 0,5       | 20 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0400.030.10 | • 4   | 0,3       | 10 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0400.030.20 | • 4   | 0,3       | 20 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0400.030.30 | • 4   | 0,3       | 30 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0400.050.10 | • 4   | 0,5       | 10 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0400.050.20 | • 4   | 0,5       | 20 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0400.050.30 | • 4   | 0,5       | 30 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296523.0500.030.15 | • 5   | 0,3       | 15 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296523.0500.030.25 | • 5   | 0,3       | 25 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296523.0500.030.35 | • 5   | 0,3       | 35 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296523.0500.050.15 | • 5   | 0,5       | 15 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296523.0500.050.25 | • 5   | 0,5       | 25 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296523.0500.050.35 | • 5   | 0,5       | 35 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296523.0600.030.20 | • 6   | 0,3       | 20 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.030.30 | • 6   | 0,3       | 30 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.030.40 | • 6   | 0,3       | 40 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.050.20 | • 6   | 0,5       | 20 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.050.30 | • 6   | 0,5       | 30 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.050.40 | • 6   | 0,5       | 40 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.100.20 | • 6   | 1,0       | 20 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.100.30 | • 6   | 1,0       | 30 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0600.100.40 | • 6   | 1,0       | 40 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296523.0800.030.25 | • 8   | 0,3       | 25 | 8     | 7,6  | 100 | 7,0 | 2 | 307,00 |
| 296523.0800.030.40 | • 8   | 0,3       | 40 | 8     | 7,6  | 100 | 7,0 | 2 | 307,00 |
| 296523.0800.050.25 | • 8   | 0,5       | 25 | 8     | 7,6  | 100 | 7,0 | 2 | 307,00 |
| 296523.0800.050.40 | • 8   | 0,5       | 40 | 8     | 7,6  | 100 | 7,0 | 2 | 307,00 |
| 296523.0800.100.25 | • 8   | 1,0       | 25 | 8     | 7,6  | 100 | 7,0 | 2 | 307,00 |
| 296523.0800.100.40 | • 8   | 1,0       | 40 | 8     | 7,6  | 100 | 7,0 | 2 | 307,00 |
| 296523.1000.050.30 | • 10  | 0,5       | 30 | 10    | 9,6  | 100 | 8,0 | 2 | 367,00 |
| 296523.1000.050.50 | • 10  | 0,5       | 50 | 10    | 9,6  | 100 | 8,0 | 2 | 367,00 |
| 296523.1000.100.30 | • 10  | 1,0       | 30 | 10    | 9,6  | 100 | 8,0 | 2 | 367,00 |
| 296523.1000.100.50 | • 10  | 1,0       | 50 | 10    | 9,6  | 100 | 8,0 | 2 | 367,00 |
| 296523.1200.050.35 | • 12  | 0,5       | 35 | 12    | 11,6 | 105 | 9,0 | 2 | 437,00 |
| 296523.1200.050.60 | • 12  | 0,5       | 60 | 12    | 11,6 | 105 | 9,0 | 2 | 437,00 |
| 296523.1200.100.35 | • 12  | 1,0       | 35 | 12    | 11,6 | 105 | 9,0 | 2 | 437,00 |
| 296523.1200.100.60 | • 12  | 1,0       | 60 | 12    | 11,6 | 105 | 9,0 | 2 | 437,00 |

Art. 29.6524 CVD-Schaftfräser, zylindrisch

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

PVDF GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN < 1200 N/mm

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

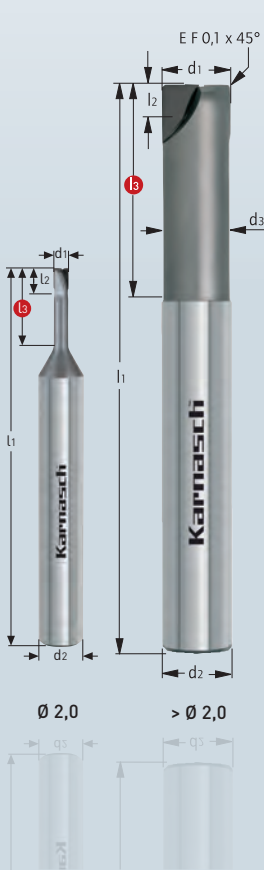
STAHL-GRAPIT

ZIRKO-NIUM

KUNST-STOFF-GRAPHIT

E.MAX FOR CAD/CAM TECHNOLOGY

Ampco



- CVD- end mills, HSC high-speed-cutting
- CVD fresa de mango, HSC
- CVD-3D - концевая фреза, высокоскоростная резка HSC

| Art.           | d1 h7 | l3 | d2 h6 | d3   | l1  | l2  | Z | €      |
|----------------|-------|----|-------|------|-----|-----|---|--------|
| 296524.0200.04 | • 2   | 4  | 4     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296524.0200.06 | • 2   | 6  | 4     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296524.0200.08 | • 2   | 8  | 4     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296524.0200.10 | • 2   | 10 | 4     | 1,92 | 50  | 2,5 | 2 | 200,00 |
| 296524.0300.10 | • 3   | 10 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296524.0300.15 | • 3   | 15 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296524.0300.20 | • 3   | 20 | 6     | 2,8  | 75  | 2,5 | 2 | 206,00 |
| 296524.0400.10 | • 4   | 10 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296524.0400.20 | • 4   | 20 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296524.0400.30 | • 4   | 30 | 6     | 3,8  | 75  | 2,5 | 2 | 206,00 |
| 296524.0500.15 | • 5   | 15 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296524.0500.25 | • 5   | 25 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296524.0500.35 | • 5   | 35 | 6     | 4,6  | 75  | 3,0 | 2 | 215,00 |
| 296524.0600.20 | • 6   | 20 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296524.0600.30 | • 6   | 30 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296524.0600.40 | • 6   | 40 | 6     | 5,5  | 100 | 6,0 | 2 | 259,00 |
| 296524.0800.25 | • 8   | 25 | 8     | 7,4  | 100 | 7,0 | 2 | 307,00 |
| 296524.0800.40 | • 8   | 40 | 8     | 7,4  | 100 | 7,0 | 2 | 307,00 |
| 296524.1000.30 | • 10  | 30 | 10    | 9,2  | 100 | 8,0 | 2 | 367,00 |
| 296524.1000.50 | • 10  | 50 | 10    | 9,2  | 100 | 8,0 | 2 | 367,00 |
| 296524.1200.35 | • 12  | 35 | 12    | 11,6 | 105 | 9,0 | 2 | 437,00 |
| 296524.1200.60 | • 12  | 60 | 12    | 11,6 | 105 | 9,0 | 2 | 437,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

0°

45° x 0,1

HSC High-Speed-Cutting

99,9% Diamond

Schnittdaten Cutting data



Art. 29.6525 CVD-Schaftfräser, extra kurz

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

PVDF GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN < 1200 N/mm

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

STAHL-GRAPIT

ZIRKO-NIUM

KUNST-STOFF-GRAPHIT

E.MAX FOR CAD/CAM TECHNOLOGY

Ampco



- CVD- end mills, < 20 mm CVD - cutting-length, HSC high-speed-cutting
- CVD fresa de mango con cuchillas de < 20 mm CVD, HSC
- CVD - концевая фреза с длиной резцов CVD < 20 mm, высокоскоростная резка HSC

| Art.           | d1 h7 | l2 | d2 h6 | l1 | Z | €      |
|----------------|-------|----|-------|----|---|--------|
| 296525.0300.05 | • 3   | 5  | 6     | 50 | 2 | 206,00 |
| 296525.0400.10 | • 4   | 10 | 6     | 50 | 2 | 259,00 |
| 296525.0500.10 | • 5   | 10 | 6     | 50 | 2 | 301,00 |
| 296525.0500.20 | • 5   | 20 | 6     | 60 | 2 | 411,00 |
| 296525.0600.10 | • 6   | 10 | 6     | 50 | 2 | 325,00 |
| 296525.0600.20 | • 6   | 20 | 6     | 60 | 2 | 465,00 |
| 296525.0800.10 | • 8   | 10 | 8     | 50 | 2 | 369,00 |
| 296525.0800.20 | • 8   | 20 | 8     | 60 | 2 | 538,00 |
| 296525.1000.10 | • 10  | 10 | 10    | 55 | 2 | 426,00 |
| 296525.1000.20 | • 10  | 20 | 10    | 65 | 2 | 622,00 |
| 296525.1200.10 | • 12  | 10 | 12    | 60 | 2 | 482,00 |
| 296525.1200.20 | • 12  | 20 | 12    | 70 | 2 | 720,00 |
| 296525.1600.10 | • 16  | 10 | 16    | 65 | 2 | 615,00 |
| 296525.1600.20 | • 16  | 20 | 16    | 75 | 2 | 921,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

0°

45° x 0,1

HSC High-Speed-Cutting

99,9% Diamond

Schnittdaten Cutting data





CVD-Schaftfräser

Art. 29.6526

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

PVDF GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN < 1200 N/mm

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

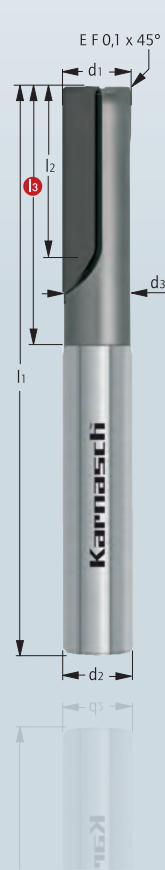
STAHL-GRAPIT

ZIRKO-NIUM

KUNST-STOFF-GRAPHIT

E.MAX FOR CAD/CAM TECHNOLOGY

Ampco



- CVD- end mills, < 20 mm CVD- cutting-length, HSC high-speed-cutting
- CVD fresa de mango con cuchillas de < 20 mm CVD, HSC
- CVD - концевая фреза с длиной резцов CVD < 20 mm, высокоскоростная резка HSC



| Art.           | d1 h7 | l2 | l3 | d2 h6 | d3   | l1  | Z | €      |
|----------------|-------|----|----|-------|------|-----|---|--------|
| 296526.0400.08 | • 4   | 8  | 10 | 6     | 3,9  | 50  | 2 | 266,00 |
| 296526.0400.15 | • 4   | 15 | 20 | 6     | 3,9  | 50  | 2 | 330,00 |
| 296526.0600.10 | • 6   | 10 | 15 | 6     | 5,8  | 65  | 2 | 330,00 |
| 296526.0600.15 | • 6   | 15 | 20 | 6     | 5,8  | 65  | 2 | 396,00 |
| 296526.0600.20 | • 6   | 20 | 25 | 6     | 5,8  | 65  | 2 | 465,00 |
| 296526.0800.10 | • 8   | 10 | 15 | 8     | 7,6  | 70  | 2 | 378,00 |
| 296526.0800.15 | • 8   | 15 | 20 | 8     | 7,6  | 70  | 2 | 458,00 |
| 296526.0800.20 | • 8   | 20 | 30 | 8     | 7,6  | 70  | 2 | 538,00 |
| 296526.1000.10 | • 10  | 10 | 15 | 10    | 9,6  | 85  | 2 | 428,00 |
| 296526.1000.15 | • 10  | 15 | 20 | 10    | 9,6  | 85  | 2 | 538,00 |
| 296526.1000.20 | • 10  | 20 | 30 | 10    | 9,6  | 85  | 2 | 636,00 |
| 296526.1200.10 | • 12  | 10 | 15 | 12    | 11,8 | 92  | 2 | 488,00 |
| 296526.1200.15 | • 12  | 15 | 20 | 12    | 11,8 | 92  | 2 | 607,00 |
| 296526.1200.20 | • 12  | 20 | 30 | 12    | 11,8 | 92  | 2 | 702,00 |
| 296526.1600.10 | • 16  | 10 | 30 | 16    | 15,8 | 92  | 2 | 664,00 |
| 296526.1600.15 | • 16  | 15 | 35 | 16    | 15,8 | 92  | 2 | 814,00 |
| 296526.1600.20 | • 16  | 20 | 40 | 16    | 15,8 | 102 | 2 | 972,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

0°

45° x 0,1

HSC High-Speed-Cutting

99,9% Diamond

Schnittdaten  
Cutting data



i S. 332

CVD-Igelfräser-UGT, Ungleichspirale mit Innenkühlung

Art. 29.6553

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

TITAN < 1200 N/mm

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

GRAPHIT graphite

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

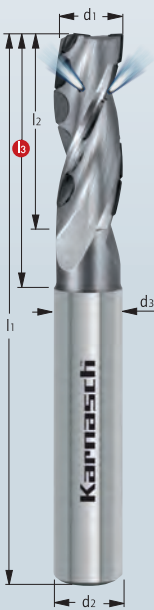
kurz-spanend short chip

NIMONIC 105

lang-spanend long chip

ZIRKO-NIUM

Ampco



- CVD- spiked milling cutter – unequally split, non-symmetrical spirals with interior cooling
- Fresa a riccio CVD, ripartizione non omogenea spirale non uniforme con refrigeracion interna
- Игольчатая фреза с неравномерным шагом зубьев, покрытие CVD, внутреннее охлаждение, несимметричная спираль

| Art.               | d1 h8 | rp  | l2 | l3 | d2 h6 | d3   | l1  | Z | €        |
|--------------------|-------|-----|----|----|-------|------|-----|---|----------|
| 296553.0800.020.15 | • 8   | 0,2 | 15 | 30 | 8     | 7,4  | 70  | 3 | 981,00   |
| 296553.0800.020.25 | • 8   | 0,2 | 25 | 40 | 8     | 7,4  | 80  | 3 | 1.218,00 |
| 296553.1000.020.20 | • 10  | 0,2 | 20 | 35 | 10    | 9,4  | 80  | 3 | 1.159,00 |
| 296553.1000.020.30 | • 10  | 0,2 | 30 | 45 | 10    | 9,4  | 85  | 3 | 1.434,00 |
| 296553.1200.020.20 | • 12  | 0,2 | 20 | 35 | 12    | 11,4 | 85  | 4 | 1.469,00 |
| 296553.1200.020.30 | • 12  | 0,2 | 30 | 45 | 12    | 11,4 | 90  | 4 | 1.869,00 |
| 296553.1600.030.20 | • 16  | 0,3 | 20 | 35 | 16    | 15,4 | 85  | 5 | 1.707,00 |
| 296553.1600.030.30 | • 16  | 0,3 | 30 | 45 | 16    | 15,4 | 95  | 5 | 2.063,00 |
| 296553.2000.030.20 | • 20  | 0,3 | 20 | 40 | 20    | 19,4 | 95  | 5 | 1.980,00 |
| 296553.2000.030.30 | • 20  | 0,3 | 30 | 50 | 20    | 19,4 | 105 | 5 | 2.344,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HAK

25°

HSC HPC

99,9% Diamond

Schnittdaten  
Cutting data



i S. 332

Art. 29.6562 CVD-Schaftfräser – "up & down"-Fräser

COMPO-SITES

GFK-CFK  
GFK-CFK

Aramid-faser  
AFK-SFK

Hybrid-stoffe

CFK-ALU  
Composite

Schicht-stoffe  
Laminat

PA66  
GF30

PVDF  
GF30

Ampco

NIMONIC  
105

ZIRKO-NIUM

TITAN  
< 1200  
N/mm

PVDF  
GF25

PTFE  
CF25

ALU  
> 12% Si

TITAN

kurz-spanend  
short chip



- CVD milling cutter – "up & down" end mill
- CVD Fresa DI espiral desigual, "up & down"
- CVD- ежовая фреза неравного деления неравная спираль, "up & down"

| Art.             | d1 h8 | l2 | l3 | d2 h6 | d3   | l1 | Z | €        |
|------------------|-------|----|----|-------|------|----|---|----------|
| 296562.0800.15.3 | ▲ 8   | 15 | 28 | 8     | 7,4  | 65 | 3 | 633,00   |
| 296562.0800.15.4 | ● 8   | 15 | 28 | 8     | 7,4  | 65 | 4 | 808,00   |
| 296562.0800.24.4 | ● 8   | 24 | 37 | 8     | 7,4  | 75 | 4 | 1.091,00 |
| 296562.1000.15.3 | ▲ 10  | 15 | 28 | 10    | 9,2  | 70 | 3 | 688,00   |
| 296562.1000.25.3 | ▲ 10  | 25 | 38 | 10    | 9,2  | 80 | 3 | 953,00   |
| 296562.1000.15.4 | ● 10  | 15 | 28 | 10    | 9,2  | 70 | 4 | 897,00   |
| 296562.1000.24.4 | ● 10  | 24 | 37 | 10    | 9,2  | 80 | 4 | 1.192,00 |
| 296562.1200.15.4 | ● 12  | 15 | 28 | 12    | 11,2 | 75 | 4 | 921,00   |
| 296562.1200.24.4 | ● 12  | 24 | 37 | 12    | 11,2 | 85 | 4 | 1.221,00 |
| 296562.1600.15.4 | ● 16  | 15 | 28 | 16    | 15,2 | 80 | 4 | 1.045,00 |
| 296562.1600.24.4 | ● 16  | 24 | 37 | 16    | 15,2 | 90 | 4 | 1.353,00 |

CVD

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

UGT

45° x 0,1

up & down

99,9%  
Diamond

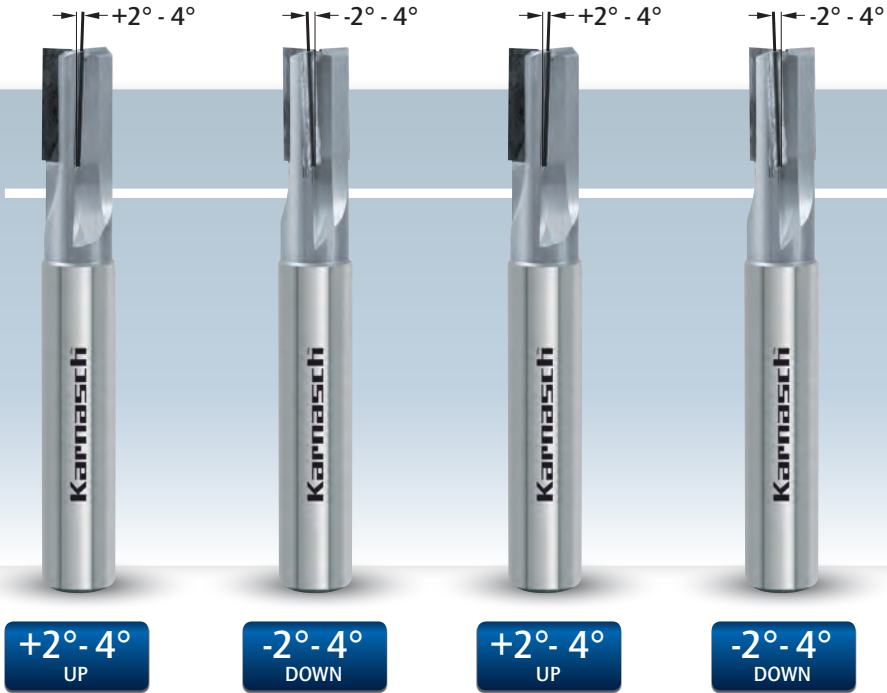
Oil Mist  
Mist Air

Schnittdaten  
Cutting data

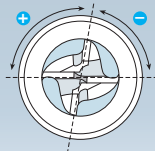


i S. 332

Perfekte Ergebnisse mit Karnasch "up & down"- Fräser  
Perfect result with Karnasch "up & down" end mill



Z=4



Ungleiche Teilung + "up & down"  
Unequal pitch + "up & down"

CVD-Vielzahn-Konturfräser - high end superfinish

Art. **29.6572**

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

PVDF GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN < 1200 N/mm

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

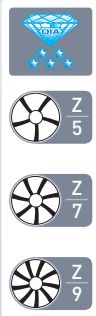
STAHL-GRAPIT

ZIRKO-NIUM

KUNST-STOFF-GRAPHIT

E.MAX FOR CAD/CAM TECHNOLOGY

Ampco



- CVD multiple-tooth-contour mill – high-end superfinish
- Fresa CVD multidiente para contornos – terminación high end
- Многозубчатые контурные фрезы с покрытием CVD для высококачественного суперфиниша

| Art.              | d1 h8 | l2 | l3 | d2 h6 | d3   | l1 | Z | €        |
|-------------------|-------|----|----|-------|------|----|---|----------|
| 296572.0800.10.05 | • 8   | 10 | 18 | 8     | 7,4  | 55 | 5 | 597,00   |
| 296572.0800.20.05 | • 8   | 20 | 28 | 8     | 7,4  | 65 | 5 | 894,00   |
| 296572.1000.12.05 | • 10  | 12 | 20 | 10    | 9,2  | 60 | 5 | 659,00   |
| 296572.1000.22.05 | • 10  | 22 | 30 | 10    | 9,2  | 70 | 5 | 962,00   |
| 296572.1200.15.07 | • 12  | 15 | 23 | 12    | 11,2 | 70 | 7 | 1.075,00 |
| 296572.1200.25.07 | • 12  | 25 | 33 | 12    | 11,2 | 80 | 7 | 1.521,00 |
| 296572.1600.25.07 | • 16  | 25 | 33 | 16    | 15,7 | 80 | 7 | 1.507,00 |
| 296572.1600.25.09 | • 16  | 25 | 33 | 16    | 15,2 | 80 | 9 | 1.866,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

UGT

45° x 0,1

HSC High-Speed-Cutting

99,9% Diamond

Oil Cool

AWM

Schnittdaten  
Cutting data

i S. 332

# Chemical Vapour Deposition (CVD)

revolutioniert die Bearbeitung in der Luft-, Raumfahrt- und Automobilindustrie.  
revolutionize the machining in aerospace and automobile industry.



- Bis 1,0 mm Diamantstärke
- Extrem scharfe Schneiden durch Laserverfahren
- Hochgenaue Schneidkantentoleranz von max. 1µ
- Standzeitenerhöhung bis zu 300%
- Up to 1,0 mm diamond thickness
- extreme sharp cutting edge by the use of Laser process
- high-precision cutting edge tolerance of max. 1µ
- Increase of tool life up to 300%



Art. 29.6573 CVD-Vielzahn-Konturfräser - high end superfinish / ziehender Schnitt

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

PVDF GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN < 1200 N/mm

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

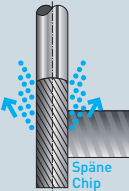
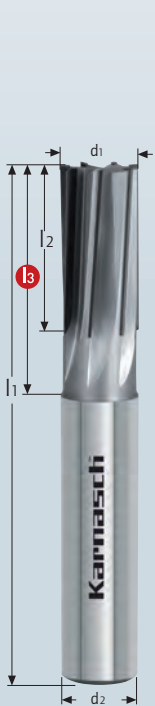
STAHL-GRAPHIT

ZIRKO-NIUM

KUNST-STOFF-GRAPHIT

E.MAX FOR CAD/CAM TECHNOLOGY

Ampco



- CVD multiple-tooth-contour mill – high-end superfinish, drawing cut
- Fresa CVD multidiente para contornos – terminación high end, corte por tracción
- Многозубчатые контурные фрезы с покрытием CVD для высококачественного суперфиниша, проходной шаг

Schnittdaten  
Cutting data



i S. 332

| Art.                 | d1 h8 | l2 | l3 | d2 h6 | d3   | l1 | Z | €        |
|----------------------|-------|----|----|-------|------|----|---|----------|
| 296573.0800.10.18.05 | • 8   | 10 | 18 | 8     | 7,4  | 55 | 5 | 597,00   |
| 296573.0800.20.28.05 | • 8   | 20 | 28 | 8     | 7,4  | 65 | 5 | 894,00   |
| 296573.1000.12.20.05 | • 10  | 12 | 20 | 10    | 9,2  | 60 | 5 | 659,00   |
| 296573.1000.22.30.05 | • 10  | 22 | 30 | 10    | 9,2  | 70 | 5 | 962,00   |
| 296573.1200.15.23.07 | • 12  | 15 | 23 | 12    | 11,2 | 70 | 7 | 1.075,00 |
| 296573.1200.24.33.07 | • 12  | 24 | 33 | 12    | 11,2 | 80 | 7 | 1.521,00 |
| 296573.1600.24.33.07 | • 16  | 24 | 33 | 16    | 15,7 | 80 | 7 | 1.507,00 |
| 296573.1600.24.33.09 | • 16  | 24 | 33 | 16    | 15,2 | 80 | 9 | 1.866,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

UGT

45° x 0,1

HSC High-Speed-Cutting

99,9% Diamond

Oil Emul MMS Air

Art. 29.6574 CVD-Vielzahn-Konturfräser - high end superfinish / schiebender Schnitt

COMPO-SITES

GF GF25

GFK-CFK  
GFK-CFK

PVDF GF25

Aramid-faser  
AFK-SFK

TITAN

Hybrid-stoffe

TITAN < 1200 N/mm

CFK-ALU Composite

ALU > 6% Si

Schicht-stoffe Laminat

MESSING brass

PA66 GF30

KUPFER copper

PVDF GF30

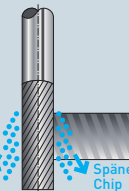
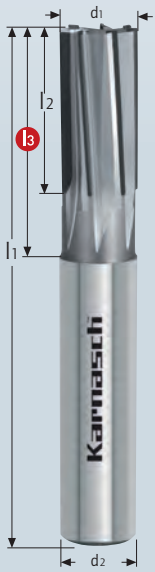
STAHL-GRAPHIT

ZIRKO-NIUM

KUNST-STOFF-GRAPHIT

E.MAX FOR CAD/CAM TECHNOLOGY

Ampco



- CVD multiple-tooth-contour mill – high-end superfinish, pushing cut
- Fresa CVD multidiente para contornos – terminación high end, corte empujando
- Многозубчатые контурные фрезы с покрытием CVD для высококачественного суперфиниша, скользящее резание

Schnittdaten  
Cutting data



i S. 332

| Art.                 | d1 h8 | l2 | l3 | d2 h6 | d3   | l1 | Z | €        |
|----------------------|-------|----|----|-------|------|----|---|----------|
| 296574.0800.10.18.05 | • 8   | 10 | 18 | 8     | 7,4  | 55 | 5 | 597,00   |
| 296574.0800.20.28.05 | • 8   | 20 | 28 | 8     | 7,4  | 65 | 5 | 894,00   |
| 296574.1000.12.20.05 | • 10  | 12 | 20 | 10    | 9,2  | 60 | 5 | 659,00   |
| 296574.1000.22.30.05 | • 10  | 22 | 30 | 10    | 9,2  | 70 | 5 | 962,00   |
| 296574.1200.15.23.07 | • 12  | 15 | 23 | 12    | 11,2 | 70 | 7 | 1.075,00 |
| 296574.1200.24.33.07 | • 12  | 24 | 33 | 12    | 11,2 | 80 | 7 | 1.521,00 |
| 296574.1600.24.33.07 | • 16  | 24 | 33 | 16    | 15,7 | 80 | 7 | 1.507,00 |
| 296574.1600.24.33.09 | • 16  | 24 | 33 | 16    | 15,2 | 80 | 9 | 1.866,00 |

CVD

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

UGT

45° x 0,1

HSC High-Speed-Cutting

99,9% Diamond

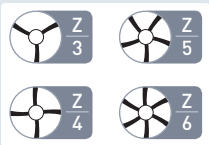
Oil Emul MMS Air



90° Plan – Eckfräser mit  $\mu$  genauer Planlauf-Feineinstellung und Innenkühlung  
für Karnasch CVD Schneidplatten

Art. **29.6600**

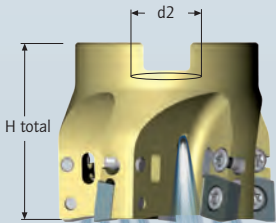
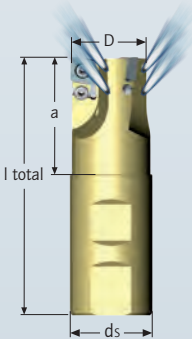
- COMPO-SITES
- PEEK CF30
- GFK
- PEEK
- PA66 GF30
- PVDF GF30
- PEEK GF30
- GF GF25
- CFK
- PTFE CF25



90° level corner cutter with  $\mu$ -precise axial run-out setting and inner cooling. For Karnasch CVD cutting plates

Fresa de plato de 90° con ajuste exacto al  $\mu$  del juego axial y con refrigeración interna. Para placas de corte CVD de Karnasch

90° угловая фреза с точность регулировки до  $\mu$  и внутренним охлаждением. Для режущих пластинок Karnasch с покрытием CVD



| Art.        | D      | ds h6 | a  | l total | Z | n max.<br>U/min. RPM | €      |
|-------------|--------|-------|----|---------|---|----------------------|--------|
| 296600.3200 | • 32,0 | 32    | 45 | 100     | 3 | 26.000               | 663,00 |

| Art.        | D      | d2 | H total | Z | n max.<br>U/min. RPM | €      |
|-------------|--------|----|---------|---|----------------------|--------|
| 296600.4000 | • 40,0 | 16 | 40      | 4 | 24.000               | 696,00 |
| 296600.5000 | • 50,0 | 22 | 40      | 5 | 22.000               | 754,00 |
| 296600.6300 | • 63,0 | 22 | 40      | 6 | 20.000               | 860,00 |

Anzugsdrehmomente: Schneidplatte | Cutting insert: 1,2 Nm  
Tightening torque: Einstellschraube | Adjustment screw: 0,6 N

CVD

KARNASCH NORM

90°

15°

HPC

GELÄPPT LAPPED

Schnittdaten  
Cutting data



i S. 337

| Art.      |  | Wendeplatten/<br>Inserts                                     | L mm | B mm | r <sub>e</sub> | R mm | SKL mm | €                             |
|-----------|--|--------------------------------------------------------------|------|------|----------------|------|--------|-------------------------------|
| 29.6610   |  | <br>CVD<br>Plan/Face<br>CXHW 09T3PDFR5                       | 9,67 | 1,8  | 0,4            | 12,5 | 5      | 108,00<br>1 Stück /<br>Pieces |
| 29.6615   |  | <br>CVD<br>Eck/Shoulder<br>CXHW 09 T3 PD FR 8                | 9,67 | 1,2  | 0,1x45°        | 25   | 8      | 133,00<br>1 Stück /<br>Pieces |
| 29.6617   |  | <br>CVD<br>Breitschlichten/<br>Finishing<br>CXHW 09 T3 XX FR | 9,73 | 4,0  | 0,4x45°        | 100  | 5      | 108,00<br>1 Stück /<br>Pieces |
| 29.6618   |  | Wendeplattenschraubenset<br>Torx T15<br>Torx Screw T15       |      |      |                |      |        | 15,00<br>10 Stück /<br>Pieces |
| 29.6619-1 |  | Drehmoment-Schraubendreher<br>Nm 0,3 - 1,2<br>Torx T15       |      |      |                |      |        | 103,00<br>1 Stück /<br>Pieces |
| 29.6619-2 |  | Drehmoment-Schraubendreher<br>Nm 3,0<br>Torx T15             |      |      |                |      |        | 55,00<br>1 Stück /<br>Pieces  |

Art. 29.6620 MKD-Diamant/PKD Hochglanz-Finish-Messerkopf

|            |               |
|------------|---------------|
| PLEXI-GLAS | SAN           |
| Acryl      | CORAN         |
| PMMA GS    | ALU aluminium |
| PE PP      | Bronze Brass  |
| PC PET PPE | MESSING brass |
| PMMA XT    | KUPFER copper |
| PS         | GOLD gold     |
| PETG       | TITAN         |



- Knife edge for mirror finish
- Cabezal portacuchillas para rectificado de espejo
- Ножевая головка для зеркальной шлифовки

|            |                                |
|------------|--------------------------------|
| ALU-MINIUM | KARNASCH NORM                  |
| SPEZIAL    |                                |
| SPEZIAL    | GRATFREI BURRFREE              |
|            | ACRYL ALU KUPFER MESSING TITAN |
|            | PKD MKD                        |
|            |                                |

| Art.          | Ø d1  | H total | d2 | Z | €        |
|---------------|-------|---------|----|---|----------|
| 296620.040.16 | • 40  | 45      | 16 | 2 | 405,00   |
| 296620.050.16 | • 50  | 45      | 16 | 2 | 446,00   |
| 296620.060.22 | • 60  | 45      | 22 | 2 | 635,00   |
| 296620.085.27 | • 85  | 55      | 27 | 2 | 945,00   |
| 296620.100.27 | • 100 | 48      | 27 | 2 | 1.580,00 |

- Schneideinsätze für Messerköpfe / hochglanz Spiegelschliff
- Cutting insert for knife head/high gloss mirror finish
- Insertos de corte cabezales portacuchillas/acabado espejo de brillo intenso
- Режущие насадки для резцовых головок / зеркальная обработка высокого блеска

|   |                                                                                    |                                                   |                                                     |                                                                                     |                                |                       |                                |                                |                       |       |                     |                                    |
|---|------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------|-----------------------|--------------------------------|--------------------------------|-----------------------|-------|---------------------|------------------------------------|
| A |  | PCD Universal<br>Read cutter                      | PKD Universal<br>Vorschneidezahn                    |  | PMMA<br>GS                     | PMMA<br>XT            | ALU<br>aluminium<br>WEICH/SOFT | KUPFER<br>copper<br>WEICH/SOFT | MESSING<br>WEICH/SOFT | TITAN | 29.6621<br>€ 176,00 |                                    |
| B |  | ND natural diamond<br>Finishing<br>Acrylic        | ND Natur Diamant<br>Fertigschneider<br>Acryl        |  | PMMA<br>GS                     | PMMA<br>XT            | PE<br>PP                       | PS                             | PETG                  | SAN   | CORAN               | 29.6622<br>Auf Anfrage /On request |
| B |  | ND natural diamond<br>Finishing<br>Soft aluminium | ND Natur Diamant<br>Fertigschneider<br>Alu weich    |  | ALU<br>aluminium<br>WEICH/SOFT | GOLD<br>gold          |                                |                                |                       |       |                     | 29.6623<br>Auf Anfrage /On request |
| B |  | ND natural diamond<br>Finishing<br>Soft copper    | ND Natur Diamant<br>Fertigschneider<br>Kupfer weich |  | KUPFER<br>copper<br>WEICH/SOFT | MESSING<br>WEICH/SOFT |                                |                                |                       |       |                     | 29.6624<br>Auf Anfrage /On request |
| B |  | ND natural diamond<br>Finishing<br>TITANIUM       | ND Natur Diamant<br>Fertigschneider<br>Titan        |  | TITAN                          |                       |                                |                                |                       |       |                     | 29.6625<br>Auf Anfrage /On request |

Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

**Einstellen und Wuchten:** Wir empfehlen, uns mit Ihrer Bestellung Ihre Werkzeugaufnahme zur Verfügung zu stellen. Diese wird dann mit dem neu eingestellten Messerkopf gewuchtet. Nur so ist ein Spiegelfinish zu erreichen. Alle Diamant-Fertigschneider sind mehrfach nachschleifbar. Zum Nachschleifen mit Karnasch Originalgeometrie bitte um Angabe für welches Material: Acryl Typ GS / Typ XT / Alu weich / Messing weich / Kupfer weich / Titan  
**Adjusting and balancing:** We recommend that you make the tool holder available to us when making your order. Your tool holder will be balanced with the newly adjusted cutter head. This is the only way to achieve a mirror finish.

**Ajuste y equilibrado:** Recomendamos enviarnos conjuntamente con su pedido también su asiento de herramienta. Su asiento de herramienta se equilibra con el cabezal portacuchillas nuevamente ajustado. Solamente así es posible obtener un acabado reflector.  
**Настройка и балансировка:** Мы рекомендуем при заказе направлять нам и соответствующий инструментальный крепеж. Тогда балансировка Вашего инструментального крепежа будет производиться одновременно с новой резцовой головкой. Только при таких условиях можно достичь финишной обработки зеркального качества.

MKD Monokristallin-Diamant, Radiusfräser für Hochglanz-Spiegelfinish

Art. **29.6811**

PLEXI-GLAS

MESSING  
WEICH/SOFT

Acryl

ACRYL  
TYP GS

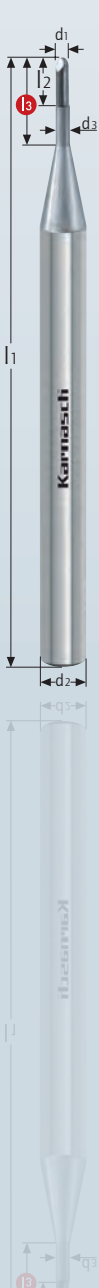
PMMA  
GS

ACRYL  
TYP XT

ALU  
aluminium  
WEICH/SOFT

GOLD  
gold

KUPFER  
copper  
WEICH/SOFT



- MKD/mono-crystal diamond radius milling cutter for high-gloss mirror finish
- MCD/diamante monocristalino, fresa de radios para acabado espejular de alto brillo
- MKD/монокристалльно-алмазная радиальная фреза для зеркальной финишной обработки высокого блеска

| Art.           | d1    | r    | l3 | d2 h5 | d3  | l1 | l2 | Z | € |
|----------------|-------|------|----|-------|-----|----|----|---|---|
| 296811.0100.04 | • 1   | 0,5  | 4  | 3     | 0,9 | 50 | 3  | 1 |   |
| 296811.0150.04 | • 1,5 | 0,75 | 4  | 3     | 1,3 | 50 | 3  | 1 |   |
| 296811.0200.04 | • 2   | 1    | 4  | 3     | 1,7 | 50 | 3  | 1 |   |
| 296811.0300.04 | • 3   | 1,5  | 4  | 4     | 2,6 | 60 | 3  | 1 |   |
| 296811.0400.05 | • 4   | 2    | 5  | 6     | 3,5 | 65 | 3  | 1 |   |
| 296811.0600.05 | • 6   | 3    | 5  | 6     | 5,0 | 75 | 4  | 1 |   |

Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

MKD  
Mono-  
kristallin

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

SPEZIAL

Z=1

HSC  
HPC

GELÄPPT  
LAPPED

Oil  
AMMO

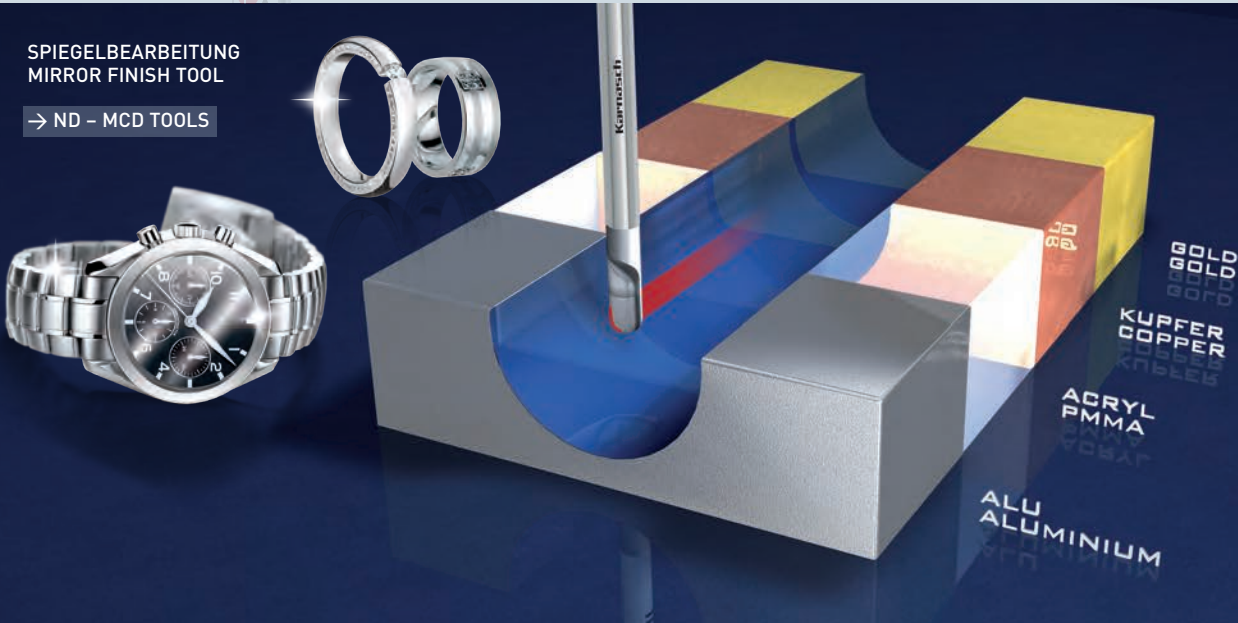
Schnittdaten  
Cutting data



i S. 334

SPIEGELBEARBEITUNG  
MIRROR FINISH TOOL

→ ND - MCD TOOLS



Art. 29.6837 MKD/Monokristalliner Diamantfräser für Hochglanz Spiegelfinish, stirnschneidend

PLEXI-GLAS

ALU aluminium WEICH/SOFT

Acryl

ACRYL TYP GS

PMMA GS

ACRYL TYP XT

GOLD gold

Kupfer Copper



- MKD/mono-crystal diamond milling cutter for high-gloss mirror finish, end cutting
- MCD/fresa con punta de diamante monocristalino para acabado especular de alto brillo, corte frontal
- MKD/монокристалльно-алмазная фреза для зеркальной финишной обработки высокого блеска, торцовое фрезерование

MKD Mono-kristallin

KARNASCH NORM

SPEZIAL

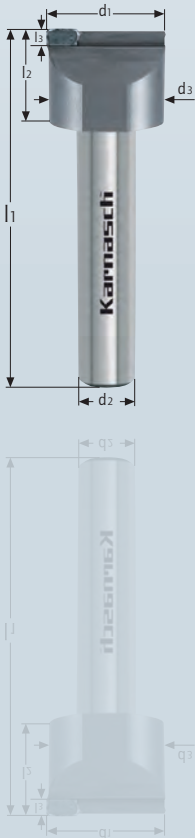
DIN 6535 Form HA

SPEZIAL

r-spezial

HSC HPC

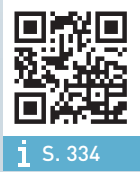
GELÄPPT LAPPED



| Art.        | d1   | d1 - 2 | d2 h5 | d3   | l1 | l2 | l3 | € |
|-------------|------|--------|-------|------|----|----|----|---|
| 296837.1200 | • 12 | 5      | 8     | 11,4 | 60 | 15 | 3  |   |
| 296837.1600 | • 16 | 5      | 10    | 15,4 | 60 | 15 | 3  |   |
| 296837.2000 | • 20 | 5      | 10    | 19,4 | 60 | 15 | 3  |   |

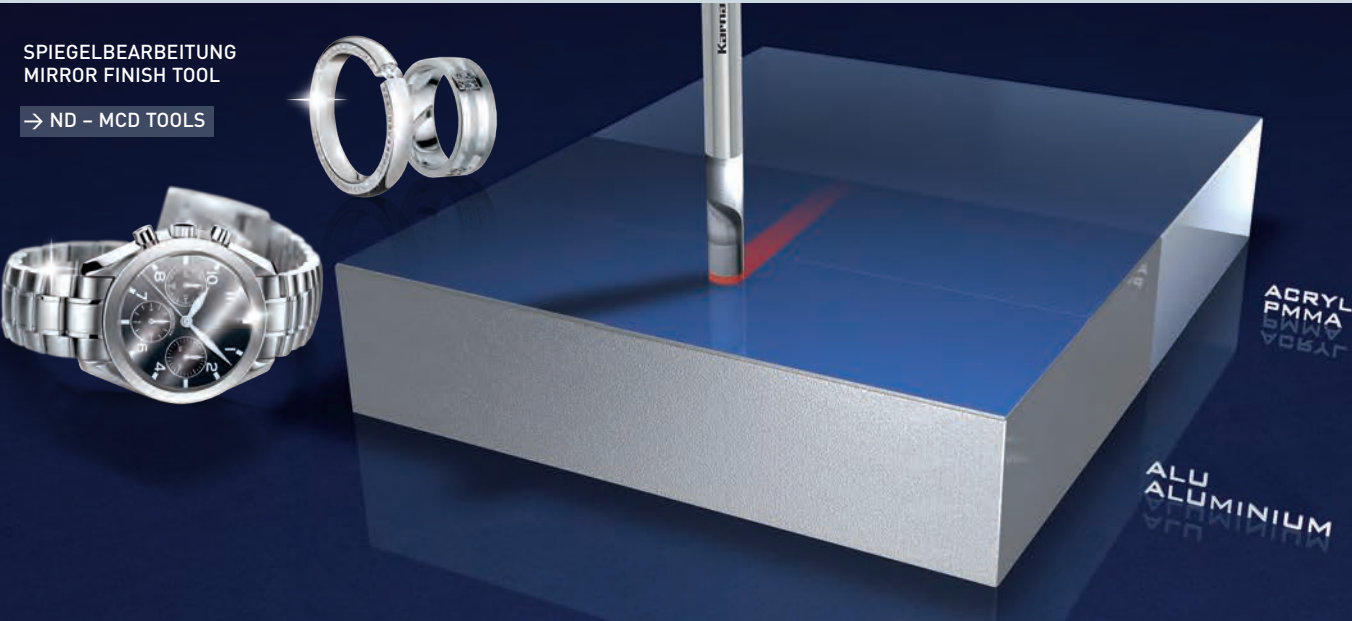
Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

Schnittdaten  
Cutting data



SPIEGELBEARBEITUNG  
MIRROR FINISH TOOL

→ ND - MCD TOOLS





MKD/Monokristalliner Diamantfräser für Hochglanz Spiegelfinish, stirnschneidend

Art. **29.6838**

- KUPFER  
copper  
WEICH/SOFT
- MESSING  
WEICH/SOFT
- GOLD  
gold
- Silver



- MKD/mono-crystal diamond milling cutter for high-gloss mirror finish, end cutting
- MCD/fresa con punta de diamante monocristalino para acabado especular de alto brillo, corte frontal
- MKD/монокристалльно-алмазная фреза для зеркальной финишной обработки высокого блеска, торцовое фрезерование

**MKD**  
Mono-  
kristallin

KARNASCH  
NORM

**SPEZIAL**

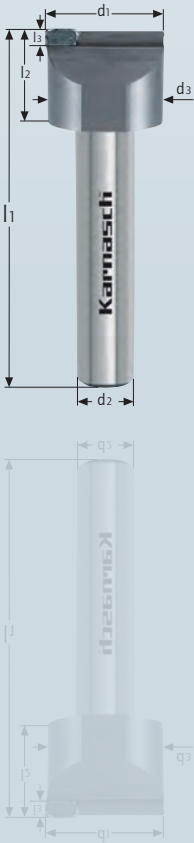
DIN 6535  
Form HA

**SPEZIAL**

r-spezial

**HSC**  
**HPC**

GELÄPPT  
LAPPED



| Art.        | d1   | d1 - 2 | d2 h5 | d3   | l1 | l2 | l3 | € |
|-------------|------|--------|-------|------|----|----|----|---|
| 296838.1200 | • 12 | 5      | 8     | 11,4 | 60 | 15 | 3  |   |
| 296838.1600 | • 16 | 5      | 10    | 15,4 | 60 | 15 | 3  |   |
| 296838.2000 | • 20 | 5      | 10    | 19,4 | 60 | 15 | 3  |   |

Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

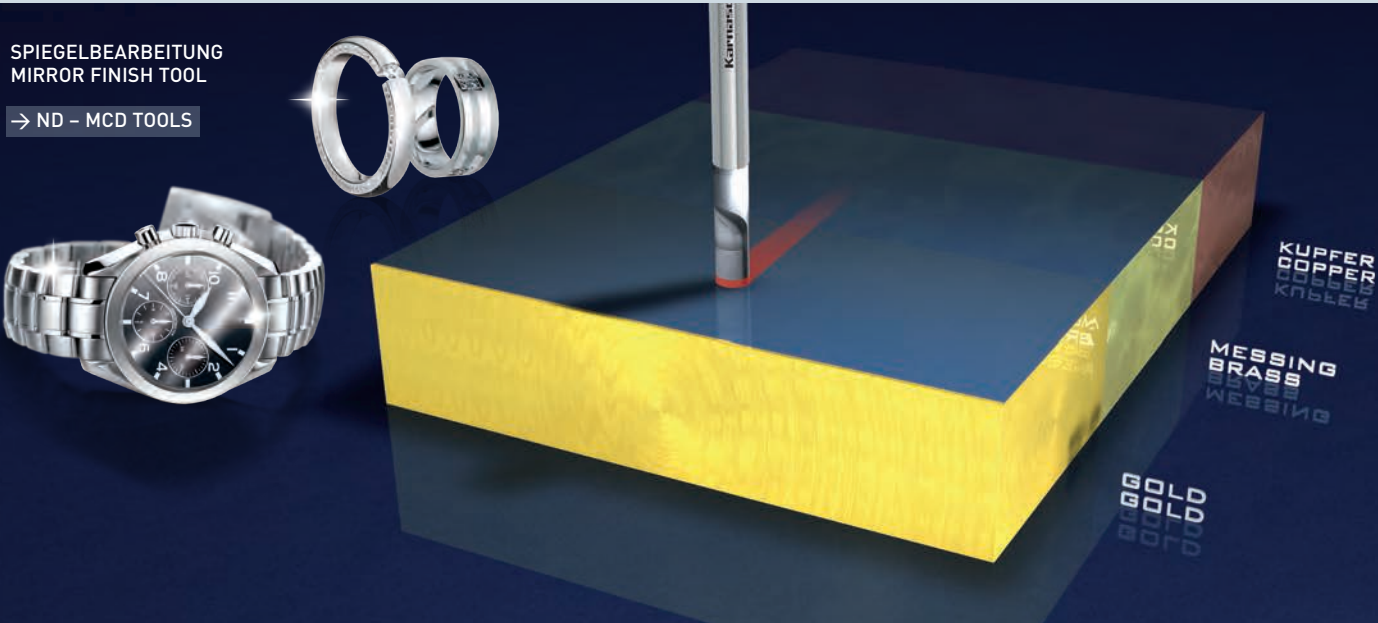
Schnittdaten  
Cutting data



i S. 334

SPIEGELBEARBEITUNG  
MIRROR FINISH TOOL

→ ND - MCD TOOLS



Art. 29.6839 MKD/Monokristalliner Diamantfräser für Hochglanz Spiegelfinish, Umfangfräsen

Acryl

MESSING  
WEICH/SOFT

ACRYL  
TYP GS

KUPFER  
copper  
WEICH/SOFT

ACRYL  
TYP XT

ALU  
aluminium  
WEICH/SOFT

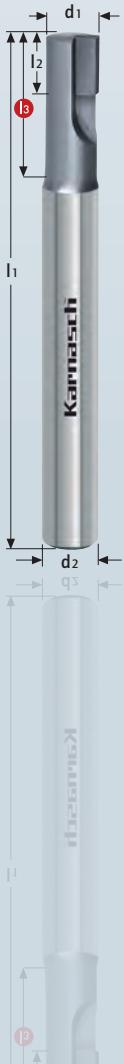
PLEXI-  
GLAS

GOLD  
gold

PMMA  
GS

Silver

Gewuchtet /  
Balanced  
< 40.000 U/min.



- MKD/mono-crystal diamond milling cutter for high gloss mirror finish, profile-milling cutter
- MCD/fresa con punta de diamante monocristalino para acabado especular de alto brillo, fresado periférico
- MKD/монокристалльно-алмазная фреза для зеркальной финишной обработки высокого блеска, охватное фрезерование

| Art.           | Ø d1 ±0,03 | l2 | l3 | d2 h5 | d3  | l1 | Z | € |
|----------------|------------|----|----|-------|-----|----|---|---|
| 296839.0600.03 | • 6,0      | 3  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296839.0600.04 | • 6,0      | 4  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296839.0600.05 | • 6,0      | 5  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296839.0600.06 | • 6,0      | 6  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296839.0800.04 | • 8,0      | 4  | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.0800.05 | • 8,0      | 5  | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.0800.06 | • 8,0      | 6  | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.0800.08 | • 8,0      | 8  | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.0800.10 | • 8,0      | 10 | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.0800.11 | • 8,0      | 11 | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.0800.12 | • 8,0      | 12 | 25 | 8     | 7,4 | 60 | 1 |   |
| 296839.1000.04 | • 10,0     | 4  | 25 | 10    | 9,4 | 60 | 1 |   |
| 296839.1000.05 | • 10,0     | 5  | 25 | 10    | 9,4 | 60 | 1 |   |
| 296839.1000.06 | • 10,0     | 6  | 25 | 10    | 9,4 | 60 | 1 |   |
| 296839.1000.08 | • 10,0     | 8  | 25 | 10    | 9,4 | 60 | 1 |   |
| 296839.1000.10 | • 10,0     | 10 | 25 | 10    | 9,4 | 60 | 1 |   |
| 296839.1000.11 | • 10,0     | 11 | 25 | 10    | 9,4 | 60 | 1 |   |
| 296839.1000.12 | • 10,0     | 12 | 25 | 10    | 9,4 | 60 | 1 |   |

Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

Bei Ihrer Bestellung bitten wir um Information, welches Material Sie bearbeiten um die Schneidengeometrie anzupassen.  
When ordering, please inform us which material you want to machine to adjust the cutting geometry.

MKD  
Mono-  
kristallin

KARNASCH  
NORM

SPEZIAL

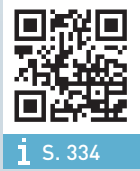
DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

GELÄPPT  
LAPPED

Air

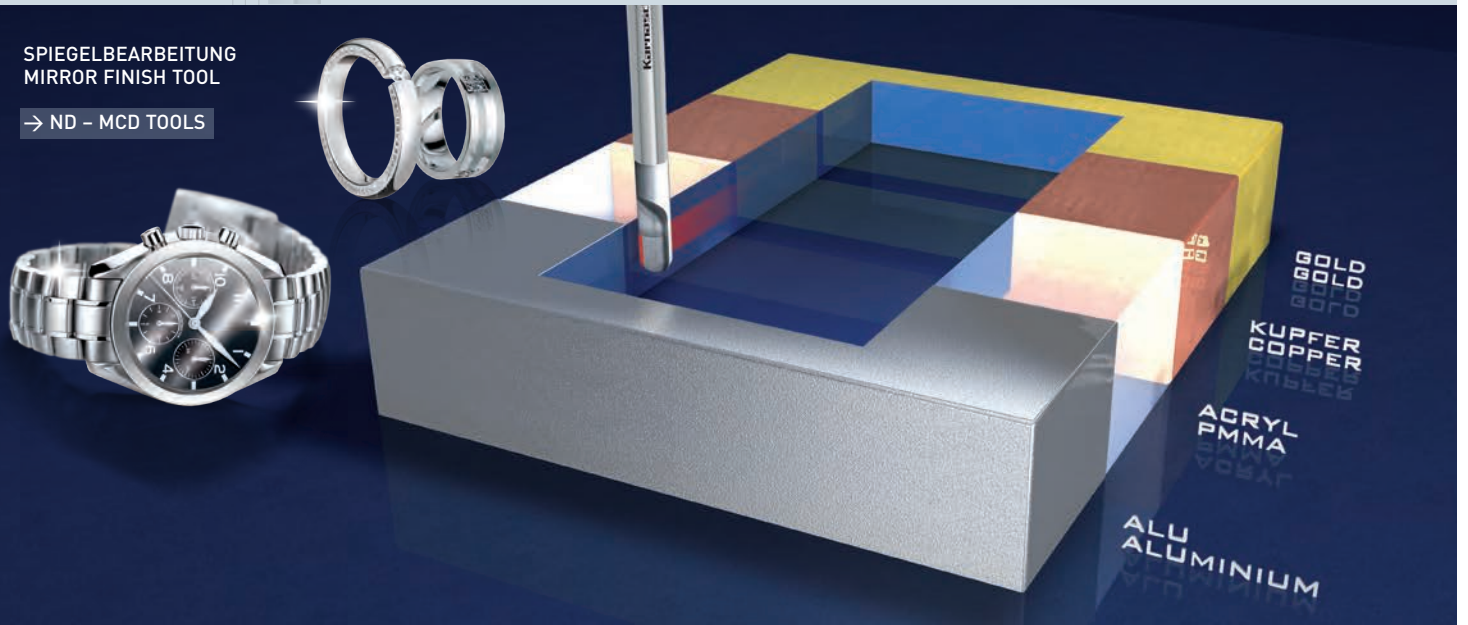
Schnittdaten  
Cutting data



i S. 334



MOVIE



MKD/Monokristalliner Diamantfräser für Hochglanz Spiegelfinish  
Umfangfräser und stirnschneidend

Art. **29.6840**

Acryl

MESSING  
WEICH/SOFT

ACRYL  
TYP GS

KUPFER  
copper  
WEICH/SOFT

ACRYL  
TYP XT

ALU  
aluminium  
WEICH/SOFT

PLEXI-  
GLAS

GOLD  
gold

PMMA  
GS

Silver

Gewuchtet /  
Balanced  
< 60.000 U./min.



- MKD/mono-crystal diamond milling cutter for high-gloss mirror finish, circumference-milling cutter and end cutting.
- MCD/fresa con punta de diamante monocristalino para acabado espejular de alto brillo, fresado periférico y corte frontal.
- MKD/монокристалльно-алмазная фреза для зеркальной финишной обработки высокого блеска, охватное и торцовое фрезерование

MKD  
Mono-  
kristallin

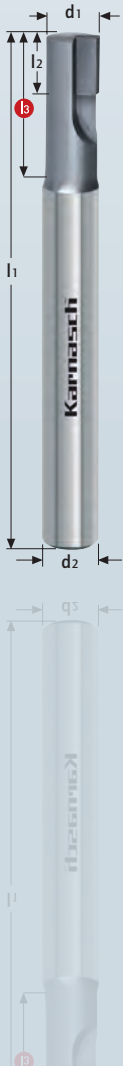
KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

GELÄPPT  
LAPPED



| Art.           | Ø d1 ±0,03 | l2 | l3 | d2 h5 | d3  | l1 | Z | € |
|----------------|------------|----|----|-------|-----|----|---|---|
| 296840.0100.02 | • 1,0      | 2  | -  | 3     | -   | 50 | 1 |   |
| 296840.0100.03 | • 1,0      | 3  | -  | 3     | -   | 50 | 1 |   |
| 296840.0100.04 | • 1,0      | 4  | -  | 3     | -   | 50 | 1 |   |
| 296840.0150.03 | • 1,5      | 3  | -  | 3     | -   | 50 | 1 |   |
| 296840.0150.04 | • 1,5      | 4  | -  | 3     | -   | 50 | 1 |   |
| 296840.0150.05 | • 1,5      | 5  | -  | 3     | -   | 50 | 1 |   |
| 296840.0200.03 | • 2,0      | 3  | -  | 3     | -   | 50 | 1 |   |
| 296840.0200.04 | • 2,0      | 4  | -  | 3     | -   | 50 | 1 |   |
| 296840.0200.05 | • 2,0      | 5  | -  | 3     | -   | 50 | 1 |   |
| 296840.0200.06 | • 2,0      | 6  | -  | 3     | -   | 50 | 1 |   |
| 296840.0300.03 | • 3,0      | 3  | -  | 4     | -   | 50 | 1 |   |
| 296840.0300.04 | • 3,0      | 4  | -  | 4     | -   | 50 | 1 |   |
| 296840.0300.05 | • 3,0      | 5  | -  | 4     | -   | 50 | 1 |   |
| 296840.0300.06 | • 3,0      | 6  | -  | 4     | -   | 50 | 1 |   |
| 296840.0400.03 | • 4,0      | 3  | 12 | 4     | 3,4 | 50 | 1 |   |
| 296840.0400.04 | • 4,0      | 4  | 12 | 4     | 3,4 | 50 | 1 |   |
| 296840.0400.05 | • 4,0      | 5  | 12 | 4     | 3,4 | 50 | 1 |   |
| 296840.0400.06 | • 4,0      | 6  | 12 | 4     | 3,4 | 50 | 1 |   |
| 296840.0600.03 | • 6,0      | 3  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296840.0600.04 | • 6,0      | 4  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296840.0600.05 | • 6,0      | 5  | 20 | 6     | 5,4 | 50 | 1 |   |
| 296840.0600.06 | • 6,0      | 6  | 20 | 6     | 5,4 | 50 | 1 |   |

Schnittdaten  
Cutting data

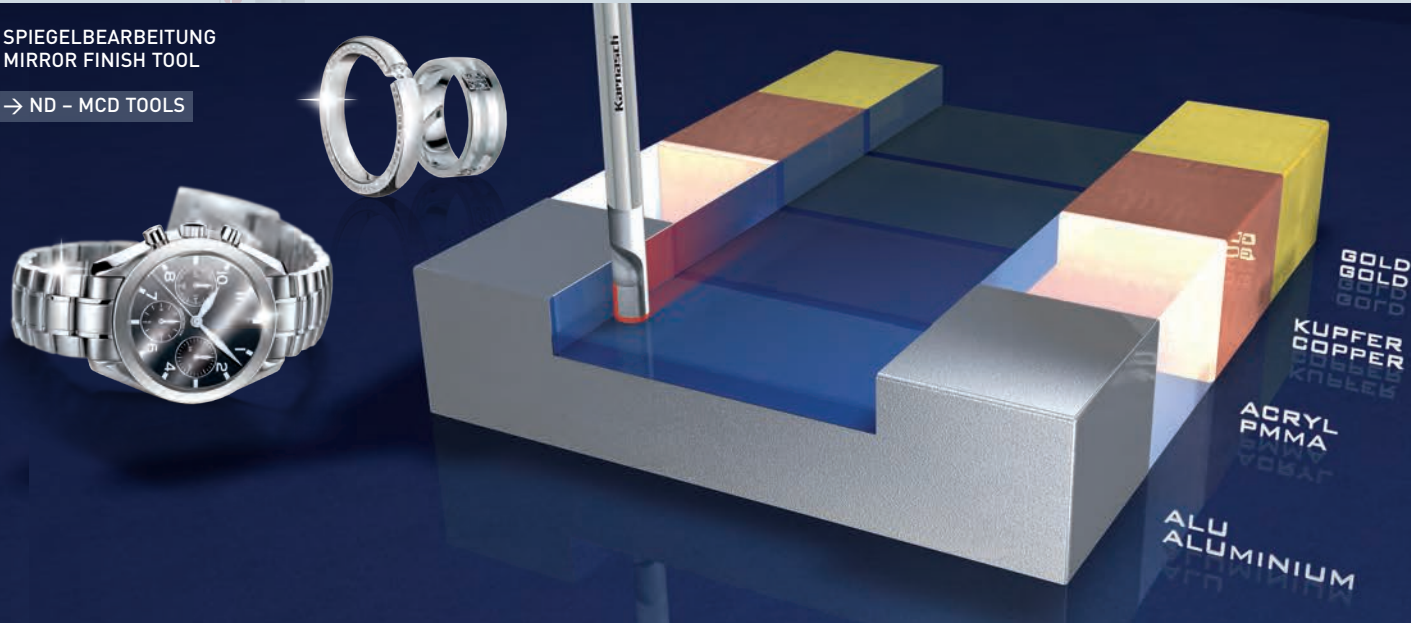


Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

Bei Ihrer Bestellung bitten wir um Information, welches Material Sie bearbeiten um die Schneidengeometrie anzupassen.  
When ordering, please inform us which material you want to machine to adjust the cutting geometry.

SPIEGELBEARBEITUNG  
MIRROR FINISH TOOL

→ ND - MCD TOOLS





Art. 29.6843 Monokristalliner Diamant/MKD-Fasensenker 45° – Hochglanz Spiegelfinish

Acryl

MESSING  
WEICH/SOFT

ACRYL  
TYP GS

KUPFER  
copper  
WEICH/SOFT

ACRYL  
TYP XT

ALU  
aluminium  
WEICH/SOFT

PLEXI-  
GLAS

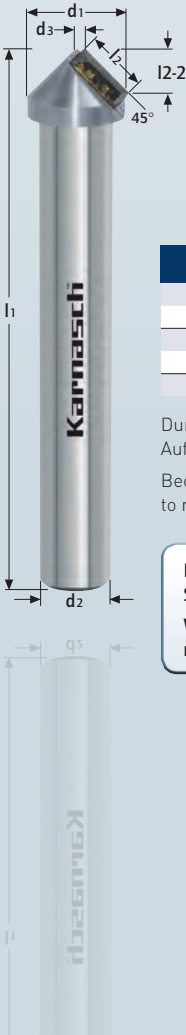
GOLD  
gold

PMMA  
GS

Silver



- Mono-crystalline Diamond/MKD countersink 45° - high gloss mirror finish. Balanced < 30.000 Rpm
- Broca monocristalina de diamante/MKD con acabado espejo de brillo intenso 45° Equilibrado < 30.000 RPM.
- Монокристалльный алмаз/MKD-фасочный зенкер 45°- зеркальная обработка высокого блеска. Отбалансировано < 30.000 об./мин.



| Art.           | Ø d1   | l2 | l2 - 2 | d2 h5 | d3  | l1 | Z | € |
|----------------|--------|----|--------|-------|-----|----|---|---|
| 296843.0800.05 | • 8,0  | 5  | 3,7    | 8     | 1,0 | 60 | 1 |   |
| 296843.0950.06 | • 9,5  | 6  | 4,3    | 10    | 1,0 | 60 | 1 |   |
| 296843.1100.07 | • 11,0 | 7  | 5,1    | 12    | 1,0 | 60 | 1 |   |
| 296843.1200.08 | • 12,0 | 8  | 5,7    | 12    | 1,0 | 60 | 1 |   |
| 296843.1350.09 | • 13,5 | 9  | 6,4    | 14    | 1,0 | 60 | 1 |   |

Durch Diamantpreisschwankungen empfehlen wir vor Auftragserteilung die aktuellen Preise anzufragen.  
Because of diamond price fluctuation, we ask you, to request the current prices, before ordering.

Bei Ihrer Bestellung bitten wir um Information, welches Material Sie bearbeiten um die Schneidengeometrie anzupassen.  
When ordering, please inform us which material you want to machine to adjust the cutting geometry.

MKD  
Mono-  
kristallin

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

0°

HSC  
High-Speed-  
Cutting

GELÄPPT  
LAPPED

45°

Schnittdaten  
Cutting data



SPIEGELBEARBEITUNG  
MIRROR FINISH TOOL

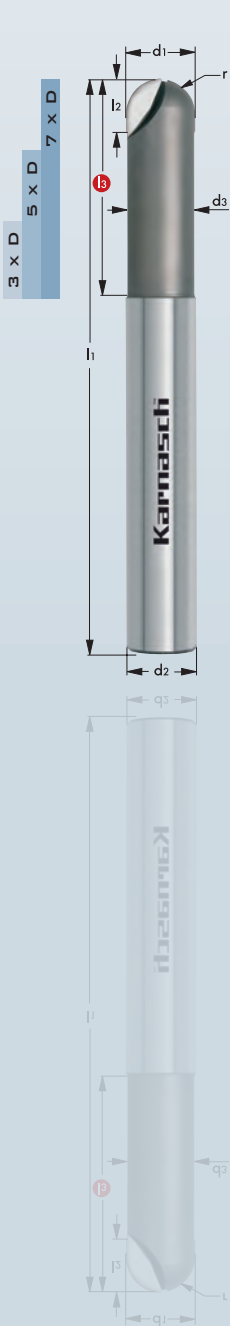
→ ND - MKD TOOLS



PKD-3D-Radiusfräser mit Kugelstirn, 3xD-5xD-7xD

Art. 30.6522

- ALU  
< 6% Si
- ALU  
> 6% Si
- MESSING  
brass
- KUPFER  
copper
- GFK-CFK  
GFK-CFK
- GRAPHIT  
graphite
- kurz-  
spanend  
short chip
- lang-  
spanend  
long chip



- PCD-3D- ball milling cutter, 3xD-5xD-7xD, HSC high-speed-cutting
- PKD-3D- fresa de radio con frente cónico, 3xD-5xD-7xD, HSC
- PKD-3D - радиусная фреза с шаровым торцом, 3xD-5xD-7xD, высокоскоростная резка HSC

| Art.           | d1 h7 | r ± 0,005 | l3 | d2 h6 | d3   | l1  | l2   | Z | €      |
|----------------|-------|-----------|----|-------|------|-----|------|---|--------|
| 306522.0300.09 | • 3   | 1,5       | 9  | 6     | 2,8  | 75  | 2,5  | 2 | 184,00 |
| 306522.0300.15 | • 3   | 1,5       | 15 | 6     | 2,8  | 75  | 2,5  | 2 | 184,00 |
| 306522.0300.21 | • 3   | 1,5       | 21 | 6     | 2,8  | 75  | 2,5  | 2 | 184,00 |
| 306522.0400.12 | • 4   | 2,0       | 12 | 6     | 3,8  | 75  | 2,5  | 2 | 187,00 |
| 306522.0400.20 | • 4   | 2,0       | 20 | 6     | 3,8  | 75  | 2,5  | 2 | 187,00 |
| 306522.0400.28 | • 4   | 2,0       | 28 | 6     | 3,8  | 75  | 2,5  | 2 | 187,00 |
| 306522.0500.15 | • 5   | 2,5       | 15 | 6     | 4,6  | 75  | 3,0  | 2 | 187,00 |
| 306522.0500.25 | • 5   | 2,5       | 25 | 6     | 4,6  | 75  | 3,0  | 2 | 187,00 |
| 306522.0500.35 | • 5   | 2,5       | 35 | 6     | 4,6  | 75  | 3,0  | 2 | 187,00 |
| 306522.0600.18 | • 6   | 3,0       | 18 | 6     | 5,9  | 100 | 6,0  | 2 | 208,00 |
| 306522.0600.30 | • 6   | 3,0       | 30 | 6     | 5,9  | 100 | 6,0  | 2 | 208,00 |
| 306522.0600.42 | • 6   | 3,0       | 42 | 6     | 5,9  | 100 | 6,0  | 2 | 208,00 |
| 306522.0600.60 | • 6   | 3,0       | 60 | 6     | 5,9  | 100 | 6,0  | 2 | 208,00 |
| 306522.0800.24 | • 8   | 4,0       | 24 | 8     | 7,8  | 100 | 8,0  | 2 | 225,00 |
| 306522.0800.40 | • 8   | 4,0       | 40 | 8     | 7,8  | 100 | 8,0  | 2 | 225,00 |
| 306522.0800.60 | • 8   | 4,0       | 60 | 8     | 7,8  | 100 | 8,0  | 2 | 225,00 |
| 306522.1000.30 | • 10  | 5,0       | 30 | 10    | 9,8  | 100 | 10,0 | 2 | 268,00 |
| 306522.1000.50 | • 10  | 5,0       | 50 | 10    | 9,8  | 100 | 10,0 | 2 | 268,00 |
| 306522.1000.60 | • 10  | 5,0       | 60 | 10    | 9,8  | 105 | 10,0 | 2 | 268,00 |
| 306522.1200.36 | • 12  | 6,0       | 36 | 12    | 11,2 | 105 | 9,0  | 2 | 281,00 |
| 306522.1200.60 | • 12  | 6,0       | 60 | 12    | 11,2 | 105 | 9,0  | 2 | 281,00 |

PKD  
EXTREME

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

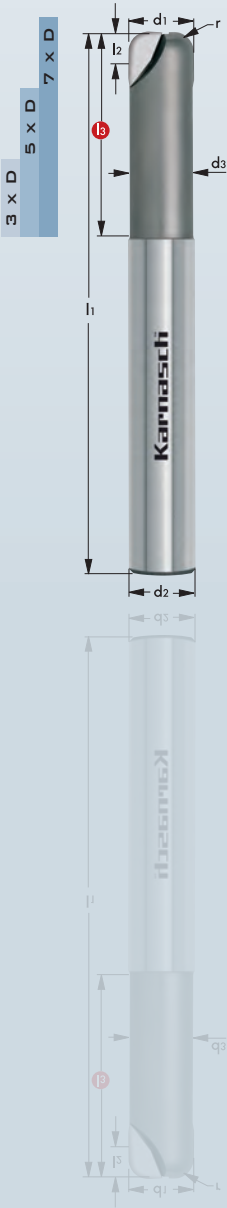
POLIERT  
POLISHED

Schnittdaten  
Cutting data



Art. 30.6523 PKD-Schaftfräser mit Eckenradius, 3xD–5xD–7xD

- ALU  
< 6% Si
- ALU  
> 6% Si
- MESSING  
brass
- KUPFER  
copper
- GFK-CFK  
GFK-CFK
- GRAPHIT  
graphite
- kurz-  
spanend  
short chip
- lang-  
spanend  
long chip



- PCD- end mill with corner radius, 3xD–5xD–7xD, HSC high-speed-cutting
- PKD fresa de mango con radio angular, 3xD-5xD-7xD, HSC
- PKD-3D - концевая фреза с угловым радиусом, 3xD-5xD-7xD, высокоскоростная резка HSC

PKD  
EXTREME

KARNASCH  
NORM

SPEZIAL

DIN 6535  
Form HA

HSC  
High-Speed-  
Cutting

POLIERT  
POLISHED

Schnittdaten  
Cutting data

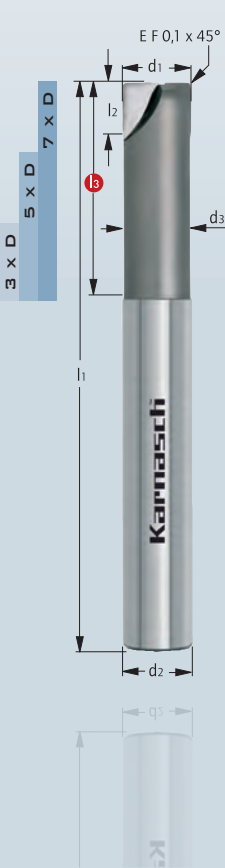


| Art.              | d1 h7 | r ± 0,005 | l3 | d2 h6 | d3   | l1  | l2   | Z | €      |
|-------------------|-------|-----------|----|-------|------|-----|------|---|--------|
| 306523.0300.03.09 | • 3   | 0,3       | 9  | 6     | 2,8  | 75  | 2,5  | 2 | 173,00 |
| 306523.0300.03.15 | • 3   | 0,3       | 15 | 6     | 2,8  | 75  | 2,5  | 2 | 173,00 |
| 306523.0300.03.21 | • 3   | 0,3       | 21 | 6     | 2,8  | 75  | 2,5  | 2 | 173,00 |
| 306523.0300.05.21 | • 3   | 0,5       | 21 | 6     | 2,8  | 75  | 2,5  | 2 | 173,00 |
| 306523.0400.03.12 | • 4   | 0,3       | 12 | 6     | 3,8  | 75  | 2,5  | 2 | 181,00 |
| 306523.0400.03.20 | • 4   | 0,3       | 20 | 6     | 3,8  | 75  | 2,5  | 2 | 181,00 |
| 306523.0400.03.28 | • 4   | 0,3       | 28 | 6     | 3,8  | 75  | 2,5  | 2 | 181,00 |
| 306523.0400.05.28 | • 4   | 0,5       | 28 | 6     | 3,8  | 75  | 2,5  | 2 | 181,00 |
| 306523.0500.03.15 | • 5   | 0,3       | 15 | 6     | 4,6  | 75  | 3,0  | 2 | 184,00 |
| 306523.0500.03.25 | • 5   | 0,3       | 25 | 6     | 4,6  | 75  | 3,0  | 2 | 184,00 |
| 306523.0500.03.35 | • 5   | 0,3       | 35 | 6     | 4,6  | 75  | 3,0  | 2 | 184,00 |
| 306523.0500.05.35 | • 5   | 0,5       | 35 | 6     | 4,6  | 75  | 3,0  | 2 | 184,00 |
| 306523.0600.03.18 | • 6   | 0,3       | 18 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.03.30 | • 6   | 0,3       | 30 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.03.42 | • 6   | 0,3       | 42 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.05.18 | • 6   | 0,5       | 18 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.05.30 | • 6   | 0,5       | 30 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.05.42 | • 6   | 0,5       | 42 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.05.60 | • 6   | 0,5       | 60 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.10.18 | • 6   | 1,0       | 18 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.10.30 | • 6   | 1,0       | 30 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0600.10.42 | • 6   | 1,0       | 42 | 6     | 5,9  | 100 | 6,0  | 2 | 219,00 |
| 306523.0800.03.24 | • 8   | 0,3       | 24 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.03.40 | • 8   | 0,3       | 40 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.05.24 | • 8   | 0,5       | 24 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.05.40 | • 8   | 0,5       | 40 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.05.60 | • 8   | 0,5       | 60 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.10.24 | • 8   | 1,0       | 24 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.10.40 | • 8   | 1,0       | 40 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.0800.10.60 | • 8   | 1,0       | 60 | 8     | 7,8  | 100 | 8,0  | 2 | 249,00 |
| 306523.1000.05.30 | • 10  | 0,5       | 30 | 10    | 9,8  | 100 | 10,0 | 2 | 262,00 |
| 306523.1000.05.50 | • 10  | 0,5       | 50 | 10    | 9,8  | 100 | 10,0 | 2 | 262,00 |
| 306523.1000.05.60 | • 10  | 0,5       | 60 | 10    | 9,8  | 105 | 10,0 | 2 | 262,00 |
| 306523.1000.10.30 | • 10  | 1,0       | 30 | 10    | 9,8  | 100 | 10,0 | 2 | 262,00 |
| 306523.1000.10.50 | • 10  | 1,0       | 50 | 10    | 9,8  | 100 | 10,0 | 2 | 262,00 |
| 306523.1000.10.60 | • 10  | 1,0       | 60 | 10    | 9,8  | 105 | 10,0 | 2 | 262,00 |
| 306523.1000.15.30 | • 10  | 1,5       | 30 | 10    | 9,8  | 100 | 10,0 | 2 | 262,00 |
| 306523.1000.15.50 | • 10  | 1,5       | 50 | 10    | 9,8  | 100 | 10,0 | 2 | 262,00 |
| 306523.1200.05.36 | • 12  | 0,5       | 36 | 12    | 11,6 | 105 | 10,0 | 2 | 292,00 |
| 306523.1200.05.60 | • 12  | 0,5       | 60 | 12    | 11,6 | 105 | 10,0 | 2 | 292,00 |
| 306523.1200.10.36 | • 12  | 1,0       | 36 | 12    | 11,6 | 105 | 10,0 | 2 | 292,00 |
| 306523.1200.10.60 | • 12  | 1,0       | 60 | 12    | 11,6 | 105 | 10,0 | 2 | 292,00 |
| 306523.1200.15.36 | • 12  | 1,5       | 36 | 12    | 11,6 | 105 | 10,0 | 2 | 292,00 |
| 306523.1200.15.60 | • 12  | 1,5       | 60 | 12    | 11,6 | 105 | 10,0 | 2 | 292,00 |

PKD-Schaftfräser, 3xD-5xD-7xD

Art. 30.6524

- ALU< 6% Si
- ALU> 6% Si
- MESSINGbrass
- KUPFERcopper
- GFK-CFKGFK-CFK
- GRAPHITgraphite
- kurz-spanendshort chip
- lang-spanendlong chip
- < 12° - 0,1
- 45°



- PCD- end mills, 3xD-5xD-7xD, HSC high-speed-cutting
- PKD fresa de mango, 3xD-5xD-7xD, HSC
- PKD-3D - концевая фреза, 3xD-5xD-7xD, высокоскоростная резка HSC

| Art.           | d1 h7 | l3 | d2 h6 | d3   | l1  | l2  | Z | €      |
|----------------|-------|----|-------|------|-----|-----|---|--------|
| 306524.0300.09 | • 3   | 9  | 6     | 2,9  | 75  | 2,5 | 2 | 176,00 |
| 306524.0300.15 | • 3   | 15 | 6     | 2,9  | 75  | 2,5 | 2 | 176,00 |
| 306524.0300.21 | • 3   | 21 | 6     | 2,9  | 75  | 2,5 | 2 | 176,00 |
| 306524.0400.12 | • 4   | 12 | 6     | 3,8  | 75  | 2,5 | 2 | 179,00 |
| 306524.0400.20 | • 4   | 20 | 6     | 3,8  | 75  | 2,5 | 2 | 179,00 |
| 306524.0400.28 | • 4   | 28 | 6     | 3,8  | 75  | 2,5 | 2 | 179,00 |
| 306524.0500.15 | • 5   | 15 | 6     | 4,8  | 75  | 3,0 | 2 | 184,00 |
| 306524.0500.25 | • 5   | 25 | 6     | 4,8  | 75  | 3,0 | 2 | 184,00 |
| 306524.0500.35 | • 5   | 35 | 6     | 4,8  | 75  | 3,0 | 2 | 184,00 |
| 306524.0600.18 | • 6   | 18 | 6     | 5,5  | 100 | 6,0 | 2 | 206,00 |
| 306524.0600.30 | • 6   | 30 | 6     | 5,5  | 100 | 6,0 | 2 | 206,00 |
| 306524.0600.42 | • 6   | 42 | 6     | 5,5  | 100 | 6,0 | 2 | 206,00 |
| 306524.0800.24 | • 8   | 24 | 8     | 7,4  | 100 | 7,0 | 2 | 252,00 |
| 306524.0800.40 | • 8   | 40 | 8     | 7,4  | 100 | 7,0 | 2 | 252,00 |
| 306524.1000.30 | • 10  | 30 | 10    | 9,6  | 100 | 8,0 | 2 | 281,00 |
| 306524.1000.50 | • 10  | 50 | 10    | 9,6  | 100 | 8,0 | 2 | 281,00 |
| 306524.1200.36 | • 12  | 36 | 12    | 11,6 | 105 | 9,0 | 2 | 295,00 |
| 306524.1200.60 | • 12  | 60 | 12    | 11,6 | 105 | 9,0 | 2 | 295,00 |

PKD EXTREMEKARNASCH NORM

SPEZIALDIN 6535 Form HA









Schnittdaten  
Cutting data

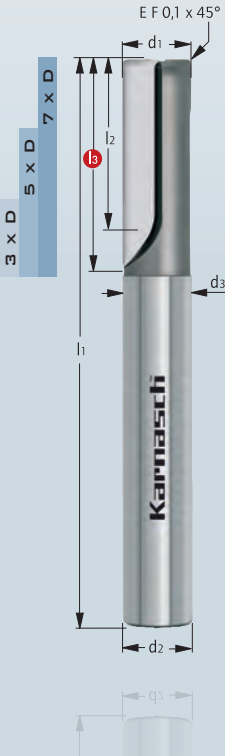


i S. 336

PKD-Schaftfräser mit 15/20 mm PKD-Schneidenlänge

Art. 30.6526

- ALU< 6% Si
- ALU> 6% Si
- MESSINGbrass
- KUPFERcopper
- GFK-CFKGFK-CFK
- GRAPHITgraphite
- kurz-spanendshort chip
- lang-spanendlong chip
- < 20° - 0,1
- 45°



- PCD- end mills, 15/20 mm PCD- cutting-length, HSC high-speed-cutting
- PKD fresa de mango con cuchillas de 15/20 mm PKD, HSC
- PKD - концевая фреза с длиной резцов PKD 15/20 мм, высокоскоростная резка HSC

| Art.           | d1 h10 | l2 | d2 h6 | l1 | l3 | Z | €      |
|----------------|--------|----|-------|----|----|---|--------|
| 306526.0600.07 | △ 6    | 7  | 6     | 55 | 8  | 2 | 300,00 |
| 306526.0600.15 | △ 6    | 15 | 6     | 54 | 18 | 2 | 340,00 |
| 306526.0600.20 | △ 6    | 20 | 6     | 54 | 23 | 2 | 390,00 |
| 306526.1000.07 | △ 10   | 7  | 10    | 65 | 8  | 2 | 339,00 |
| 306526.1200.07 | △ 12   | 7  | 12    | 72 | 8  | 2 | 373,00 |
| 306526.1200.15 | △ 12   | 15 | 12    | 73 | 18 | 2 | 410,00 |
| 306526.1200.20 | △ 12   | 20 | 12    | 73 | 23 | 2 | 463,00 |
| 306526.1600.15 | △ 16   | 15 | 16    | 82 | 18 | 2 | 439,00 |
| 306526.1600.20 | △ 16   | 20 | 16    | 82 | 23 | 2 | 540,00 |

Nachfolgewerkzeug Art. 29.6526 + 29.6525  
Be discontinued. Replacement article 29.6526 + 29.6525

PKD EXTREMEKARNASCH NORM

SPEZIALDIN 6535 Form HA









Schnittdaten  
Cutting data



i S. 336

Art. 30.6528

PKD/PCD EXTREME

Schaftfräser Typ "V" Fräser für gradfreies Fräsen an Ober- und Unterkante von faserverstärkten Kunststoffen

COMPO-SITES

PEEK CF30

GFK-CFK  
GFK-CFK

GF GF25

Aramid-faser  
AFK-SFK

PVDF GF25

Hybrid-stoffe

TITAN

CFK-ALU  
Composite

ALU  
> 6% Si

Schicht-stoffe  
Laminat

MESSING  
brass

PA66 GF30

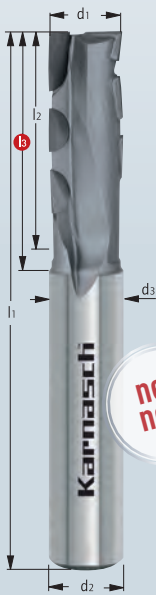
KUPFER  
copper

PVDF GF30

kurz-spanend  
short chip

PEEK GF30

lang-spanend  
long chip



PCD-EXTREME type "V" mill for burr-free milling of upper and lower edge of fibre-reinforced plastics

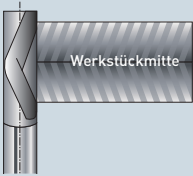


PCD-EXTREME Fresa tipo "V" de metal duro y macizo recubierta de diamante para fresar sin rebaba las aristas superior e inferior de plásticos reforzados con fibras.



PCD-EXTREME Твердосплавные фрезы типа "V" с алмазным покрытием для ровного фрезерования верхней и нижней грани армированных волокон пластмасс.

| Art.        | d1 h8 | l2 | l3 | d2 h6 | d3   | l1  | Z | €        |
|-------------|-------|----|----|-------|------|-----|---|----------|
| 306528.1000 | • 10  | 22 | 30 | 10    | 9,4  | 72  | 2 | 686,00   |
| 306528.1200 | • 12  | 26 | 36 | 12    | 11,4 | 83  | 2 | 900,00   |
| 306528.1600 | • 16  | 32 | 42 | 16    | 15,4 | 92  | 2 | 1.140,00 |
| 306528.2000 | • 20  | 38 | 52 | 20    | 19,4 | 104 | 2 | 1.296,00 |



Die gleichzeitig ziehende und schiebende Anordnung der Schneiden verhindert Delamination.

Concurrent drawing and pushing blade alignment prevents delamination.

La disposición de las cuchillas que tira y empuja simultáneamente impide la deslaminación.

Одновременное вытягивающее и сдвигающее положение режки предотвращает расслаивание.

PKD EXTREME

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

45° x 0,1

HPC

POLIERT POLISHED

Air

Schnittdaten  
Cutting data



i S. 336

Art. 30.6534

PKD-Eckenradiusfräser mit Innenkühlung, 3xD-5xD-7xD, positiv

ALU  
< 6% Si

ALU  
> 6% Si

MESSING  
brass

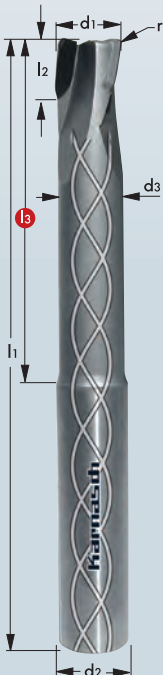
KUPFER  
copper

GFK-CFK  
GFK-CFK

GRAPHIT  
graphite

kurz-spanend  
short chip

lang-spanend  
long chip



PCD- Corner radius end mill, positiv, with interior cooling



PKD fresa de radio angular, positiva, con refrigeración interna



PKD- фреза с угловым радиусом, позитивная, с внутренним охлаждением

| Art.              | d1 h7 | r ± 0,005 | l3 | d2 | d3   | l1  | l2 | Z | €      |
|-------------------|-------|-----------|----|----|------|-----|----|---|--------|
| 306534.0600.05.18 | ▲ 6   | 0,5       | 18 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.10.18 | ▲ 6   | 1,0       | 18 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.20.18 | ▲ 6   | 2,0       | 18 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.05.30 | ▲ 6   | 0,5       | 30 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.10.30 | ▲ 6   | 1,0       | 30 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.03.42 | ▲ 6   | 0,3       | 42 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.05.42 | ▲ 6   | 0,5       | 42 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0600.10.42 | ▲ 6   | 1,0       | 42 | 6  | 5,4  | 100 | 6  | 3 | 371,00 |
| 306534.0800.03.24 | ▲ 8   | 0,3       | 24 | 8  | 7,2  | 100 | 7  | 3 | 394,00 |
| 306534.0800.05.24 | ▲ 8   | 0,5       | 24 | 8  | 7,2  | 100 | 7  | 3 | 394,00 |
| 306534.0800.10.24 | ▲ 8   | 1,0       | 24 | 8  | 7,2  | 100 | 7  | 3 | 394,00 |
| 306534.0800.20.24 | ▲ 8   | 2,0       | 24 | 8  | 7,2  | 100 | 7  | 3 | 394,00 |
| 306534.0800.03.40 | ▲ 8   | 0,3       | 40 | 8  | 7,2  | 100 | 7  | 3 | 394,00 |
| 306534.0800.05.40 | ▲ 8   | 0,5       | 40 | 8  | 7,2  | 100 | 7  | 3 | 394,00 |
| 306534.1000.10.30 | ▲ 10  | 1,0       | 30 | 10 | 9,0  | 100 | 8  | 3 | 458,00 |
| 306534.1000.10.50 | ▲ 10  | 1,0       | 50 | 10 | 9,0  | 100 | 8  | 3 | 458,00 |
| 306534.1200.05.36 | ▲ 12  | 0,5       | 36 | 12 | 11,0 | 105 | 9  | 3 | 635,00 |
| 306534.1200.20.36 | ▲ 12  | 2,0       | 36 | 12 | 11,0 | 105 | 9  | 3 | 635,00 |
| 306534.1200.05.60 | ▲ 12  | 0,5       | 60 | 12 | 11,0 | 105 | 9  | 3 | 635,00 |

PKD MICRO-GRAIN

KARNASCH NORM

SPEZIAL

DIN 6535 Form HA

15°

HSC  
High-Speed-Cutting

POLIERT POLISHED

Oil Emul. MQL

Schnittdaten  
Cutting data



i S. 336



Dia-Cut



Art. **11.1350**

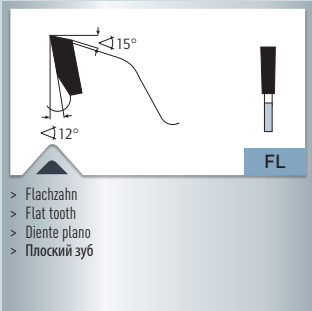
|                                 |              |
|---------------------------------|--------------|
| GFK-CFK<br><i>GFK-CFK</i>       | PA66<br>GF30 |
| THERMO-PLAST<br>THERMO-PLASTICS | PVDF<br>GF30 |
| DURO-PLASTE<br>DURO-PLASTICS    | PEEK<br>GF30 |
| Aramid-faser<br>AFK-SFK         | PEEK<br>CF30 |
| Hybrid-stoffe                   | GF<br>GF25   |
| CFK-ALU<br>Composite            | PVDF<br>GF25 |
| Schicht-stoffe<br>Laminat       | GMT          |
| Kevlar                          | SMC          |
| PLEXI-GLAS                      | Acryl        |
| AL/TI                           | PMMA<br>GS   |
| TI-CFK                          | Eternit      |

|                                           |                           |
|-------------------------------------------|---------------------------|
| PKD<br>MICRO-GRAIN                        | KARNASCH<br>NORM          |
| SPEZIAL                                   |                           |
| $\alpha = 12^\circ$<br>$\beta = 15^\circ$ |                           |
|                                           | HSC<br>High-Speed-Cutting |
|                                           | PKD                       |
|                                           | Air                       |



Maschine | Machine | máquina | Машина

- Für Handkreissägen, Kapp- und Gehrungssägen
- For hand-held circular saws and mitre saws
- Para sierras circulares manuales, sierras de corte y de inglete
- Для ручных циркулярных пил, торцовочных и усорезных пил



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| Art.        |       |         |       |       |          |   |
|-------------|-------|---------|-------|-------|----------|---|
| 11.1350-005 | • 160 | 2,2/1,6 | 20/16 | 8 FL  | 2-6-32,5 | ✓ |
| 11.1350-007 | • 160 | 2,2/1,6 | 20/16 | 30 FL | 2-6-32,5 | ✓ |
| 11.1350-010 | • 180 | 2,2/1,6 | 30/20 | 8 FL  | 2-7-42   | ✓ |
| 11.1350-015 | • 190 | 2,2/1,6 | 30/20 | 8 FL  | 2-7-42   | ✓ |
| 11.1350-017 | • 190 | 2,2/1,6 | 30/20 | 30 FL | 2-7-42   | ✓ |
| 11.1350-020 | • 210 | 2,2/1,6 | 30    | 12 FL | UNI      | ✓ |
| 11.1350-022 | • 216 | 2,2/1,6 | 30    | 12 FL | UNI      | ✓ |
| 11.1350-025 | • 230 | 2,2/1,6 | 30    | 15 FL | UNI      | ✓ |
| 11.1350-027 | • 230 | 2,2/1,6 | 30    | 30 FL | 2-7-42   | ✓ |
| 11.1350-030 | • 250 | 2,2/1,6 | 30    | 16 FL | UNI      | ✓ |
| 11.1350-033 | • 250 | 2,2/1,6 | 30    | 40 FL | UNI      | ✓ |
| 11.1350-035 | ▲ 300 | 2,2/1,6 | 30    | 30 FL | UNI      | ✓ |
| 11.1350-037 | • 300 | 2,2/1,6 | 30    | 36 FL | UNI      | ✓ |
| 11.1350-040 | • 300 | 2,2/1,6 | 30    | 48 FL | UNI      | ✓ |

UNI = 2-7-42 + 2-9-46,40 + 2-10-60



SCHNITTDATEN / TECHNISCHE INFORMATIONEN

CUTTING DATA / TECHNICAL INFORMATION

DATOS DE CORTE / DATOS TÉCNICOS

ПАРАМЕТРЫ ДЛЯ РЕЗЬБЫ/ТЕХНИЧЕСКАЯ ИНФОРМАЦИЯ СЕЙЧАС ОНЛАЙН ДЛЯ ВАС



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Art. **30.6232**

Schnittdaten für Vollhartmetall „Alu-Kunststoff-Holz“ HSC-Fräser  
Recommended cutting data for „alu-plastic-wood“ HSC solid carbide HSC end mills

| Nuten<br>Slot milling             |                       |                              |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|-----------------------|------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | HSC<br>Nuten<br>Slot milling | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                        | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                        | 1,5                   | 2,0                   | 2,5                    | 3,0                    | 4,0                    | 4,5                    | 5,0                    |
|                                   |                       | Vc m/min                     | 900                   | 900                   | 950                    | 1.000                  | 1.200                  | 1.300                  | 1.400                  |
|                                   |                       | n min <sup>-1</sup>          | 48.000                | 36.000                | 31.000                 | 27.000                 | 24.000                 | 24.000                 | 23.000                 |
|                                   |                       | fz mm                        | 0,100                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,250                  |
|                                   |                       | Vf mm/min                    | 9.550                 | 7.878                 | 7.258                  | 11.141                 | 11.459                 | 11.035                 | 13.369                 |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Nuten<br>Slot milling<br>0,5xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|--------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                          | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                          | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                       | Vc m/min                       | 600                   | 600                   | 600                    | 650                    | 680                    | 700                    | 900                    |
|                                   |                       | n min <sup>-1</sup>            | 32.000                | 24.000                | 20.000                 | 18.000                 | 14.000                 | 13.000                 | 15.000                 |
|                                   |                       | fz mm                          | 0,070                 | 0,075                 | 0,085                  | 0,090                  | 0,120                  | 0,130                  | 0,150                  |
|                                   |                       | Vf mm/min                      | 4.456                 | 3.581                 | 3.247                  | 4.655                  | 7.870                  | 4.828                  | 6.446                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Nuten<br>Slot milling<br>1,0xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|--------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                          | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                          | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | Vc m/min                       | 300                   | 300                   | 300                    | 350                    | 350                    | 360                    | 420                    |
|                                   |                       | n min <sup>-1</sup>            | 16.000                | 12.000                | 10.000                 | 10.000                 | 7.000                  | 7.000                  | 7.000                  |
|                                   |                       | fz mm                          | 0,035                 | 0,045                 | 0,055                  | 0,065                  | 0,080                  | 0,090                  | 0,120                  |
|                                   |                       | Vf mm/min                      | 1.114                 | 1.074                 | 1.050                  | 1.810                  | 1.671                  | 1.719                  | 2.406                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Nuten / Slot milling<br>Max. Schneidenlänge<br>Max. Cutting length | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|--------------------------------------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                                                              | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                                                              | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                                                           | 150                   | 160                   | 170                    | 190                    | 200                    | 220                    | 250                    |
|                                   |                       | n min <sup>-1</sup>                                                | 8.000                 | 7.000                 | 6.000                  | 6.000                  | 4.000                  | 4.000                  | 4.000                  |
|                                   |                       | fz mm                                                              | 0,020                 | 0,025                 | 0,030                  | 0,035                  | 0,040                  | 0,050                  | 0,060                  |
|                                   |                       | Vf mm/min                                                          | 318                   | 318                   | 325                    | 529                    | 477                    | 584                    | 716                    |

| Umfangfräsen<br>Side milling      |                       |                                     |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|-----------------------|-------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | HSC<br>Umfangfräsen<br>Side milling | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                               | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                       | ap mm                               | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                            | 900                   | 900                   | 950                    | 100                    | 1.200                  | 1.300                  | 1.500                  |
|                                   |                       | n min <sup>-1</sup>                 | 48.000                | 36.000                | 31.000                 | 27.000                 | 34.000                 | 23.000                 | 24.000                 |
|                                   |                       | fz mm                               | 0,120                 | 0,130                 | 0,150                  | 0,160                  | 0,180                  | 0,200                  | 0,220                  |
|                                   |                       | Vf mm/min                           | 11.459                | 9.311                 | 9.072                  | 12.733                 | 12.892                 | 13.794                 | 15.757                 |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Umfangfräsen<br>Side milling<br>0,1xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|---------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                                 | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                       | ap mm                                 | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                              | 600                   | 600                   | 600                    | 700                    | 720                    | 750                    | 950                    |
|                                   |                       | n min <sup>-1</sup>                   | 32.000                | 24.000                | 2.000                  | 19.000                 | 15.000                 | 14.000                 | 16.000                 |
|                                   |                       | fz mm                                 | 0,075                 | 0,090                 | 0,100                  | 0,110                  | 0,135                  | 0,145                  | 0,180                  |
|                                   |                       | Vf mm/min                             | 4.775                 | 4.297                 | 3.820                  | 6.128                  | 5.801                  | 5.770                  | 8.165                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Umfangfräsen<br>Side milling<br>0,5xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|---------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                                 | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                       | ap mm                                 | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                              | 300                   | 300                   | 350                    | 350                    | 380                    | 400                    | 450                    |
|                                   |                       | n min <sup>-1</sup>                   | 16.000                | 12.000                | 12.000                 | 1.000                  | 8.000                  | 8.000                  | 8.000                  |
|                                   |                       | fz mm                                 | 0,040                 | 0,045                 | 0,060                  | 0,070                  | 0,100                  | 0,110                  | 0,150                  |
|                                   |                       | Vf mm/min                             | 1.273                 | 1.074                 | 1.337                  | 1.950                  | 2.268                  | 2.334                  | 3.223                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Umfangfräsen<br>Side milling<br>Max. Schneidenlänge<br>Max. Cutting length | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|----------------------------------------------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                                                                      | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                       | ap mm                                                                      | 16,0                  | 22,0                  | 25,0                   | 28,0                   | 36,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                                                                   | 200                   | 220                   | 230                    | 240                    | 250                    | 275                    | 300                    |
|                                   |                       | n min <sup>-1</sup>                                                        | 11.000                | 9.000                 | 8.000                  | 7.000                  | 5.000                  | 5.000                  | 5.000                  |
|                                   |                       | fz mm                                                                      | 0,030                 | 0,035                 | 0,040                  | 0,045                  | 0,050                  | 0,060                  | 0,080                  |
|                                   |                       | Vf mm/min                                                                  | 637                   | 613                   | 586                    | 859                    | 746                    | 875                    | 1.146                  |



Schnittdaten für Vollhartmetall „Alu–Kunststoff–Holz“ HSC–Fräser  
Recommended cutting data for „alu–plastic–wood“ HSC solid carbide HSC end mills

Art. 30.6232

| Nuten<br>Slot milling             |                                          |                              |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|------------------------------------------|------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | HSC<br>Nuten<br>Slot milling | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                        | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                        | 1,5                   | 2,0                   | 2,5                    | 3,0                    | 4,0                    | 4,5                    | 5,0                    |
|                                   |                                          | Vc m/min                     | 600                   | 630                   | 660                    | 660                    | 700                    | 700                    | 750                    |
|                                   |                                          | n min <sup>-1</sup>          | 32.000                | 26.000                | 22.000                 | 18.000                 | 14.000                 | 13.000                 | 12.000                 |
|                                   |                                          | fz mm                        | 0,100                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,250                  |
|                                   |                                          | Vf mm/min                    | 6.366                 | 6.016                 | 6.303                  | 9.454                  | 8.356                  | 8.170                  | 8.953                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Nuten<br>Slot milling<br>0,5xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|------------------------------------------|--------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                          | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                          | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                          | Vc m/min                       | 450                   | 460                   | 470                    | 790                    | 520                    | 520                    | 550                    |
|                                   |                                          | n min <sup>-1</sup>            | 24.000                | 19.000                | 15.000                 | 13.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                          | fz mm                          | 0,060                 | 0,070                 | 0,080                  | 0,100                  | 0,120                  | 0,120                  | 0,160                  |
|                                   |                                          | Vf mm/min                      | 2.865                 | 2.562                 | 2.394                  | 3.899                  | 3.724                  | 3.311                  | 4.202                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Nuten<br>Slot milling<br>1,0xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|------------------------------------------|--------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                          | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                          | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | Vc m/min                       | 300                   | 310                   | 320                    | 340                    | 360                    | 360                    | 400                    |
|                                   |                                          | n min <sup>-1</sup>            | 16.000                | 13.000                | 11.000                 | 10.000                 | 8.000                  | 7.000                  | 7.000                  |
|                                   |                                          | fz mm                          | 0,036                 | 0,045                 | 0,055                  | 0,080                  | 0,100                  | 0,120                  | 0,150                  |
|                                   |                                          | Vf mm/min                      | 1.146                 | 1.110                 | 1.120                  | 2.165                  | 2.149                  | 2.292                  | 2.865                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Nuten / Slot milling<br>Max. Schneidenlänge<br>Max. Cutting length | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|------------------------------------------|--------------------------------------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                              | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                                                              | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                                                           | 150                   | 160                   | 170                    | 190                    | 200                    | 220                    | 250                    |
|                                   |                                          | n min <sup>-1</sup>                                                | 8.000                 | 7.000                 | 6.000                  | 6.000                  | 4.000                  | 4.000                  | 4.000                  |
|                                   |                                          | fz mm                                                              | 0,020                 | 0,025                 | 0,030                  | 0,035                  | 0,040                  | 0,050                  | 0,060                  |
|                                   |                                          | Vf mm/min                                                          | 318                   | 318                   | 325                    | 529                    | 477                    | 584                    | 716                    |

| Umfangfräsen<br>Side milling      |                                          |                                     |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|------------------------------------------|-------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | HSC<br>Umfangfräsen<br>Side milling | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                               | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                                          | ap mm                               | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                            | 800                   | 820                   | 850                    | 850                    | 900                    | 900                    | 1.000                  |
|                                   |                                          | n min <sup>-1</sup>                 | 43.000                | 33.000                | 28.000                 | 23.000                 | 18.000                 | 16.000                 | 16.000                 |
|                                   |                                          | fz mm                               | 0,120                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,280                  |
|                                   |                                          | Vf mm/min                           | 10.186                | 7.831                 | 8.117                  | 12.176                 | 10.743                 | 10.505                 | 13.369                 |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Umfangfräsen<br>Side milling<br>0,1xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|------------------------------------------|---------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                 | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                                          | ap mm                                 | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                              | 450                   | 460                   | 470                    | 490                    | 520                    | 520                    | 550                    |
|                                   |                                          | n min <sup>-1</sup>                   | 24.000                | 19.000                | 15.000                 | 13.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                          | fz mm                                 | 0,120                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,280                  |
|                                   |                                          | Vf mm/min                             | 5.730                 | 4.393                 | 4.488                  | 7.019                  | 6.207                  | 6.069                  | 7.353                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Umfangfräsen<br>Side milling<br>0,5xØ | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|------------------------------------------|---------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                 | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                          | ap mm                                 | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                              | 310                   | 320                   | 330                    | 350                    | 370                    | 370                    | 410                    |
|                                   |                                          | n min <sup>-1</sup>                   | 17.000                | 13.000                | 11.000                 | 10.000                 | 8.000                  | 7.000                  | 7.000                  |
|                                   |                                          | fz mm                                 | 0,040                 | 0,050                 | 0,060                  | 0,085                  | 0,110                  | 0,130                  | 0,165                  |
|                                   |                                          | Vf mm/min                             | 1.316                 | 1.273                 | 1.261                  | 2.367                  | 2.429                  | 2.552                  | 3.230                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Umfangfräsen<br>Side milling<br>Max. Schneidenlänge<br>Max. Cutting length | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|------------------------------------------|----------------------------------------------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.1<br>Termoplaste                | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                          | ap mm                                                                      | 16,0                  | 22,0                  | 25,0                   | 28,0                   | 36,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                                                                   | 170                   | 190                   | 215                    | 230                    | 240                    | 265                    | 280                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 10.000                | 8.000                 | 7.000                  | 7.000                  | 5.000                  | 5.000                  | 5.000                  |
|                                   |                                          | fz mm                                                                      | 0,030                 | 0,035                 | 0,040                  | 0,045                  | 0,050                  | 0,060                  | 0,080                  |
|                                   |                                          | Vf mm/min                                                                  | 541                   | 529                   | 548                    | 824                    | 716                    | 844                    | 1.070                  |

Art. 30.6232

Schnittdaten für Vollhartmetall „Alu-Kunststoff-Holz“ HSC-Fräser  
Recommended cutting data for „alu-plastic-wood“ HSC solid carbide HSC end mills

| Nuten<br>Slot milling             |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|--------------------------------------------|----------------------------------------------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | HSC<br>Nuten<br>Slot milling                                               | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                                                                      | 1,5                   | 2,0                   | 2,5                    | 3,0                    | 4,0                    | 4,5                    | 5,0                    |
|                                   |                                            | Vc m/min                                                                   | 650                   | 675                   | 700                    | 750                    | 800                    | 900                    | 1.000                  |
|                                   |                                            | n min <sup>-1</sup>                                                        | 35.000                | 27.000                | 23.000                 | 20.000                 | 16.000                 | 16.000                 | 16.000                 |
|                                   |                                            | fz mm                                                                      | 0,100                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,250                  |
|                                   |                                            | Vf mm/min                                                                  | 6.897                 | 6.446                 | 6.685                  | 10.743                 | 9.950                  | 10.505                 | 11.937                 |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Nuten<br>Slot milling<br>0,5xØ                                             | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                                                                      | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                            | Vc m/min                                                                   | 450                   | 460                   | 470                    | 490                    | 520                    | 520                    | 550                    |
|                                   |                                            | n min <sup>-1</sup>                                                        | 24.000                | 19.000                | 15.000                 | 13.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                            | fz mm                                                                      | 0,100                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,250                  |
|                                   |                                            | Vf mm/min                                                                  | 4.775                 | 4.393                 | 4.488                  | 7.019                  | 6.207                  | 6.069                  | 6.565                  |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Nuten<br>Slot milling<br>1,0xØ                                             | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                                                                      | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                            | Vc m/min                                                                   | 400                   | 400                   | 420                    | 420                    | 420                    | 450                    | 500                    |
|                                   |                                            | n min <sup>-1</sup>                                                        | 22.000                | 16.000                | 14.000                 | 12.000                 | 9.000                  | 8.000                  | 8.000                  |
|                                   |                                            | fz mm                                                                      | 0,050                 | 0,065                 | 0,090                  | 0,120                  | 0,150                  | 0,150                  | 0,200                  |
|                                   |                                            | Vf mm/min                                                                  | 2.122                 | 2.069                 | 2.406                  | 4.011                  | 3.760                  | 3.581                  | 4.775                  |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Nuten / Slot milling<br>Max. Schneidenlänge<br>Max. Cutting length         | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                                                                      | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                            | Vc m/min                                                                   | 170                   | 190                   | 215                    | 230                    | 240                    | 265                    | 280                    |
|                                   |                                            | n min <sup>-1</sup>                                                        | 10.000                | 8.000                 | 7.000                  | 7.000                  | 5.000                  | 5.000                  | 5.000                  |
|                                   |                                            | fz mm                                                                      | 0,030                 | 0,035                 | 0,040                  | 0,045                  | 0,050                  | 0,060                  | 0,080                  |
|                                   |                                            | Vf mm/min                                                                  | 541                   | 529                   | 548                    | 824                    | 716                    | 844                    | 1.070                  |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Umfangfräsen<br>Side milling      |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | HSC<br>Umfangfräsen<br>Side milling                                        | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                                            | ap mm                                                                      | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 62,0                   | 36,0                   | 40,0                   |
|                                   |                                            | Vc m/min                                                                   | 650                   | 675                   | 700                    | 750                    | 800                    | 900                    | 1.000                  |
|                                   |                                            | n min <sup>-1</sup>                                                        | 35.000                | 27.000                | 23.000                 | 20.000                 | 16.000                 | 16.000                 | 16.000                 |
|                                   |                                            | fz mm                                                                      | 0,120                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,280                  |
|                                   |                                            | Vf mm/min                                                                  | 8.276                 | 6.446                 | 6.685                  | 10.743                 | 9.950                  | 10.505                 | 13.369                 |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Umfangfräsen<br>Side milling<br>0,1xØ                                      | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                                            | ap mm                                                                      | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 62,0                   | 36,0                   | 40,0                   |
|                                   |                                            | Vc m/min                                                                   | 450                   | 470                   | 510                    | 540                    | 570                    | 600                    | 630                    |
|                                   |                                            | n min <sup>-1</sup>                                                        | 24.000                | 19.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 11.000                 |
|                                   |                                            | fz mm                                                                      | 0,120                 | 0,120                 | 0,150                  | 0,180                  | 0,200                  | 0,220                  | 0,280                  |
|                                   |                                            | Vf mm/min                                                                  | 5.730                 | 4.488                 | 4.870                  | 7.735                  | 6.804                  | 7.003                  | 8.423                  |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Umfangfräsen<br>Side milling<br>0,5xØ                                      | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                            | ap mm                                                                      | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 32,0                   | 40,0                   |
|                                   |                                            | Vc m/min                                                                   | 200                   | 225                   | 250                    | 265                    | 290                    | 310                    | 335                    |
|                                   |                                            | n min <sup>-1</sup>                                                        | 11.000                | 9.000                 | 8.000                  | 8.000                  | 6.000                  | 6.000                  | 6.000                  |
|                                   |                                            | fz mm                                                                      | 0,060                 | 0,070                 | 0,080                  | 0,100                  | 0,120                  | 0,120                  | 0,160                  |
|                                   |                                            | Vf mm/min                                                                  | 1.273                 | 1.253                 | 1.273                  | 2.109                  | 2.077                  | 1.974                  | 2.559                  |
|                                   |                                            |                                                                            |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Umfangfräsen<br>Side milling<br>Max. Schneidenlänge<br>Max. Cutting length | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfen | ae mm                                                                      | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                            | ap mm                                                                      | 16,0                  | 22,0                  | 25,0                   | 28,0                   | 36,0                   | 36,0                   | 41,0                   |
|                                   |                                            | Vc m/min                                                                   | 200                   | 220                   | 230                    | 250                    | 270                    | 300                    | 320                    |
|                                   |                                            | n min <sup>-1</sup>                                                        | 11.000                | 9.000                 | 8.000                  | 7.000                  | 6.000                  | 6.000                  | 6.000                  |
|                                   |                                            | fz mm                                                                      | 0,050                 | 0,065                 | 0,080                  | 0,100                  | 0,120                  | 0,120                  | 1,150                  |
|                                   |                                            | Vf mm/min                                                                  | 1.061                 | 1.138                 | 1.171                  | 1.989                  | 1.934                  | 1.910                  | 2.292                  |

Schnittdaten für Vollhartmetall „Alu-Kunststoff-Holz“ HSC-Fräser  
Recommended cutting data for „alu-plastic-wood“ HSC solid carbide HSC end mills

Art. 30.6233 Art. 30.6234

| Nuten<br>Slot milling             |                       |                              |                       |                       |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|-----------------------|------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | HSC<br>Nuten<br>Slot milling | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                        | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                        | 1,0                   | 1,2                   | 1,5                   | 2,0                   | 2,5                    | 3,0                    | 4,0                    | 4,5                    | 5,0                    |
|                                   |                       | Vc m/min                     | 800                   | 850                   | 880                   | 900                   | 900                    | 950                    | 950                    | 950                    | 1.000                  |
|                                   |                       | n min <sup>-1</sup>          | 64.000                | 55.000                | 47.000                | 36.000                | 29.000                 | 26.000                 | 19.000                 | 17.000                 | 16.000                 |
|                                   |                       | fz mm                        | 0,048                 | 0,060                 | 0,072                 | 0,084                 | 0,100                  | 0,072                  | 0,084                  | 0,090                  | 0,100                  |
|                                   |                       | Vf mm/min                    | 6.112                 | 6.494                 | 6.723                 | 6.016                 | 5.730                  | 5.443                  | 4.763                  | 4.536                  | 4.775                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Nuten<br>Slot milling<br>0,5xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                          | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                          | 2,0                   | 2,5                   | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                       | Vc m/min                       | 450                   | 460                   | 480                   | 500                   | 500                    | 500                    | 500                    | 500                    | 500                    |
|                                   |                       | n min <sup>-1</sup>            | 36.000                | 30.000                | 26.000                | 20.000                | 16.000                 | 14.000                 | 10.000                 | 9.000                  | 8.000                  |
|                                   |                       | fz mm                          | 0,030                 | 0,035                 | 0,045                 | 0,060                 | 0,072                  | 0,060                  | 0,072                  | 0,080                  | 0,090                  |
|                                   |                       | Vf mm/min                      | 2.149                 | 2.050                 | 2.292                 | 2.387                 | 2.292                  | 2.387                  | 2.149                  | 2.122                  | 2.149                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Nuten<br>Slot milling<br>1,0xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                          | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | ap mm                          | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                       | Vc m/min                       | 300                   | 310                   | 330                   | 350                   | 370                    | 400                    | 400                    | 400                    | 400                    |
|                                   |                       | n min <sup>-1</sup>            | 24.000                | 20.000                | 18.000                | 14.000                | 12.000                 | 11.000                 | 8.000                  | 8.000                  | 7.000                  |
|                                   |                       | fz mm                          | 0,025                 | 0,030                 | 0,035                 | 0,042                 | 0,048                  | 0,040                  | 0,050                  | 0,055                  | 0,060                  |
|                                   |                       | Vf mm/min                      | 1.194                 | 1.184                 | 1.226                 | 1.170                 | 1.131                  | 1.273                  | 1.194                  | 1.167                  | 1.146                  |

Umfangfräsen  
Side milling

| Werkstoffgruppe<br>Material group | HSC<br>Umfangfräsen<br>Side milling | HSC<br>Walzen       | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-------------------------------------|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5                   | ae mm               | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                     | ap mm               | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                     | Vc m/min            | 850                   | 880                   | 900                   | 900                   | 950                    | 1.000                  | 1.050                  | 1.100                  | 1.200                  |
|                                   |                                     | n min <sup>-1</sup> | 68.000                | 57.000                | 48.000                | 36.000                | 31.000                 | 27.000                 | 21.000                 | 20.000                 | 20.000                 |
|                                   |                                     | fz mm               | 0,076                 | 0,095                 | 0,120                 | 0,150                 | 0,070                  | 0,139                  | 0,156                  | 0,173                  | 0,200                  |
|                                   |                                     | Vf mm/min           | 10.282                | 10.645                | 11.459                | 10.743                | 10.282                 | 11.062                 | 9.776                  | 10.096                 | 11.459                 |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Umfangfräsen<br>Side milling<br>0,3xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|---------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                                 | 1,2                   | 1,5                   | 1,8                   | 2,4                   | 3,0                    | 3,6                    | 4,8                    | 5,4                    | 6,0                    |
|                                   |                       | ap mm                                 | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                              | 500                   | 520                   | 550                   | 600                   | 600                    | 650                    | 650                    | 650                    | 650                    |
|                                   |                       | n min <sup>-1</sup>                   | 40.000                | 34.000                | 30.000                | 24.000                | 20.000                 | 18.000                 | 13.000                 | 12.000                 | 11.000                 |
|                                   |                       | fz mm                                 | 0,044                 | 0,055                 | 0,066                 | 0,072                 | 0,090                  | 0,080                  | 0,090                  | 0,100                  | 0,120                  |
|                                   |                       | Vf mm/min                             | 3.502                 | 3.642                 | 3.852                 | 3.438                 | 3.438                  | 4.138                  | 3.492                  | 3.448                  | 3.724                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Umfangfräsen<br>Side milling<br>0,5xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|-----------------------|---------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 4.1/4.3<br>Aluminium<br><6% Si    | AL 99,9<br>Mg 0,5     | ae mm                                 | 2,0                   | 42,5                  | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                       | ap mm                                 | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                       | Vc m/min                              | 320                   | 330                   | 350                   | 400                   | 400                    | 420                    | 450                    | 450                    | 450                    |
|                                   |                       | n min <sup>-1</sup>                   | 26.000                | 22.000                | 19.000                | 16.000                | 13.000                 | 12.000                 | 9.000                  | 8.000                  | 8.000                  |
|                                   |                       | fz mm                                 | 0,028                 | 0,032                 | 0,040                 | 0,046                 | 0,050                  | 0,040                  | 0,050                  | 0,060                  | 0,070                  |
|                                   |                       | Vf mm/min                             | 1.426                 | 1.345                 | 1.485                 | 1.464                 | 1.273                  | 1.337                  | 1.343                  | 1.432                  | 1.504                  |

| Nuten<br>Slot milling             |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|------------------------------------------|----------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | HSC<br>Nuten<br>Slot milling                                               | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                                                                      | 1,0                   | 1,2                   | 1,5                   | 2,0                   | 2,5                    | 3,0                    | 4,0                    | 4,5                    | 5,0                    |
|                                   |                                          | Vc m/min                                                                   | 450                   | 470                   | 785                   | 500                   | 520                    | 540                    | 570                    | 570                    | 590                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                          | fz mm                                                                      | 0,070                 | 0,084                 | 0,116                 | 0,140                 | 0,160                  | 0,180                  | 0,200                  | 0,200                  | 0,250                  |
|                                   |                                          | Vf mm/min                                                                  | 5.014                 | 5.027                 | 5.970                 | 5.571                 | 5.297                  | 7.735                  | 6.804                  | 6.048                  | 7.043                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Nuten<br>Slot milling<br>0,5xØ                                             | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                                                                      | 2,0                   | 2,5                   | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                          | Vc m/min                                                                   | 450                   | 470                   | 485                   | 500                   | 520                    | 540                    | 570                    | 570                    | 590                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 36.000                | 30.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                          | fz mm                                                                      | 0,050                 | 0,059                 | 0,082                 | 0,100                 | 0,118                  | 0,140                  | 0,160                  | 0,160                  | 0,200                  |
|                                   |                                          | Vf mm/min                                                                  | 3.581                 | 3.531                 | 4.220                 | 3.979                 | 3.906                  | 6.016                  | 5.443                  | 4.838                  | 5.634                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Nuten<br>Slot milling<br>1,0xØ                                             | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                                                                      | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | Vc m/min                                                                   | 450                   | 470                   | 785                   | 500                   | 520                    | 540                    | 540                    | 550                    | 550                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 36.000                | 30.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                          | fz mm                                                                      | 0,035                 | 0,042                 | 0,058                 | 0,070                 | 0,084                  | 0,100                  | 0,130                  | 0,140                  | 0,160                  |
|                                   |                                          | Vf mm/min                                                                  | 2.507                 | 2.513                 | 2.985                 | 2.785                 | 2.781                  | 4.297                  | 4.190                  | 4.085                  | 4.202                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Nuten / Slot milling<br>Max. Schneidenlänge<br>Max. Cutting length         | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                          | ap mm                                                                      | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                                                                   | 200                   | 200                   | 210                   | 230                   | 250                    | 265                    | 290                    | 310                    | 335                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 16.000                | 13.000                | 12.000                | 10.000                | 8.000                  | 8.000                  | 6.000                  | 6.000                  | 6.000                  |
|                                   |                                          | fz mm                                                                      | 0,025                 | 0,030                 | 0,038                 | 0,046                 | 0,052                  | 0,045                  | 0,055                  | 0,060                  | 0,070                  |
|                                   |                                          | Vf mm/min                                                                  | 796                   | 764                   | 847                   | 842                   | 828                    | 949                    | 952                    | 987                    | 1.120                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Umfangfräsen<br>Side milling      |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | HSC<br>Umfangfräsen<br>Side milling                                        | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 0,4                   | 0,5                   | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                                          | ap mm                                                                      | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                                                                   | 465                   | 475                   | 490                   | 500                   | 530                    | 560                    | 600                    | 600                    | 620                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                          | fz mm                                                                      | 0,110                 | 0,132                 | 0,180                 | 0,210                 | 0,240                  | 0,180                  | 0,240                  | 0,250                  | 0,300                  |
|                                   |                                          | Vf mm/min                                                                  | 8.141                 | 7.983                 | 9.359                 | 8.356                 | 8.089                  | 8.022                  | 8.595                  | 7.958                  | 8.881                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Umfangfräsen<br>Side milling<br>0,3xØ                                      | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 1,2                   | 1,5                   | 1,8                   | 2,4                   | 3,0                    | 3,6                    | 4,8                    | 5,4                    | 6,0                    |
|                                   |                                          | ap mm                                                                      | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                          | Vc m/min                                                                   | 465                   | 475                   | 490                   | 500                   | 530                    | 560                    | 600                    | 600                    | 620                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                          | fz mm                                                                      | 0,070                 | 0,084                 | 0,116                 | 0,140                 | 0,160                  | 0,180                  | 0,200                  | 0,200                  | 0,250                  |
|                                   |                                          | Vf mm/min                                                                  | 5.181                 | 5.080                 | 6.031                 | 5.571                 | 5.399                  | 8.022                  | 7.162                  | 6.366                  | 7.401                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Umfangfräsen<br>Side milling<br>0,5xØ                                      | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 2,0                   | 2,5                   | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                          | ap mm                                                                      | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 32,0                   | 40,0                   |
|                                   |                                          | Vc m/min                                                                   | 465                   | 475                   | 490                   | 500                   | 530                    | 540                    | 550                    | 550                    | 560                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                          | fz mm                                                                      | 0,050                 | 0,066                 | 0,088                 | 0,110                 | 0,130                  | 0,120                  | 0,160                  | 0,160                  | 0,200                  |
|                                   |                                          | Vf mm/min                                                                  | 3.700                 | 3.992                 | 4.575                 | 4.377                 | 4.386                  | 5.157                  | 5.252                  | 4.669                  | 5.348                  |
|                                   |                                          |                                                                            |                       |                       |                       |                       |                        |                        |                        |                        |                        |
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                    | Umfangfräsen<br>Side milling<br>Max. Schneidenlänge<br>Max. Cutting length | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.1<br>Thermoplaste               | ABS/ EP/<br>PA/ PC/<br>PMMA/<br>Polyamid | ae mm                                                                      | 2,0                   | 2,5                   | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                          | ap mm                                                                      | 11,0                  | 13,0                  | 16,0                  | 22,0                  | 25,0                   | 28,0                   | 36,0                   | 36,0                   | 41,0                   |
|                                   |                                          | Vc m/min                                                                   | 300                   | 310                   | 330                   | 350                   | 370                    | 400                    | 400                    | 420                    | 450                    |
|                                   |                                          | n min <sup>-1</sup>                                                        | 24.000                | 20.000                | 18.000                | 14.000                | 12.000                 | 11.000                 | 8.000                  | 8.000                  | 8.000                  |
|                                   |                                          | fz mm                                                                      | 0,040                 | 0,048                 | 0,056                 | 0,062                 | 0,070                  | 0,063                  | 0,072                  | 0,075                  | 0,088                  |
|                                   |                                          | Vf mm/min                                                                  | 1.910                 | 1.895                 | 1.961                 | 1.727                 | 1.649                  | 2.005                  | 1.719                  | 1.671                  | 7.162                  |



Schnittdaten für Vollhartmetall „Alu–Kunststoff–Holz“ HSC-Fräser  
Recommended cutting data for „alu–plastic–wood“ HSC solid carbide HSC end mills

Art. 30.6233 Art. 30.6234

| Nuten<br>Slot milling             |                                            |                              |                       |                       |                       |                       |                        |                        |                        |                        |                        |
|-----------------------------------|--------------------------------------------|------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | HSC<br>Nuten<br>Slot milling | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfon | ae mm                        | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                        | 1,0                   | 1,2                   | 1,5                   | 2,0                   | 2,5                    | 3,0                    | 4,0                    | 4,5                    | 5,0                    |
|                                   |                                            | Vc m/min                     | 450                   | 470                   | 785                   | 500                   | 520                    | 540                    | 570                    | 570                    | 590                    |
|                                   |                                            | n min <sup>-1</sup>          | 36.000                | 30.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                            | fz mm                        | 0,064                 | 0,080                 | 0,096                 | 0,116                 | 0,125                  | 0,140                  | 0,160                  | 0,180                  | 0,200                  |
|                                   |                                            | Vf mm/min                    | 4.584                 | 4.788                 | 4.940                 | 4.616                 | 4.138                  | 6.016                  | 5.443                  | 5.443                  | 5.634                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Nuten<br>Slot milling<br>0,5xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|--------------------------------------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfon | ae mm                          | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                          | 2,0                   | 2,5                   | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                            | Vc m/min                       | 450                   | 470                   | 485                   | 500                   | 520                    | 540                    | 570                    | 570                    | 590                    |
|                                   |                                            | n min <sup>-1</sup>            | 36.000                | 30.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                            | fz mm                          | 0,045                 | 0,056                 | 0,068                 | 0,084                 | 0,106                  | 0,120                  | 0,140                  | 0,145                  | 0,160                  |
|                                   |                                            | Vf mm/min                      | 3.223                 | 3.351                 | 3.499                 | 3.342                 | 3.509                  | 5.157                  | 4.763                  | 4.385                  | 4.507                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Nuten<br>Slot milling<br>1,0xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|--------------------------------------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfon | ae mm                          | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | ap mm                          | 4,0                   | 5,0                   | 6,0                   | 8,0                   | 10,0                   | 12,0                   | 16,0                   | 18,0                   | 20,0                   |
|                                   |                                            | Vc m/min                       | 450                   | 470                   | 485                   | 500                   | 520                    | 540                    | 540                    | 550                    | 550                    |
|                                   |                                            | n min <sup>-1</sup>            | 36.000                | 30.000                | 26.000                | 20.000                | 14.000                 | 15.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                            | fz mm                          | 0,032                 | 0,040                 | 0,048                 | 0,060                 | 0,075                  | 0,085                  | 0,072                  | 0,084                  | 0,096                  |
|                                   |                                            | Vf mm/min                      | 2.292                 | 2.394                 | 2.470                 | 2.387                 | 2.483                  | 3.653                  | 2.321                  | 1.451                  | 2.521                  |

Umfangfräsen  
Side milling

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | HSC<br>Umfangfräsen<br>Side milling | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|--------------------------------------------|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfon | ae mm                               | 0,4                   | 0,5                   | 0,6                   | 0,8                   | 1,0                    | 1,2                    | 1,6                    | 1,8                    | 2,0                    |
|                                   |                                            | ap mm                               | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 36,0                   | 40,0                   |
|                                   |                                            | Vc m/min                            | 465                   | 475                   | 490                   | 500                   | 530                    | 560                    | 600                    | 600                    | 620                    |
|                                   |                                            | n min <sup>-1</sup>                 | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                            | fz mm                               | 0,095                 | 0,110                 | 0,132                 | 0,168                 | 0,210                  | 0,180                  | 0,210                  | 0,225                  | 0,250                  |
|                                   |                                            | Vf mm/min                           | 7.031                 | 6.653                 | 6.863                 | 6.685                 | 7.086                  | 8.022                  | 7.520                  | 7.162                  | 7.401                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Umfangfräsen<br>Side milling<br>0,3xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|--------------------------------------------|---------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfon | ae mm                                 | 1,2                   | 1,5                   | 1,8                   | 2,4                   | 3,0                    | 3,6                    | 4,8                    | 5,4                    | 6,0                    |
|                                   |                                            | ap mm                                 | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 32,0                   | 40,0                   |
|                                   |                                            | Vc m/min                              | 465                   | 475                   | 490                   | 500                   | 530                    | 540                    | 550                    | 550                    | 560                    |
|                                   |                                            | n min <sup>-1</sup>                   | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 12.000                 | 11.000                 | 10.000                 |
|                                   |                                            | fz mm                                 | 0,065                 | 0,078                 | 0,088                 | 0,100                 | 0,120                  | 0,132                  | 0,156                  | 0,182                  | 0,208                  |
|                                   |                                            | Vf mm/min                             | 4.811                 | 4.717                 | 4.575                 | 3.979                 | 4.049                  | 5.883                  | 5.587                  | 5.793                  | 6.158                  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Umfangfräsen<br>Side milling<br>0,5xØ | Ø4,0<br>l3 = 20<br>Z2 | Ø5,0<br>l3 = 20<br>Z2 | Ø6,0<br>l3 = 21<br>Z2 | Ø8,0<br>l3 = 27<br>Z2 | Ø10,0<br>l3 = 32<br>Z2 | Ø12,0<br>l3 = 38<br>Z3 | Ø16,0<br>l3 = 44<br>Z3 | Ø18,0<br>l3 = 44<br>Z3 | Ø20,0<br>l3 = 54<br>Z3 |
|-----------------------------------|--------------------------------------------|---------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 8.2<br>Duroplaste/<br>Preßstoffe  | MF/<br>Pertinax/<br>Resopal/<br>Polysulfon | ae mm                                 | 2,0                   | 2,5                   | 3,0                   | 4,0                   | 5,0                    | 6,0                    | 8,0                    | 9,0                    | 10,0                   |
|                                   |                                            | ap mm                                 | 8,0                   | 10,0                  | 12,0                  | 16,0                  | 20,0                   | 24,0                   | 32,0                   | 32,0                   | 40,0                   |
|                                   |                                            | Vc m/min                              | 465                   | 475                   | 490                   | 500                   | 530                    | 540                    | 550                    | 550                    | 560                    |
|                                   |                                            | n min <sup>-1</sup>                   | 38.000                | 31.000                | 26.000                | 20.000                | 17.000                 | 15.000                 | 11.000                 | 10.000                 | 9.000                  |
|                                   |                                            | fz mm                                 | 0,048                 | 0,061                 | 0,068                 | 0,077                 | 0,093                  | 0,105                  | 0,120                  | 0,140                  | 0,160                  |
|                                   |                                            | Vf mm/min                             | 3.552                 | 3.689                 | 3.535                 | 3.064                 | 6.138                  | 4.512                  | 3.939                  | 4.085                  | 4.278                  |

Art. 30.6222

Richtwerte für den Einsatz von Vollhartmetall Schruppfräser für Alu  
Recommended cutting data for solid carbide roughing end mills

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                                                          |          | d1=5,0mm | d1=6,0mm | d1=8,0mm | d1=10,0mm | d1=12,0mm |
|-----------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|-----------|-----------|
| 9.1-9.2                           | 3.0255-3.3315-3.3535-<br>3.0615-3.1645<br>Aluminium / aluminium                | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 350-550  | 350-550  | 350-550  | 350-550   | 350-550   |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |
| 9.3-9.5                           | 3.1841-3.2161-3.2373-<br>3.3241-3.5812<br>Aluminium / aluminium                | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 200-500  | 200-500  | 200-500  | 200-500   | 200-500   |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |
| 10.1-10.2                         | 2.0290-2.0401-2.1096-2.0220-<br>2.0240-2.0280-2.0380-2.0596<br>Kupfer / copper | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 90-180   | 90-180   | 90-180   | 90-180    | 90-180    |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |
| 10.3                              | 2.0082-2.0872-2.0936-2.1086<br>Kupfer / copper                                 | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 90-150   | 90-150   | 90-150   | 90-150    | 90-150    |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |
| 10.1-10.3                         | Messing / brass                                                                | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 100-250  | 100-250  | 100-250  | 100-250   | 100-250   |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |
| 10.3                              | Bronze / bronze                                                                | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 90-150   | 90-150   | 90-150   | 90-150    | 90-150    |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |
|                                   | Ampco / ampco                                                                  | ae mm    | 0,25     | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 10,0     | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 40-80    | 40-80    | 40-80    | 40-80     | 40-80     |
|                                   |                                                                                | fz mm    | 0,035    | 0,040    | 0,040    | 0,050     | 0,050     |

Art. 30.6223

Richtwerte für den Einsatz von Vollhartmetall-HPC Schaftfräser für Alu  
Recommended cutting data for solid carbide HPC End mills for Aluminium

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                                                          |          | d1=3,0mm | d1=4,0mm | d1=5,0mm | d1=6,0mm | d1=8,0mm | d1=10,0mm | d1=12,0mm |
|-----------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|-----------|-----------|
| 9.1-9.2                           | 3.0255-3.3315-3.3535-<br>3.0615-3.1645<br>Aluminium / aluminium                | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 650      | 650      | 650      | 650      | 650      | 650       | 650       |
|                                   |                                                                                | fz mm    | 0,035    | 0,035    | 0,055    | 0,060    | 0,060    | 0,070     | 0,070     |
| 9.3-9.5                           | 3.1841-3.2161-3.2373-<br>3.3241-3.5812<br>Aluminium / aluminium                | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 400      | 400      | 400      | 400      | 400      | 400       | 400       |
|                                   |                                                                                | fz mm    | 0,030    | 0,030    | 0,045    | 0,050    | 0,050    | 0,070     | 0,070     |
| 10.1-10.2                         | 2.0290-2.0401-2.1096-2.0220-<br>2.0240-2.0280-2.0380-2.0596<br>Kupfer / copper | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 160      | 160      | 160      | 160      | 160      | 160       | 160       |
|                                   |                                                                                | fz mm    | 0,020    | 0,020    | 0,040    | 0,040    | 0,040    | 0,060     | 0,060     |
| 10.3                              | 2.0082-2.0872-2.0936-2.1086<br>Kupfer / copper                                 | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 120      | 120      | 120      | 120      | 120      | 120       | 120       |
|                                   |                                                                                | fz mm    | 0,020    | 0,020    | 0,400    | 0,040    | 0,040    | 0,060     | 0,060     |
| 10.1-10.3                         | Messing / brass                                                                | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 200      | 200      | 200      | 200      | 200      | 200       | 200       |
|                                   |                                                                                | fz mm    | 0,020    | 0,020    | 0,035    | 0,040    | 0,040    | 0,060     | 0,060     |
| 10.3                              | Bronze / bronze                                                                | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 160      | 160      | 160      | 160      | 160      | 160       | 160       |
|                                   |                                                                                | fz mm    | 0,020    | 0,020    | 0,035    | 0,040    | 0,040    | 0,060     | 0,060     |
|                                   | Ampco / ampco                                                                  | ae mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | ap mm    | 3,0      | 4,0      | 5,0      | 6,0      | 8,0      | 10,0      | 12,0      |
|                                   |                                                                                | Vc m/min | 60       | 60       | 60       | 60       | 60       | 60        | 60        |
|                                   |                                                                                | fz mm    | 0,020    | 0,020    | 0,035    | 0,040    | 0,040    | 0,060     | 0,060     |

Art. 30.6224

Richtwerte für den Einsatz von Vollhartmetall Schaftfräser - Superfinish Alu.  
Recommended cutting data for solid carbide end mills - Superfinish - Aluminium

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                                                          |          | d1=6,0mm | d1=8,0mm | d1=10,0mm | d1=12,0mm |
|-----------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|
| 9.1-9.2                           | 3.0255-3.3315-3.3535-<br>3.0615-3.1645<br>Aluminium / aluminium                | ae mm    | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 380      | 380      | 380       | 380       |
|                                   |                                                                                | fz mm    | 0,040    | 0,050    | 0,050     | 0,060     |
| 9.3-9.5                           | 3.1841-3.2161-3.2373-<br>3.3241-3.5812<br>Aluminium / aluminium                | ae mm    | 0,4      | 0,5      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 250      | 250      | 250       | 250       |
|                                   |                                                                                | fz mm    | 0,020    | 0,025    | 0,030     | 0,050     |
| 10.1-10.2                         | 2.0290-2.0401-2.1096-2.0220-<br>2.0240-2.0280-2.0380-2.0596<br>Kupfer / copper | ae mm    | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 100      | 100      | 100       | 100       |
|                                   |                                                                                | fz mm    | 0,020    | 0,030    | 0,030     | 0,050     |
| 10.3                              | 2.0082-2.0872-2.0936-2.1086<br>Kupfer / copper                                 | ae mm    | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 90       | 90       | 90        | 90        |
|                                   |                                                                                | fz mm    | 0,020    | 0,030    | 0,030     | 0,050     |
| 10.1-10.3                         | Messing / brass                                                                | ae mm    | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 130      | 130      | 130       | 130       |
|                                   |                                                                                | fz mm    | 0,020    | 0,025    | 0,030     | 0,050     |
| 10.3                              | Bronze / bronze                                                                | ae mm    | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 100      | 100      | 100       | 100       |
|                                   |                                                                                | fz mm    | 0,020    | 0,025    | 0,030     | 0,050     |
|                                   | Ampco / ampco                                                                  | ae mm    | 0,3      | 0,4      | 0,5       | 0,6       |
|                                   |                                                                                | ap mm    | 12,0     | 16,0     | 20,0      | 24,0      |
|                                   |                                                                                | Vc m/min | 55       | 55       | 55        | 55        |
|                                   |                                                                                | fz mm    | 0,020    | 0,025    | 0,030     | 0,050     |

Richtwerte für den Einsatz von Karnasch Vollhartmetall-Fräsern für HSC/HPC- Bearbeitung  
Recommended cutting data for solid carbide end mills HSC/HPC

Art. 30.6209

Art. 30.6202

| Werkstoffgruppe<br>material group |           | 9.1 - 9.2 - 10.1 - 10.2 - 10.3<br>Alu, Kupfer, Messing<br>Aluminium, copper, brass |           |       |       | 2.1 - 2.2 - 2.3 - 2.4 - 2.5 - 2.6<br>Vergütungsstähle/ heat-treated steels<br>< 30 HRC (1300 N/mm <sup>2</sup> ) |           |       |       | 3.1 - 3.2<br>Vergütungsstähle/ heat-treated steels<br>< 35 HRC (1200 N/mm <sup>2</sup> ) |           |       |       |
|-----------------------------------|-----------|------------------------------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------------------------------------|-----------|-------|-------|
| d1                                | <b>13</b> | min <sup>1</sup>                                                                   | Vf mm/min | fz mm | ap mm | min <sup>1</sup>                                                                                                 | Vf mm/min | fz mm | ap mm | min <sup>1</sup>                                                                         | Vf mm/min | fz mm | ap mm |
| 0,05                              | 0,10      | 70.000                                                                             | 100       | 0,002 | 0,005 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,06                              | 0,12      | 70.000                                                                             | 180       | 0,002 | 0,006 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,08                              | 0,16      | 70.000                                                                             | 240       | 0,003 | 0,008 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,10                              | 0,20      | 70.000                                                                             | 280       | 0,003 | 0,010 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,12                              | 0,24      | 70.000                                                                             | 300       | 0,003 | 0,012 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,15                              | 0,30      | 70.000                                                                             | 400       | 0,004 | 0,015 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,20                              | 0,50      | 70.000                                                                             | 500       | 0,006 | 0,020 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,30                              | 1,00      | 70.000                                                                             | 600       | 0,007 | 0,025 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,40                              | 1,00      | 70.000                                                                             | 800       | 0,008 | 0,028 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,40                              | 2,00      | 70.000                                                                             | 700       | 0,007 | 0,025 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,50                              | 1,00      | 70.000                                                                             | 800       | 0,010 | 0,045 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,50                              | 2,00      | 70.000                                                                             | 800       | 0,010 | 0,032 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,50                              | 4,00      | 70.000                                                                             | 800       | 0,009 | 0,023 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,50                              | 6,00      | 70.000                                                                             | 800       | 0,009 | 0,013 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,60                              | 1,50      | 50.000                                                                             | 900       | 0,012 | 0,055 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,60                              | 4,00      | 50.000                                                                             | 800       | 0,012 | 0,040 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,70                              | 2,00      | 50.000                                                                             | 900       | 0,012 | 0,065 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,70                              | 4,00      | 50.000                                                                             | 800       | 0,010 | 0,050 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,75                              | 2,00      | 50.000                                                                             | 900       | 0,010 | 0,065 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,80                              | 2,00      | 50.000                                                                             | 1.100     | 0,015 | 0,065 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,80                              | 4,00      | 50.000                                                                             | 1.100     | 0,015 | 0,055 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,80                              | 6,00      | 50.000                                                                             | 1.100     | 0,015 | 0,035 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,80                              | 9,00      | 50.000                                                                             | 1.100     | 0,015 | 0,010 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,85                              | 2,00      | 50.000                                                                             | 1.100     | 0,015 | 0,060 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,90                              | 2,50      | 50.000                                                                             | 1.400     | 0,016 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,90                              | 6,00      | 50.000                                                                             | 1.200     | 0,016 | 0,060 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 0,95                              | 2,50      | 50.000                                                                             | 1.400     | 0,016 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,00                              | 3,00      | 45.000                                                                             | 1.600     | 0,018 | 0,080 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,00                              | 4,00      | 45.000                                                                             | 1.500     | 0,018 | 0,075 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,00                              | 6,00      | 45.000                                                                             | 1.400     | 0,018 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,00                              | 9,00      | 45.000                                                                             | 1.300     | 0,018 | 0,030 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,00                              | 12,00     | 45.000                                                                             | 1.200     | 0,018 | 0,020 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,05                              | 3,00      | 45.000                                                                             | 1.600     | 0,018 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,10                              | 3,00      | 45.000                                                                             | 1.600     | 0,018 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,15                              | 3,00      | 45.000                                                                             | 1.600     | 0,018 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,20                              | 4,00      | 39.000                                                                             | 1.500     | 0,022 | 0,095 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,20                              | 6,00      | 39.000                                                                             | 1.400     | 0,022 | 0,090 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,20                              | 9,00      | 39.000                                                                             | 1.400     | 0,022 | 0,060 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,25                              | 4,00      | 39.000                                                                             | 1.400     | 0,022 | 0,090 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,40                              | 4,00      | 32.000                                                                             | 1.500     | 0,025 | 0,140 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,40                              | 6,00      | 32.000                                                                             | 1.300     | 0,025 | 0,120 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,40                              | 9,00      | 32.000                                                                             | 1.300     | 0,025 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,50                              | 4,00      | 30.000                                                                             | 1.400     | 0,026 | 0,180 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,50                              | 6,00      | 30.000                                                                             | 1.300     | 0,026 | 0,150 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,50                              | 9,00      | 30.000                                                                             | 1.300     | 0,026 | 0,100 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,50                              | 12,00     | 30.000                                                                             | 1.200     | 0,026 | 0,070 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,60                              | 5,00      | 30.000                                                                             | 1.300     | 0,026 | 0,150 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,80                              | 9,00      | 25.000                                                                             | 1.300     | 0,030 | 0,220 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,80                              | 12,00     | 25.000                                                                             | 1.300     | 0,030 | 0,110 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 1,90                              | 5,00      | 25.000                                                                             | 1.400     | 0,030 | 0,200 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 2,00                              | 5,00      | 23.000                                                                             | 1.300     | 0,034 | 0,300 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 2,00                              | 9,00      | 23.000                                                                             | 1.300     | 0,034 | 0,250 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 2,00                              | 12,00     | 23.000                                                                             | 1.300     | 0,034 | 0,140 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |
| 2,00                              | 15,00     | 23.000                                                                             | 1.300     | 0,034 | 0,090 |                                                                                                                  |           |       |       |                                                                                          |           |       |       |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

Art. 30.6212

Richtwerte für den Einsatz von Karnasch Vollhartmetall-Fräsern für HSC/HPC- Bearbeitung  
Recommended cutting data for solid carbide end mills HSC/HPC

Art. 30.6203

| Werkstoffgruppe<br>Material group |     | 9.1 - 9.2 - 10.1 - 10.2 - 10.3<br>Alu, Kupfer, Messing<br>Aluminium, copper, brass |           |       |       |
|-----------------------------------|-----|------------------------------------------------------------------------------------|-----------|-------|-------|
| d1                                | f3  | min <sup>1</sup>                                                                   | Vf mm/min | fz mm | ap mm |
| 0,2                               | 0,5 | 60.000                                                                             | 1.900     | 0,016 | 0,020 |
| 0,2                               | 1   | 60.000                                                                             | 1.900     | 0,016 | 0,014 |
| 0,3                               | 1   | 58.000                                                                             | 2.400     | 0,021 | 0,018 |
| 0,3                               | 2   | 52.000                                                                             | 2.050     | 0,020 | 0,012 |
| 0,3                               | 3   | 45.000                                                                             | 1.450     | 0,016 | 0,008 |
| 0,3                               | 5   | 38.000                                                                             | 900       | 0,012 | 0,005 |
| 0,4                               | 2   | 48.000                                                                             | 2.000     | 0,021 | 0,026 |
| 0,4                               | 4   | 43.000                                                                             | 1.600     | 0,019 | 0,010 |
| 0,4                               | 6   | 43.000                                                                             | 1.600     | 0,019 | 0,005 |
| 0,5                               | 3   | 42.000                                                                             | 2.200     | 0,026 | 0,018 |
| 0,5                               | 4   | 42.000                                                                             | 2.200     | 0,026 | 0,016 |
| 0,5                               | 5   | 42.000                                                                             | 2.200     | 0,026 | 0,013 |
| 0,6                               | 2   | 42.000                                                                             | 2.800     | 0,033 | 0,022 |
| 0,6                               | 4   | 42.000                                                                             | 2.800     | 0,033 | 0,022 |
| 0,6                               | 6   | 42.000                                                                             | 2.800     | 0,033 | 0,015 |
| 0,6                               | 8   | 42.000                                                                             | 2.800     | 0,033 | 0,010 |
| 0,7                               | 6   | 48.000                                                                             | 2.600     | 0,027 | 0,040 |
| 0,7                               | 10  | 40.000                                                                             | 1.800     | 0,022 | 0,030 |
| 0,8                               | 4   | 48.000                                                                             | 2.700     | 0,028 | 0,040 |
| 0,8                               | 6   | 48.000                                                                             | 2.700     | 0,028 | 0,034 |
| 0,8                               | 8   | 48.000                                                                             | 2.700     | 0,028 | 0,030 |
| 0,8                               | 10  | 42.000                                                                             | 2.200     | 0,026 | 0,022 |
| 0,9                               | 6   | 36.000                                                                             | 2.600     | 0,036 | 0,035 |
| 0,9                               | 12  | 34.000                                                                             | 2.250     | 0,033 | 0,025 |
| 1,0                               | 3   | 44.000                                                                             | 3.500     | 0,040 | 0,065 |
| 1,0                               | 5   | 38.000                                                                             | 2.900     | 0,038 | 0,040 |
| 1,0                               | 7   | 38.000                                                                             | 2.900     | 0,038 | 0,040 |
| 1,0                               | 10  | 38.000                                                                             | 2.700     | 0,036 | 0,025 |
| 1,0                               | 12  | 33.000                                                                             | 2.200     | 0,033 | 0,025 |
| 1,0                               | 15  | 33.000                                                                             | 1.850     | 0,028 | 0,015 |
| 1,0                               | 20  | 26.000                                                                             | 1.350     | 0,026 | 0,010 |
| 1,0                               | 25  | 21.000                                                                             | 750       | 0,018 | 0,008 |
| 1,2                               | 6   | 38.000                                                                             | 2.900     | 0,038 | 0,040 |
| 1,2                               | 8   | 38.000                                                                             | 2.900     | 0,038 | 0,040 |
| 1,2                               | 10  | 38.000                                                                             | 2.700     | 0,036 | 0,025 |
| 1,2                               | 12  | 33.000                                                                             | 2.200     | 0,033 | 0,025 |
| 1,2                               | 18  | 24.000                                                                             | 1.250     | 0,026 | 0,010 |
| 1,2                               | 25  | 21.000                                                                             | 750       | 0,018 | 0,008 |
| 1,4                               | 8   | 38.000                                                                             | 2.900     | 0,038 | 0,045 |
| 1,4                               | 16  | 33.000                                                                             | 1.700     | 0,026 | 0,030 |
| 1,5                               | 4   | 33.000                                                                             | 2.400     | 0,036 | 0,060 |
| 1,5                               | 6   | 32.000                                                                             | 2.300     | 0,036 | 0,060 |
| 1,5                               | 8   | 31.000                                                                             | 2.200     | 0,036 | 0,055 |
| 1,5                               | 10  | 31.000                                                                             | 2.200     | 0,036 | 0,055 |
| 1,5                               | 12  | 30.000                                                                             | 2.100     | 0,036 | 0,050 |
| 1,5                               | 16  | 26.000                                                                             | 1.700     | 0,033 | 0,035 |
| 1,5                               | 20  | 26.000                                                                             | 1.350     | 0,026 | 0,030 |
| 1,5                               | 25  | 24.000                                                                             | 1.000     | 0,021 | 0,025 |
| 1,6                               | 8   | 31.000                                                                             | 2.200     | 0,036 | 0,060 |
| 1,6                               | 16  | 26.000                                                                             | 1.700     | 0,033 | 0,037 |
| 1,8                               | 10  | 31.000                                                                             | 2.200     | 0,036 | 0,060 |
| 1,8                               | 20  | 26.000                                                                             | 1.700     | 0,033 | 0,037 |
| 2,0                               | 5   | 25.000                                                                             | 3.200     | 0,065 | 0,200 |
| 2,0                               | 8   | 25.000                                                                             | 3.000     | 0,060 | 0,140 |
| 2,0                               | 10  | 24.000                                                                             | 2.800     | 0,060 | 0,100 |
| 2,0                               | 12  | 22.000                                                                             | 2.600     | 0,060 | 0,080 |
| 2,0                               | 15  | 22.000                                                                             | 2.600     | 0,060 | 0,080 |
| 2,0                               | 20  | 22.000                                                                             | 2.600     | 0,060 | 0,050 |
| 2,0                               | 25  | 20.000                                                                             | 2.000     | 0,050 | 0,025 |
| 2,0                               | 30  | 20.000                                                                             | 2.000     | 0,050 | 0,016 |
| 2,5                               | 10  | 24.000                                                                             | 2.800     | 0,060 | 0,100 |
| 2,5                               | 20  | 22.000                                                                             | 2.600     | 0,060 | 0,060 |

| Werkstoffgruppe<br>Material group |    | 9.1 - 9.2 - 10.1 - 10.2 - 10.3<br>Alu, Kupfer, Messing<br>Aluminium, copper, brass |           |       |       |
|-----------------------------------|----|------------------------------------------------------------------------------------|-----------|-------|-------|
| d1                                | f3 | min <sup>1</sup>                                                                   | Vf mm/min | fz mm | ap mm |
| 3,0                               | 5  | 20.000                                                                             | 2.600     | 0,066 | 0,300 |
| 3,0                               | 10 | 20.000                                                                             | 2.600     | 0,066 | 0,210 |
| 3,0                               | 15 | 20.000                                                                             | 2.600     | 0,066 | 0,120 |
| 3,0                               | 20 | 17.000                                                                             | 2.000     | 0,060 | 0,120 |
| 3,0                               | 25 | 17.000                                                                             | 2.000     | 0,060 | 0,100 |
| 3,0                               | 30 | 14.000                                                                             | 2.000     | 0,060 | 0,080 |
| 4,0                               | 10 | 15.000                                                                             | 3.000     | 0,100 | 0,300 |
| 4,0                               | 15 | 15.000                                                                             | 3.000     | 0,100 | 0,250 |
| 4,0                               | 20 | 13.000                                                                             | 2.300     | 0,090 | 0,200 |
| 4,0                               | 25 | 13.000                                                                             | 2.300     | 0,090 | 0,130 |
| 4,0                               | 30 | 11.000                                                                             | 1.800     | 0,090 | 0,100 |
| 5,0                               | 10 | 11.000                                                                             | 2.600     | 0,120 | 0,400 |
| 5,0                               | 20 | 11.000                                                                             | 2.600     | 0,120 | 0,380 |
| 5,0                               | 30 | 11.000                                                                             | 2.600     | 0,120 | 0,200 |
| 5,0                               | 40 | 10.000                                                                             | 2.000     | 0,110 | 0,120 |
| 6,0                               | 10 | 11.000                                                                             | 2.600     | 0,120 | 0,400 |
| 6,0                               | 20 | 10.000                                                                             | 3.000     | 0,150 | 0,300 |
| 6,0                               | 30 | 10.000                                                                             | 2.800     | 0,140 | 0,250 |
| 6,0                               | 40 | 8.000                                                                              | 2.000     | 0,130 | 0,240 |
| 6,0                               | 50 | 7.000                                                                              | 1.800     | 0,130 | 0,160 |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.

*These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.*



Richtwerte für den Einsatz von Karnasch Vollhartmetall-Fräsern für HSC/HPC- Bearbeitung  
Recommended cutting data for solid carbide end mills HSC/HPC

Art. 30.6213

Art. 30.6204

| Werkstoffgruppe<br>Material group |     | 9.1 – 9.2 – 10.1 – 10.2 – 10.3<br>Alu, Kupfer, Messing<br>Aluminium, copper, brass |           |       |       |       |
|-----------------------------------|-----|------------------------------------------------------------------------------------|-----------|-------|-------|-------|
| d1                                | I3  | min <sup>1</sup>                                                                   | Vf mm/min | fz mm | ae mm | ap    |
| 0,1                               | 0,1 | 60.000                                                                             | 600       | 0,005 | 0,008 | 0,004 |
| 0,1                               | 0,2 | 60.000                                                                             | 600       | 0,005 | 0,005 | 0,002 |
| 0,2                               | 0,5 | 60.000                                                                             | 2.750     | 0,023 | 0,020 | 0,060 |
| 0,2                               | 1   | 60.000                                                                             | 2.750     | 0,023 | 0,012 | 0,040 |
| 0,3                               | 1   | 60.000                                                                             | 2.750     | 0,023 | 0,020 | 0,060 |
| 0,3                               | 2   | 60.000                                                                             | 2.400     | 0,020 | 0,012 | 0,035 |
| 0,3                               | 3   | 48.000                                                                             | 1.700     | 0,018 | 0,008 | 0,020 |
| 0,3                               | 5   | 36.000                                                                             | 600       | 0,008 | 0,005 | 0,005 |
| 0,4                               | 2   | 48.000                                                                             | 2.900     | 0,030 | 0,025 | 0,080 |
| 0,4                               | 4   | 38.000                                                                             | 1.800     | 0,024 | 0,010 | 0,030 |
| 0,4                               | 6   | 24.000                                                                             | 400       | 0,008 | 0,005 | 0,010 |
| 0,5                               | 3   | 43.000                                                                             | 2.300     | 0,027 | 0,030 | 0,090 |
| 0,5                               | 4   | 43.000                                                                             | 2.300     | 0,027 | 0,020 | 0,050 |
| 0,5                               | 5   | 38.000                                                                             | 1.800     | 0,024 | 0,015 | 0,045 |
| 0,6                               | 2   | 48.000                                                                             | 3.600     | 0,038 | 0,040 | 0,120 |
| 0,6                               | 4   | 43.000                                                                             | 3.600     | 0,038 | 0,022 | 0,065 |
| 0,6                               | 6   | 38.000                                                                             | 2.200     | 0,030 | 0,015 | 0,040 |
| 0,6                               | 8   | 38.000                                                                             | 2.200     | 0,030 | 0,015 | 0,035 |
| 0,7                               | 6   | 43.000                                                                             | 2.900     | 0,034 | 0,022 | 0,070 |
| 0,7                               | 10  | 38.000                                                                             | 2.300     | 0,030 | 0,015 | 0,038 |
| 0,8                               | 4   | 48.000                                                                             | 3.600     | 0,038 | 0,050 | 0,160 |
| 0,8                               | 6   | 43.000                                                                             | 2.900     | 0,034 | 0,030 | 0,090 |
| 0,8                               | 8   | 38.000                                                                             | 1.150     | 0,030 | 0,020 | 0,060 |
| 0,8                               | 10  | 38.000                                                                             | 1.150     | 0,030 | 0,020 | 0,050 |
| 0,9                               | 6   | 43.000                                                                             | 2.900     | 0,034 | 0,030 | 0,090 |
| 0,9                               | 12  | 33.000                                                                             | 2.200     | 0,034 | 0,020 | 0,060 |
| 1,0                               | 3   | 43.000                                                                             | 3.800     | 0,045 | 0,100 | 0,300 |
| 1,0                               | 5   | 38.000                                                                             | 3.000     | 0,040 | 0,040 | 0,100 |
| 1,0                               | 7   | 38.000                                                                             | 3.000     | 0,040 | 0,040 | 0,100 |
| 1,0                               | 10  | 38.000                                                                             | 3.000     | 0,040 | 0,025 | 0,075 |
| 1,0                               | 12  | 35.000                                                                             | 2.450     | 0,035 | 0,025 | 0,070 |
| 1,0                               | 15  | 35.000                                                                             | 2.450     | 0,035 | 0,020 | 0,065 |
| 1,0                               | 20  | 26.000                                                                             | 1.600     | 0,032 | 0,010 | 0,025 |
| 1,0                               | 25  | 22.000                                                                             | 1.100     | 0,025 | 0,010 | 0,015 |
| 1,2                               | 6   | 38.000                                                                             | 3.000     | 0,040 | 0,040 | 0,120 |
| 1,2                               | 8   | 34.000                                                                             | 2.700     | 0,040 | 0,040 | 0,110 |
| 1,2                               | 10  | 34.000                                                                             | 2.700     | 0,040 | 0,040 | 0,090 |
| 1,2                               | 12  | 34.000                                                                             | 2.700     | 0,040 | 0,030 | 0,080 |
| 1,2                               | 18  | 26.000                                                                             | 1.600     | 0,032 | 0,010 | 0,025 |
| 1,2                               | 25  | 22.000                                                                             | 1.100     | 0,025 | 0,010 | 0,015 |
| 1,4                               | 8   | 30.000                                                                             | 2.400     | 0,040 | 0,050 | 0,160 |
| 1,4                               | 16  | 28.000                                                                             | 2.000     | 0,035 | 0,030 | 0,100 |
| 1,5                               | 4   | 34.000                                                                             | 3.000     | 0,045 | 0,100 | 0,250 |
| 1,5                               | 6   | 30.000                                                                             | 3.000     | 0,045 | 0,100 | 0,250 |
| 1,5                               | 8   | 30.000                                                                             | 2.400     | 0,040 | 0,060 | 0,160 |
| 1,5                               | 10  | 30.000                                                                             | 2.400     | 0,040 | 0,060 | 0,150 |
| 1,5                               | 12  | 30.000                                                                             | 2.400     | 0,040 | 0,060 | 0,140 |
| 1,5                               | 16  | 26.000                                                                             | 1.800     | 0,035 | 0,035 | 0,100 |
| 1,5                               | 20  | 26.000                                                                             | 1.800     | 0,035 | 0,035 | 0,100 |
| 1,5                               | 25  | 26.000                                                                             | 1.800     | 0,030 | 0,030 | 0,080 |
| 1,6                               | 8   | 31.000                                                                             | 3.100     | 0,050 | 0,100 | 0,300 |
| 1,6                               | 16  | 25.000                                                                             | 2.000     | 0,040 | 0,040 | 0,110 |
| 1,8                               | 10  | 29.000                                                                             | 2.600     | 0,045 | 0,060 | 0,200 |
| 1,8                               | 20  | 25.000                                                                             | 2.000     | 0,040 | 0,040 | 0,120 |
| 2,0                               | 5   | 25.000                                                                             | 3.500     | 0,07  | 0,200 | 0,600 |
| 2,0                               | 8   | 25.000                                                                             | 3.500     | 0,07  | 0,140 | 0,400 |
| 2,0                               | 10  | 25.000                                                                             | 3.500     | 0,07  | 0,140 | 0,400 |
| 2,0                               | 12  | 22.000                                                                             | 2.600     | 0,06  | 0,080 | 0,200 |
| 2,0                               | 15  | 22.000                                                                             | 2.600     | 0,06  | 0,080 | 0,200 |
| 2,0                               | 20  | 22.000                                                                             | 2.600     | 0,06  | 0,050 | 0,150 |
| 2,0                               | 25  | 20.000                                                                             | 2.400     | 0,06  | 0,050 | 0,120 |
| 2,0                               | 30  | 20.000                                                                             | 2.400     | 0,06  | 0,030 | 0,080 |
| 2,5                               | 10  | 25.000                                                                             | 3.500     | 0,07  | 0,200 | 0,700 |
| 2,5                               | 20  | 22.000                                                                             | 2.600     | 0,06  | 0,060 | 0,180 |
| 3,0                               | 5   | 20.000                                                                             | 2.800     | 0,07  | 0,300 | 0,800 |
| 3,0                               | 10  | 19.000                                                                             | 2.600     | 0,07  | 0,200 | 0,600 |
| 3,0                               | 15  | 18.000                                                                             | 2.500     | 0,07  | 0,200 | 0,600 |
| 3,0                               | 20  | 18.000                                                                             | 2.500     | 0,07  | 0,120 | 0,250 |
| 3,0                               | 25  | 18.000                                                                             | 2.500     | 0,07  | 0,080 | 0,220 |
| 3,0                               | 30  | 16.000                                                                             | 1.900     | 0,06  | 0,080 | 0,200 |
| 4,0                               | 10  | 14.000                                                                             | 2.500     | 0,09  | 0,400 | 1,000 |
| 4,0                               | 15  | 14.000                                                                             | 2.500     | 0,09  | 0,250 | 0,800 |
| 4,0                               | 20  | 14.000                                                                             | 2.500     | 0,09  | 0,200 | 0,600 |
| 4,0                               | 25  | 12.000                                                                             | 2.100     | 0,09  | 0,180 | 0,450 |
| 4,0                               | 30  | 12.000                                                                             | 2.100     | 0,09  | 0,100 | 0,300 |
| 5,0                               | 10  | 14.000                                                                             | 3.900     | 0,14  | 0,450 | 1,200 |
| 5,0                               | 20  | 14.000                                                                             | 3.400     | 0,12  | 0,350 | 1,000 |
| 5,0                               | 30  | 10.000                                                                             | 2.200     | 0,11  | 0,200 | 0,600 |
| 5,0                               | 40  | 10.000                                                                             | 2.200     | 0,11  | 0,200 | 0,500 |
| 6,0                               | 10  | 14.000                                                                             | 3.900     | 0,14  | 0,550 | 1,400 |
| 6,0                               | 20  | 14.000                                                                             | 3.300     | 0,12  | 0,350 | 1,100 |
| 6,0                               | 30  | 9.500                                                                              | 2.200     | 0,12  | 0,300 | 0,700 |
| 6,0                               | 40  | 9.500                                                                              | 2.200     | 0,12  | 0,250 | 0,600 |
| 6,0                               | 50  | 8.500                                                                              | 1.800     | 0,11  | 0,150 | 0,400 |

|              |              |                                                                                                                                                                 |  |  |  |
|--------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| Art. 30.6261 | Art. 30.6262 | Richtwerte für den Einsatz von Karnasch Vollhartmetall-Fräsern für HSC/HHC/HPC- Bearbeitung<br>Recommended cutting data for solid carbide end mills HSC/HHC/HPC |  |  |  |
| Art. 30.6255 | Art. 30.6265 | Art. 30.6256                                                                                                                                                    |  |  |  |

| Werkstoffgruppe<br>Material group |     | 1.1 – 1.2 – 1.3 – 1.4 – 1.5<br>Unlegierte Stähle / Unalloyed steels<br>< 850 N/mm² |           |       |       | 2.1 – 2.2 – 2.3 – 2.4 – 2.5 – 2.6 – 3.1 – 3.2<br>Vergütungsstähle / Heat-treated steels<br>< 35 HRC (1200 N/mm²) |           |       |       |  |  |  |  |
|-----------------------------------|-----|------------------------------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|--|--|--|--|
| d1                                | Is  | min¹                                                                               | Vf mm/min | fz mm | ap mm | min¹                                                                                                             | Vf mm/min | fz mm | ap mm |  |  |  |  |
| 0,1                               | 0,2 | 50.000                                                                             | 1.000     | 0,010 | 0,015 | 45.000                                                                                                           | 900       | 0,010 | 0,010 |  |  |  |  |
| 0,1                               | 0,3 | 50.000                                                                             | 1.000     | 0,010 | 0,014 | 45.000                                                                                                           | 900       | 0,010 | 0,010 |  |  |  |  |
| 0,1                               | 0,4 | 50.000                                                                             | 1.000     | 0,010 | 0,010 | 45.000                                                                                                           | 900       | 0,010 | 0,008 |  |  |  |  |
| 0,2                               | 0,5 | 50.000                                                                             | 1.400     | 0,014 | 0,020 | 45.000                                                                                                           | 1.300     | 0,014 | 0,018 |  |  |  |  |
| 0,2                               | 1   | 50.000                                                                             | 1.400     | 0,014 | 0,014 | 45.000                                                                                                           | 1.300     | 0,014 | 0,013 |  |  |  |  |
| 0,2                               | 1,5 | 48.000                                                                             | 960       | 0,010 | 0,008 | 40.000                                                                                                           | 800       | 0,010 | 0,006 |  |  |  |  |
| 0,2                               | 2   | 42.000                                                                             | 840       | 0,010 | 0,008 | 36.000                                                                                                           | 720       | 0,010 | 0,006 |  |  |  |  |
| 0,3                               | 1   | 48.000                                                                             | 1.800     | 0,018 | 0,018 | 43.000                                                                                                           | 1.600     | 0,018 | 0,018 |  |  |  |  |
| 0,3                               | 1,5 | 45.000                                                                             | 1.620     | 0,018 | 0,018 | 38.000                                                                                                           | 1.064     | 0,014 | 0,015 |  |  |  |  |
| 0,3                               | 2   | 43.000                                                                             | 1.500     | 0,017 | 0,012 | 39.000                                                                                                           | 1.350     | 0,017 | 0,010 |  |  |  |  |
| 0,3                               | 2,5 | 41.000                                                                             | 1.312     | 0,016 | 0,010 | 34.000                                                                                                           | 952       | 0,014 | 0,008 |  |  |  |  |
| 0,3                               | 3   | 38.000                                                                             | 1.050     | 0,014 | 0,008 | 34.000                                                                                                           | 1.200     | 0,016 | 0,006 |  |  |  |  |
| 0,3                               | 5   | 32.000                                                                             | 640       | 0,010 | 0,005 | 30.000                                                                                                           | 500       | 0,008 | 0,003 |  |  |  |  |
| 0,4                               | 1   | 40.000                                                                             | 1.440     | 0,018 | 0,030 | 34.000                                                                                                           | 1.156     | 0,017 | 0,025 |  |  |  |  |
| 0,4                               | 1,5 | 40.000                                                                             | 1.440     | 0,018 | 0,028 | 34.000                                                                                                           | 1.156     | 0,017 | 0,024 |  |  |  |  |
| 0,4                               | 2   | 40.000                                                                             | 1.500     | 0,018 | 0,026 | 36.000                                                                                                           | 1.300     | 0,018 | 0,025 |  |  |  |  |
| 0,4                               | 3   | 36.000                                                                             | 1.200     | 0,016 | 0,016 | 32.000                                                                                                           | 1.100     | 0,016 | 0,014 |  |  |  |  |
| 0,4                               | 4   | 36.000                                                                             | 1.200     | 0,016 | 0,010 | 32.000                                                                                                           | 1.100     | 0,016 | 0,008 |  |  |  |  |
| 0,4                               | 5   | 36.000                                                                             | 1.200     | 0,016 | 0,008 | 30.000                                                                                                           | 700       | 0,012 | 0,006 |  |  |  |  |
| 0,4                               | 6   | 36.000                                                                             | 1.200     | 0,016 | 0,005 | 26.000                                                                                                           | 400       | 0,008 | 0,003 |  |  |  |  |
| 0,5                               | 1   | 42.000                                                                             | 2.100     | 0,025 | 0,035 | 36.000                                                                                                           | 1.440     | 0,020 | 0,028 |  |  |  |  |
| 0,5                               | 2   | 35.000                                                                             | 1.600     | 0,022 | 0,018 | 38.000                                                                                                           | 1.900     | 0,025 | 0,026 |  |  |  |  |
| 0,5                               | 3   | 35.000                                                                             | 1.600     | 0,022 | 0,018 | 31.000                                                                                                           | 1.400     | 0,023 | 0,018 |  |  |  |  |
| 0,5                               | 4   | 35.000                                                                             | 1.600     | 0,022 | 0,016 | 31.000                                                                                                           | 1.400     | 0,023 | 0,018 |  |  |  |  |
| 0,5                               | 5   | 35.000                                                                             | 1.600     | 0,022 | 0,013 | 31.000                                                                                                           | 1.400     | 0,023 | 0,012 |  |  |  |  |
| 0,5                               | 6   | 31.000                                                                             | 1.200     | 0,020 | 0,011 | 27.000                                                                                                           | 1.100     | 0,020 | 0,010 |  |  |  |  |
| 0,6                               | 2   | 35.000                                                                             | 2.000     | 0,028 | 0,022 | 38.000                                                                                                           | 2.300     | 0,030 | 0,030 |  |  |  |  |
| 0,6                               | 3   | 35.000                                                                             | 2.000     | 0,028 | 0,022 | 38.000                                                                                                           | 2.300     | 0,030 | 0,025 |  |  |  |  |
| 0,6                               | 4   | 35.000                                                                             | 2.000     | 0,028 | 0,022 | 32.000                                                                                                           | 1.800     | 0,028 | 0,020 |  |  |  |  |
| 0,6                               | 5   | 35.000                                                                             | 2.000     | 0,028 | 0,015 | 32.000                                                                                                           | 1.800     | 0,028 | 0,016 |  |  |  |  |
| 0,6                               | 6   | 35.000                                                                             | 2.000     | 0,028 | 0,015 | 32.000                                                                                                           | 1.800     | 0,028 | 0,014 |  |  |  |  |
| 0,6                               | 8   | 35.000                                                                             | 2.000     | 0,028 | 0,010 | 29.000                                                                                                           | 1.500     | 0,025 | 0,017 |  |  |  |  |
| 0,7                               | 4   | 40.000                                                                             | 1.800     | 0,023 | 0,040 | 32.000                                                                                                           | 1.800     | 0,028 | 0,020 |  |  |  |  |
| 0,7                               | 8   | 36.000                                                                             | 1.500     | 0,020 | 0,030 | 29.000                                                                                                           | 1.500     | 0,025 | 0,017 |  |  |  |  |
| 0,8                               | 2   | 40.000                                                                             | 1.800     | 0,024 | 0,045 | 36.000                                                                                                           | 1.700     | 0,024 | 0,055 |  |  |  |  |
| 0,8                               | 4   | 40.000                                                                             | 1.800     | 0,024 | 0,040 | 36.000                                                                                                           | 1.700     | 0,024 | 0,050 |  |  |  |  |
| 0,8                               | 5   | 40.000                                                                             | 1.800     | 0,024 | 0,038 | 36.000                                                                                                           | 1.700     | 0,024 | 0,050 |  |  |  |  |
| 0,8                               | 6   | 40.000                                                                             | 1.800     | 0,024 | 0,034 | 32.000                                                                                                           | 1.400     | 0,022 | 0,028 |  |  |  |  |
| 0,8                               | 7   | 40.000                                                                             | 1.800     | 0,024 | 0,032 | 32.000                                                                                                           | 1.400     | 0,022 | 0,028 |  |  |  |  |
| 0,8                               | 8   | 40.000                                                                             | 1.800     | 0,024 | 0,030 | 32.000                                                                                                           | 1.400     | 0,022 | 0,018 |  |  |  |  |
| 0,8                               | 10  | 35.000                                                                             | 1.500     | 0,022 | 0,022 | 29.000                                                                                                           | 1.150     | 0,020 | 0,012 |  |  |  |  |
| 0,9                               | 6   | 30.000                                                                             | 2.000     | 0,030 | 0,035 | 32.000                                                                                                           | 1.400     | 0,022 | 0,028 |  |  |  |  |
| 0,9                               | 12  | 28.000                                                                             | 1.600     | 0,028 | 0,025 | 26.000                                                                                                           | 1.000     | 0,020 | 0,020 |  |  |  |  |
| 1,0                               | 2   | 36.000                                                                             | 2.520     | 0,035 | 0,090 | 30.500                                                                                                           | 1.830     | 0,030 | 0,070 |  |  |  |  |
| 1,0                               | 3   | 36.000                                                                             | 2.500     | 0,035 | 0,065 | 32.000                                                                                                           | 2.300     | 0,035 | 0,060 |  |  |  |  |
| 1,0                               | 4   | 36.000                                                                             | 2.500     | 0,035 | 0,065 | 32.000                                                                                                           | 2.300     | 0,035 | 0,060 |  |  |  |  |
| 1,0                               | 5   | 32.000                                                                             | 2.100     | 0,032 | 0,040 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,0                               | 6   | 32.000                                                                             | 2.100     | 0,032 | 0,040 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,0                               | 7   | 32.000                                                                             | 2.100     | 0,032 | 0,040 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,0                               | 8   | 32.000                                                                             | 2.100     | 0,032 | 0,040 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,0                               | 9   | 32.000                                                                             | 2.100     | 0,030 | 0,025 | 29.000                                                                                                           | 1.900     | 0,025 | 0,022 |  |  |  |  |
| 1,0                               | 10  | 32.000                                                                             | 2.100     | 0,030 | 0,025 | 29.000                                                                                                           | 1.900     | 0,025 | 0,022 |  |  |  |  |
| 1,0                               | 12  | 28.000                                                                             | 1.600     | 0,028 | 0,025 | 25.000                                                                                                           | 1.500     | 0,028 | 0,022 |  |  |  |  |
| 1,0                               | 15  | 28.000                                                                             | 1.500     | 0,024 | 0,015 | 25.000                                                                                                           | 1.500     | 0,028 | 0,018 |  |  |  |  |
| 1,0                               | 20  | 22.000                                                                             | 1.000     | 0,022 | 0,010 | 19.000                                                                                                           | 950       | 0,025 | 0,009 |  |  |  |  |
| 1,0                               | 25  | 18.000                                                                             | 540       | 0,015 | 0,008 | 17.000                                                                                                           | 650       | 0,020 | 0,005 |  |  |  |  |
| 1,0                               | 30  | 18.000                                                                             | 540       | 0,015 | 0,006 | 14.000                                                                                                           | 400       | 0,015 | 0,003 |  |  |  |  |
| 1,2                               | 6   | 32.000                                                                             | 2.100     | 0,032 | 0,040 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,2                               | 8   | 32.000                                                                             | 2.100     | 0,032 | 0,040 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,2                               | 10  | 32.000                                                                             | 2.100     | 0,030 | 0,025 | 29.000                                                                                                           | 1.900     | 0,025 | 0,022 |  |  |  |  |
| 1,2                               | 12  | 28.000                                                                             | 1.600     | 0,028 | 0,025 | 25.000                                                                                                           | 1.500     | 0,028 | 0,022 |  |  |  |  |
| 1,2                               | 15  | 28.000                                                                             | 1.500     | 0,024 | 0,015 | 25.000                                                                                                           | 1.500     | 0,028 | 0,018 |  |  |  |  |
| 1,2                               | 20  | 22.000                                                                             | 1.000     | 0,022 | 0,010 | 19.000                                                                                                           | 950       | 0,025 | 0,009 |  |  |  |  |
| 1,2                               | 25  | 18.000                                                                             | 540       | 0,015 | 0,008 | 17.000                                                                                                           | 650       | 0,020 | 0,005 |  |  |  |  |
| 1,4                               | 8   | 32.000                                                                             | 2.100     | 0,032 | 0,045 | 29.000                                                                                                           | 1.900     | 0,030 | 0,035 |  |  |  |  |
| 1,4                               | 15  | 28.000                                                                             | 1.500     | 0,028 | 0,030 | 25.000                                                                                                           | 1.500     | 0,028 | 0,022 |  |  |  |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

|                                                                                  |  |  |  |  |  |      |         |      |         |
|----------------------------------------------------------------------------------|--|--|--|--|--|------|---------|------|---------|
| Richtwerte für den Einsatz von Karnasch VHM-Fräsern für HSC/HHC/HPC- Bearbeitung |  |  |  |  |  | Art. | 30.6261 | Art. | 30.6262 |
| Recommended cutting data for solid carbide end mills HSC/HHC/HPC                 |  |  |  |  |  | Art. | 30.6256 | Art. | 30.6255 |
|                                                                                  |  |  |  |  |  | Art. | 30.6256 | Art. | 30.6265 |

| Werkstoffgruppe<br>Material group |    | 1.1 – 1.2 – 1.3 – 1.4 – 1.5<br>Unlegierte Stähle / Unalloyed steels<br>< 850 N/mm² |           |       |       | 2.1 – 2.2 – 2.3 – 2.4 – 2.5 – 2.6 – 3.1 – 3.2<br>Vergütungsstähle / Heat-treated steels<br>< 35 HRC (1200 N/mm²) |           |       |       |  |  |  |  |
|-----------------------------------|----|------------------------------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|--|--|--|--|
| d1                                | l3 | min¹                                                                               | Vf mm/min | fz mm | ap mm | min¹                                                                                                             | Vf mm/min | fz mm | ap mm |  |  |  |  |
| 1,5                               | 4  | 27.500                                                                             | 1.925     | 0,035 | 0,070 | 23.500                                                                                                           | 1.504     | 0,032 | 0,054 |  |  |  |  |
| 1,5                               | 6  | 27.000                                                                             | 1.600     | 0,030 | 0,060 | 23.000                                                                                                           | 1.400     | 0,030 | 0,050 |  |  |  |  |
| 1,5                               | 8  | 26.000                                                                             | 1.600     | 0,030 | 0,060 | 23.000                                                                                                           | 1.400     | 0,030 | 0,050 |  |  |  |  |
| 1,5                               | 10 | 26.000                                                                             | 1.600     | 0,030 | 0,060 | 23.000                                                                                                           | 1.400     | 0,030 | 0,050 |  |  |  |  |
| 1,5                               | 12 | 25.000                                                                             | 1.600     | 0,030 | 0,060 | 22.000                                                                                                           | 1.400     | 0,030 | 0,050 |  |  |  |  |
| 1,5                               | 14 | 23.500                                                                             | 1.410     | 0,030 | 0,043 | 19.000                                                                                                           | 874       | 0,023 | 0,030 |  |  |  |  |
| 1,5                               | 15 | 22.000                                                                             | 1.200     | 0,028 | 0,037 | 20.000                                                                                                           | 1.100     | 0,028 | 0,034 |  |  |  |  |
| 1,5                               | 16 | 22.500                                                                             | 1.305     | 0,029 | 0,036 | 19.000                                                                                                           | 760       | 0,020 | 0,030 |  |  |  |  |
| 1,5                               | 18 | 22.500                                                                             | 1.305     | 0,029 | 0,036 | 19.000                                                                                                           | 760       | 0,020 | 0,030 |  |  |  |  |
| 1,5                               | 20 | 22.000                                                                             | 1.200     | 0,028 | 0,037 | 20.000                                                                                                           | 1.100     | 0,028 | 0,034 |  |  |  |  |
| 1,5                               | 25 | 20.000                                                                             | 850       | 0,022 | 0,030 | 18.000                                                                                                           | 900       | 0,025 | 0,020 |  |  |  |  |
| 1,5                               | 30 | 18.000                                                                             | 650       | 0,018 | 0,025 | 15.000                                                                                                           | 600       | 0,020 | 0,015 |  |  |  |  |
| 1,6                               | 8  | 26.000                                                                             | 1.600     | 0,030 | 0,060 | 23.000                                                                                                           | 1.400     | 0,030 | 0,050 |  |  |  |  |
| 1,6                               | 15 | 22.000                                                                             | 1.200     | 0,028 | 0,037 | 20.000                                                                                                           | 1.100     | 0,028 | 0,034 |  |  |  |  |
| 1,8                               | 10 | 26.000                                                                             | 1.600     | 0,030 | 0,060 | 23.000                                                                                                           | 1.400     | 0,030 | 0,050 |  |  |  |  |
| 1,8                               | 20 | 22.000                                                                             | 1.200     | 0,028 | 0,035 | 20.000                                                                                                           | 1.100     | 0,028 | 0,034 |  |  |  |  |
| 2,0                               | 4  | 21.000                                                                             | 2.940     | 0,070 | 0,200 | 17.500                                                                                                           | 2.555     | 0,073 | 0,150 |  |  |  |  |
| 2,0                               | 6  | 21.000                                                                             | 2.800     | 0,065 | 0,200 | 19.000                                                                                                           | 2.500     | 0,060 | 0,180 |  |  |  |  |
| 2,0                               | 8  | 21.000                                                                             | 2.800     | 0,068 | 0,140 | 19.000                                                                                                           | 2.500     | 0,060 | 0,120 |  |  |  |  |
| 2,0                               | 10 | 20.000                                                                             | 2.400     | 0,060 | 0,100 | 17.000                                                                                                           | 2.000     | 0,060 | 0,070 |  |  |  |  |
| 2,0                               | 12 | 19.000                                                                             | 2.300     | 0,060 | 0,080 | 17.000                                                                                                           | 2.000     | 0,060 | 0,070 |  |  |  |  |
| 2,0                               | 15 | 19.000                                                                             | 2.300     | 0,060 | 0,080 | 17.000                                                                                                           | 2.000     | 0,060 | 0,070 |  |  |  |  |
| 2,0                               | 20 | 19.000                                                                             | 2.300     | 0,060 | 0,050 | 17.000                                                                                                           | 2.000     | 0,060 | 0,040 |  |  |  |  |
| 2,0                               | 25 | 17.000                                                                             | 1.800     | 0,050 | 0,025 | 15.000                                                                                                           | 1.600     | 0,050 | 0,020 |  |  |  |  |
| 2,0                               | 30 | 17.000                                                                             | 1.800     | 0,050 | 0,016 | 15.000                                                                                                           | 1.600     | 0,050 | 0,015 |  |  |  |  |
| 2,5                               | 10 | 20.000                                                                             | 2.400     | 0,060 | 0,100 | 17.000                                                                                                           | 2.000     | 0,060 | 0,070 |  |  |  |  |
| 2,5                               | 15 | 19.000                                                                             | 2.300     | 0,060 | 0,080 | 17.000                                                                                                           | 2.000     | 0,060 | 0,070 |  |  |  |  |
| 2,5                               | 20 | 19.000                                                                             | 2.300     | 0,060 | 0,050 | 17.000                                                                                                           | 2.000     | 0,060 | 0,040 |  |  |  |  |
| 2,5                               | 25 | 17.000                                                                             | 1.800     | 0,050 | 0,025 | 15.000                                                                                                           | 1.600     | 0,050 | 0,020 |  |  |  |  |
| 3,0                               | 5  | 16.000                                                                             | 2.100     | 0,066 | 0,300 | 14.000                                                                                                           | 1.900     | 0,065 | 0,250 |  |  |  |  |
| 3,0                               | 10 | 16.000                                                                             | 2.100     | 0,066 | 0,210 | 14.000                                                                                                           | 1.900     | 0,065 | 0,250 |  |  |  |  |
| 3,0                               | 15 | 16.000                                                                             | 2.100     | 0,066 | 0,120 | 14.000                                                                                                           | 1.900     | 0,065 | 0,100 |  |  |  |  |
| 3,0                               | 20 | 14.000                                                                             | 1.700     | 0,060 | 0,120 | 13.000                                                                                                           | 1.600     | 0,060 | 0,100 |  |  |  |  |
| 3,0                               | 25 | 14.000                                                                             | 1.700     | 0,060 | 0,100 | 13.000                                                                                                           | 1.600     | 0,060 | 0,080 |  |  |  |  |
| 3,0                               | 30 | 14.000                                                                             | 1.700     | 0,060 | 0,080 | 13.000                                                                                                           | 1.600     | 0,060 | 0,070 |  |  |  |  |
| 4,0                               | 10 | 12.000                                                                             | 2.400     | 0,100 | 0,300 | 11.000                                                                                                           | 2.100     | 0,100 | 0,310 |  |  |  |  |
| 4,0                               | 15 | 12.000                                                                             | 2.400     | 0,100 | 0,250 | 11.000                                                                                                           | 2.100     | 0,100 | 0,310 |  |  |  |  |
| 4,0                               | 20 | 11.000                                                                             | 1.900     | 0,090 | 0,200 | 11.000                                                                                                           | 2.100     | 0,100 | 0,200 |  |  |  |  |
| 4,0                               | 25 | 11.000                                                                             | 1.900     | 0,090 | 0,150 | 9.500                                                                                                            | 1.700     | 0,090 | 0,140 |  |  |  |  |
| 4,0                               | 30 | 9.000                                                                              | 1.600     | 0,090 | 0,100 | 7.000                                                                                                            | 1.300     | 0,090 | 0,080 |  |  |  |  |
| 5,0                               | 10 | 9.000                                                                              | 2.300     | 0,120 | 0,400 | 10.000                                                                                                           | 2.400     | 0,150 | 0,400 |  |  |  |  |
| 5,0                               | 15 | 9.000                                                                              | 2.300     | 0,120 | 0,380 | 10.000                                                                                                           | 2.400     | 0,150 | 0,350 |  |  |  |  |
| 5,0                               | 20 | 9.000                                                                              | 2.300     | 0,120 | 0,350 | 8.500                                                                                                            | 2.100     | 0,120 | 0,300 |  |  |  |  |
| 5,0                               | 30 | 9.000                                                                              | 2.300     | 0,120 | 0,200 | 8.500                                                                                                            | 2.100     | 0,120 | 0,300 |  |  |  |  |
| 5,0                               | 40 | 8.500                                                                              | 2.000     | 0,110 | 0,120 | 7.500                                                                                                            | 1.700     | 0,100 | 0,120 |  |  |  |  |
| 6,0                               | 10 | 9.000                                                                              | 2.300     | 0,120 | 0,400 | 9.000                                                                                                            | 3.200     | 0,180 | 0,400 |  |  |  |  |
| 6,0                               | 15 | 9.000                                                                              | 2.300     | 0,120 | 0,400 | 9.000                                                                                                            | 3.200     | 0,180 | 0,350 |  |  |  |  |
| 6,0                               | 20 | 8.000                                                                              | 2.400     | 0,150 | 0,300 | 7.000                                                                                                            | 2.100     | 0,150 | 0,300 |  |  |  |  |
| 6,0                               | 30 | 8.000                                                                              | 2.200     | 0,140 | 0,250 | 7.000                                                                                                            | 2.100     | 0,150 | 0,300 |  |  |  |  |
| 6,0                               | 40 | 7.000                                                                              | 2.000     | 0,130 | 0,240 | 6.500                                                                                                            | 1.700     | 0,130 | 0,200 |  |  |  |  |
| 6,0                               | 50 | 5.500                                                                              | 1.500     | 0,130 | 0,160 | 5.000                                                                                                            | 1.300     | 0,130 | 0,140 |  |  |  |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

|              |              |                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |
|--------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|
| Art. 30.6261 | Art. 30.6262 | Richtwerte für den Einsatz von Karnasch Vollhartmetall-Fräsern für HSC/HHC/HPC- Bearbeitung<br>Recommended cutting data for solid carbide end mills HSC/HHC/HPC |  |  |  |  |  |  |  |  |  |  |  |
| Art. 30.6255 | Art. 30.6265 | Art. 30.6256                                                                                                                                                    |  |  |  |  |  |  |  |  |  |  |  |

| Werkstoffgruppe<br>Material group |     | 4.1 – 4.2 – 4.3<br>Rostfreie Stähle / Stainless steels<br>austenitisch/ferritisch / austenitic/ferritic<br>35 - 45 HRC |           |       |       | 8.1 –<br>gehärtete Stähle / Hardened steels<br>45 - 55 HRC |           |       |       | 8.2 – 8.3<br>gehärtete Stähle / Hardened steels<br>55 - 70 HRC |           |       |       |
|-----------------------------------|-----|------------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------|-----------|-------|-------|----------------------------------------------------------------|-----------|-------|-------|
| d1                                | Is  | min <sup>1</sup>                                                                                                       | Vf mm/min | fz mm | ap mm | min <sup>1</sup>                                           | Vf mm/min | fz mm | ap mm | min <sup>1</sup>                                               | Vf mm/min | fz mm | ap mm |
| 0,1                               | 0,2 | 48.000                                                                                                                 | 960       | 0,010 | 0,010 | 44.000                                                     | 880       | 0,010 | 0,010 | 42.000                                                         | 672       | 0,008 | 0,010 |
| 0,1                               | 0,3 | 48.000                                                                                                                 | 960       | 0,010 | 0,010 | 44.000                                                     | 880       | 0,010 | 0,010 | 42.000                                                         | 672       | 0,008 | 0,008 |
| 0,1                               | 0,4 | 48.000                                                                                                                 | 960       | 0,010 | 0,008 | 44.000                                                     | 704       | 0,010 | 0,008 | 42.000                                                         | 672       | 0,008 | 0,006 |
| 0,2                               | 0,5 | 42.000                                                                                                                 | 1.100     | 0,012 | 0,015 | 38.000                                                     | 850       | 0,012 | 0,011 | 35.000                                                         | 700       | 0,010 | 0,011 |
| 0,2                               | 1   | 42.000                                                                                                                 | 1.100     | 0,012 | 0,010 | 38.000                                                     | 850       | 0,012 | 0,009 | 35.000                                                         | 700       | 0,010 | 0,008 |
| 0,2                               | 1,5 | 40.000                                                                                                                 | 800       | 0,010 | 0,006 | 35.500                                                     | 710       | 0,010 | 0,005 | 33.000                                                         | 528       | 0,008 | 0,005 |
| 0,2                               | 2   | 36.000                                                                                                                 | 720       | 0,010 | 0,006 | 31.000                                                     | 620       | 0,010 | 0,005 | 30.000                                                         | 480       | 0,008 | 0,005 |
| 0,3                               | 1   | 41.000                                                                                                                 | 1.100     | 0,014 | 0,016 | 36.000                                                     | 850       | 0,012 | 0,014 | 34.000                                                         | 680       | 0,010 | 0,012 |
| 0,3                               | 1,5 | 38.000                                                                                                                 | 1.064     | 0,014 | 0,013 | 34.000                                                     | 816       | 0,012 | 0,012 | 32.000                                                         | 640       | 0,010 | 0,009 |
| 0,3                               | 2   | 36.000                                                                                                                 | 1.000     | 0,014 | 0,010 | 32.000                                                     | 800       | 0,012 | 0,008 | 30.000                                                         | 620       | 0,010 | 0,006 |
| 0,3                               | 2,5 | 34.000                                                                                                                 | 952       | 0,014 | 0,008 | 30.000                                                     | 720       | 0,012 | 0,006 | 28.000                                                         | 560       | 0,010 | 0,005 |
| 0,3                               | 3   | 32.000                                                                                                                 | 800       | 0,014 | 0,006 | 29.000                                                     | 700       | 0,012 | 0,005 | 27.000                                                         | 550       | 0,010 | 0,004 |
| 0,3                               | 5   | 28.000                                                                                                                 | 500       | 0,010 | 0,003 | 25.000                                                     | 500       | 0,010 | 0,003 | 24.000                                                         | 380       | 0,008 | 0,002 |
| 0,4                               | 1   | 34.000                                                                                                                 | 1.088     | 0,016 | 0,022 | 30.000                                                     | 900       | 0,015 | 0,020 | 28.000                                                         | 672       | 0,012 | 0,018 |
| 0,4                               | 1,5 | 34.000                                                                                                                 | 1.088     | 0,016 | 0,022 | 30.000                                                     | 900       | 0,015 | 0,018 | 28.000                                                         | 672       | 0,012 | 0,018 |
| 0,4                               | 2   | 34.000                                                                                                                 | 1.100     | 0,016 | 0,022 | 30.000                                                     | 900       | 0,015 | 0,018 | 28.000                                                         | 750       | 0,013 | 0,017 |
| 0,4                               | 3   | 30.000                                                                                                                 | 1.000     | 0,016 | 0,012 | 27.000                                                     | 800       | 0,015 | 0,010 | 25.000                                                         | 680       | 0,013 | 0,010 |
| 0,4                               | 4   | 30.000                                                                                                                 | 1.000     | 0,016 | 0,008 | 27.000                                                     | 800       | 0,015 | 0,007 | 25.000                                                         | 680       | 0,013 | 0,005 |
| 0,4                               | 5   | 30.000                                                                                                                 | 700       | 0,012 | 0,006 | 24.000                                                     | 480       | 0,010 | 0,004 | 22.000                                                         | 440       | 0,010 | 0,003 |
| 0,4                               | 6   | 25.000                                                                                                                 | 400       | 0,008 | 0,003 | 24.000                                                     | 480       | 0,010 | 0,002 | –                                                              | –         | –     | –     |
| 0,5                               | 1   | 35.500                                                                                                                 | 1.420     | 0,020 | 0,025 | 31.500                                                     | 1.134     | 0,018 | 0,020 | 29.500                                                         | 885       | 0,015 | 0,020 |
| 0,5                               | 2   | 36.000                                                                                                                 | 1.500     | 0,020 | 0,022 | 32.000                                                     | 1.100     | 0,018 | 0,020 | 30.000                                                         | 880       | 0,015 | 0,016 |
| 0,5                               | 3   | 30.000                                                                                                                 | 1.100     | 0,018 | 0,015 | 26.000                                                     | 800       | 0,016 | 0,012 | 24.000                                                         | 630       | 0,013 | 0,012 |
| 0,5                               | 4   | 30.000                                                                                                                 | 1.100     | 0,018 | 0,015 | 26.000                                                     | 800       | 0,016 | 0,012 | 24.000                                                         | 630       | 0,013 | 0,012 |
| 0,5                               | 5   | 30.000                                                                                                                 | 1.100     | 0,018 | 0,010 | 26.000                                                     | 800       | 0,016 | 0,008 | 24.000                                                         | 630       | 0,013 | 0,008 |
| 0,5                               | 6   | 26.000                                                                                                                 | 700       | 0,014 | 0,010 | 23.000                                                     | 600       | 0,013 | 0,008 | 21.000                                                         | 500       | 0,012 | 0,006 |
| 0,6                               | 2   | 26.000                                                                                                                 | 1.800     | 0,025 | 0,028 | 32.000                                                     | 1.400     | 0,022 | 0,020 | 30.000                                                         | 1.050     | 0,018 | 0,020 |
| 0,6                               | 3   | 29.000                                                                                                                 | 1.300     | 0,022 | 0,018 | 26.000                                                     | 1.000     | 0,020 | 0,016 | 30.000                                                         | 1.050     | 0,018 | 0,018 |
| 0,6                               | 4   | 29.000                                                                                                                 | 1.300     | 0,022 | 0,015 | 26.000                                                     | 1.000     | 0,020 | 0,016 | 24.000                                                         | 800       | 0,016 | 0,014 |
| 0,6                               | 5   | 29.000                                                                                                                 | 1.300     | 0,022 | 0,012 | 26.000                                                     | 1.000     | 0,020 | 0,010 | 24.000                                                         | 800       | 0,016 | 0,010 |
| 0,6                               | 6   | 29.000                                                                                                                 | 1.300     | 0,022 | 0,012 | 26.000                                                     | 1.000     | 0,020 | 0,010 | 24.000                                                         | 800       | 0,016 | 0,008 |
| 0,6                               | 8   | 28.000                                                                                                                 | 1.100     | 0,020 | 0,010 | 25.000                                                     | 900       | 0,018 | 0,008 | 23.000                                                         | 700       | 0,014 | 0,007 |
| 0,7                               | 4   | 29.000                                                                                                                 | 1.300     | 0,022 | 0,018 | 26.000                                                     | 1.000     | 0,020 | 0,016 | 24.000                                                         | 800       | 0,016 | 0,014 |
| 0,7                               | 8   | 28.000                                                                                                                 | 1.100     | 0,020 | 0,012 | 25.000                                                     | 900       | 0,018 | 0,008 | 23.000                                                         | 700       | 0,014 | 0,008 |
| 0,8                               | 2   | 34.000                                                                                                                 | 1.400     | 0,022 | 0,050 | 30.000                                                     | 1.100     | 0,018 | 0,040 | 28.000                                                         | 950       | 0,017 | 0,035 |
| 0,8                               | 4   | 34.000                                                                                                                 | 1.400     | 0,022 | 0,045 | 30.000                                                     | 1.100     | 0,018 | 0,035 | 28.000                                                         | 950       | 0,017 | 0,030 |
| 0,8                               | 5   | 30.000                                                                                                                 | 1.300     | 0,022 | 0,025 | 27.000                                                     | 900       | 0,016 | 0,020 | 28.000                                                         | 950       | 0,017 | 0,025 |
| 0,8                               | 6   | 30.000                                                                                                                 | 1.300     | 0,022 | 0,025 | 27.000                                                     | 900       | 0,016 | 0,020 | 25.000                                                         | 850       | 0,017 | 0,018 |
| 0,8                               | 7   | 30.000                                                                                                                 | 1.300     | 0,022 | 0,015 | 27.000                                                     | 900       | 0,016 | 0,012 | 25.000                                                         | 850       | 0,017 | 0,015 |
| 0,8                               | 8   | 30.000                                                                                                                 | 1.300     | 0,022 | 0,015 | 27.000                                                     | 900       | 0,016 | 0,012 | 25.000                                                         | 850       | 0,017 | 0,012 |
| 0,8                               | 10  | 28.000                                                                                                                 | 1.100     | 0,020 | 0,010 | 24.000                                                     | 800       | 0,016 | 0,090 | 22.500                                                         | 680       | 0,015 | 0,080 |
| 0,9                               | 6   | 30.000                                                                                                                 | 1.300     | 0,022 | 0,025 | 27.000                                                     | 900       | 0,016 | 0,020 | 28.000                                                         | 750       | 0,017 | 0,018 |
| 0,9                               | 12  | 26.000                                                                                                                 | 1.000     | 0,020 | 0,008 | 24.000                                                     | 800       | 0,016 | 0,008 | 22.500                                                         | 670       | 0,015 | 0,015 |
| 1,0                               | 2   | 30.500                                                                                                                 | 1.830     | 0,030 | 0,070 | 27.000                                                     | 1.512     | 0,028 | 0,055 | 25.000                                                         | 1.250     | 0,025 | 0,050 |
| 1,0                               | 3   | 30.000                                                                                                                 | 1.900     | 0,030 | 0,055 | 27.000                                                     | 1.500     | 0,028 | 0,055 | 25.000                                                         | 1.300     | 0,025 | 0,045 |
| 1,0                               | 4   | 30.000                                                                                                                 | 1.900     | 0,030 | 0,050 | 27.000                                                     | 1.500     | 0,028 | 0,045 | 25.000                                                         | 1.300     | 0,025 | 0,040 |
| 1,0                               | 5   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,025 | 25.000                                                         | 1.300     | 0,025 | 0,030 |
| 1,0                               | 6   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,025 | 22.500                                                         | 1.100     | 0,025 | 0,020 |
| 1,0                               | 7   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,020 | 22.500                                                         | 1.100     | 0,025 | 0,020 |
| 1,0                               | 8   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,020 | 22.500                                                         | 1.100     | 0,025 | 0,020 |
| 1,0                               | 9   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,020 | 24.000                                                     | 1.400     | 0,028 | 0,015 | 22.500                                                         | 1.100     | 0,025 | 0,015 |
| 1,0                               | 10  | 27.000                                                                                                                 | 1.700     | 0,030 | 0,020 | 24.000                                                     | 1.400     | 0,028 | 0,015 | 22.500                                                         | 1.100     | 0,025 | 0,015 |
| 1,0                               | 12  | 24.000                                                                                                                 | 1.200     | 0,025 | 0,020 | 22.000                                                     | 1.100     | 0,025 | 0,015 | 20.000                                                         | 850       | 0,022 | 0,015 |
| 1,0                               | 15  | 24.000                                                                                                                 | 1.100     | 0,020 | 0,012 | 21.000                                                     | 900       | 0,022 | 0,010 | 20.000                                                         | 700       | 0,017 | 0,009 |
| 1,0                               | 20  | 18.000                                                                                                                 | 800       | 0,020 | 0,008 | 16.000                                                     | 700       | 0,022 | 0,007 | 15.000                                                         | 550       | 0,017 | 0,005 |
| 1,0                               | 25  | 15.000                                                                                                                 | 450       | 0,015 | 0,004 | 14.000                                                     | 550       | 0,020 | 0,004 | –                                                              | –         | –     | –     |
| 1,0                               | 30  | 12.000                                                                                                                 | 250       | 0,010 | 0,003 | 12.000                                                     | 350       | 0,015 | 0,003 | –                                                              | –         | –     | –     |
| 1,2                               | 6   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,025 | 22.500                                                         | 1.100     | 0,017 | 0,020 |
| 1,2                               | 8   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,020 | 22.500                                                         | 1.100     | 0,017 | 0,020 |
| 1,2                               | 10  | 27.000                                                                                                                 | 1.700     | 0,030 | 0,020 | 24.000                                                     | 1.400     | 0,028 | 0,015 | 22.500                                                         | 1.100     | 0,017 | 0,015 |
| 1,2                               | 12  | 24.000                                                                                                                 | 1.200     | 0,025 | 0,020 | 22.000                                                     | 1.100     | 0,025 | 0,015 | 20.000                                                         | 850       | 0,022 | 0,015 |
| 1,2                               | 15  | 24.000                                                                                                                 | 1.100     | 0,020 | 0,012 | 21.000                                                     | 900       | 0,022 | 0,010 | 20.000                                                         | 700       | 0,017 | 0,009 |
| 1,2                               | 20  | 18.000                                                                                                                 | 800       | 0,020 | 0,008 | 16.000                                                     | 700       | 0,022 | 0,007 | 15.000                                                         | 550       | 0,017 | 0,005 |
| 1,2                               | 25  | 15.000                                                                                                                 | 450       | 0,015 | 0,004 | 14.000                                                     | 550       | 0,020 | 0,004 | –                                                              | –         | –     | –     |
| 1,4                               | 8   | 27.000                                                                                                                 | 1.700     | 0,030 | 0,030 | 24.000                                                     | 1.400     | 0,028 | 0,025 | 22.500                                                         | 1.100     | 0,017 | 0,020 |
| 1,4                               | 15  | 24.000                                                                                                                 | 1.100     | 0,020 | 0,012 | 21.000                                                     | 900       | 0,022 | 0,010 | 20.000                                                         | 700       | 0,017 | 0,009 |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.



|                                                                                                                                                      |  |      |         |      |         |      |         |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|---------|------|---------|------|---------|
| Richtwerte für den Einsatz von Karnasch VHM-Fräsern für HSC/HHC/HPC- Bearbeitung<br>Recommended cutting data for solid carbide end mills HSC/HHC/HPC |  | Art. | 30.6261 | Art. | 30.6262 |      |         |
|                                                                                                                                                      |  | Art. | 30.6256 | Art. | 30.6255 | Art. | 30.6265 |

| Werkstoffgruppe<br>Material group |    | 4.1 – 4.2 – 4.3<br>Rostfreie Stähle / Stainless steels<br>austenitisch/ferritisch / austenitic/ferritic<br>35 - 45 HRC |           |       |       | 8.1 –<br>gehärtete Stähle / Hardened steels<br>45 - 55 HRC |           |       |       | 8.2 – 8.3<br>gehärtete Stähle / Hardened steels<br>55 - 70 HRC |           |       |       |
|-----------------------------------|----|------------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------|-----------|-------|-------|----------------------------------------------------------------|-----------|-------|-------|
|                                   |    | min <sup>1</sup>                                                                                                       | Vf mm/min | fz mm | ap mm | min <sup>1</sup>                                           | Vf mm/min | fz mm | ap mm | min <sup>1</sup>                                               | Vf mm/min | fz mm | ap mm |
| 1,5                               | 4  | 23.500                                                                                                                 | 1.457     | 0,031 | 0,050 | 20.500                                                     | 1.230     | 0,030 | 0,040 | 19.000                                                         | 950       | 0,025 | 0,040 |
| 1,5                               | 6  | 21.000                                                                                                                 | 1.300     | 0,030 | 0,050 | 20.000                                                     | 1.200     | 0,030 | 0,040 | 18.500                                                         | 900       | 0,025 | 0,040 |
| 1,5                               | 8  | 21.000                                                                                                                 | 1.300     | 0,030 | 0,045 | 19.000                                                     | 1.000     | 0,028 | 0,035 | 17.500                                                         | 850       | 0,024 | 0,035 |
| 1,5                               | 10 | 21.000                                                                                                                 | 1.300     | 0,030 | 0,045 | 19.000                                                     | 1.000     | 0,028 | 0,035 | 17.500                                                         | 850       | 0,024 | 0,032 |
| 1,5                               | 12 | 21.000                                                                                                                 | 1.300     | 0,030 | 0,045 | 19.000                                                     | 1.000     | 0,028 | 0,035 | 17.500                                                         | 850       | 0,024 | 0,032 |
| 1,5                               | 14 | 20.000                                                                                                                 | 1.080     | 0,027 | 0,036 | 18.000                                                     | 936       | 0,026 | 0,028 | 16.800                                                         | 773       | 0,023 | 0,025 |
| 1,5                               | 15 | 19.000                                                                                                                 | 900       | 0,025 | 0,030 | 17.000                                                     | 850       | 0,025 | 0,025 | 16.000                                                         | 700       | 0,022 | 0,022 |
| 1,5                               | 16 | 19.000                                                                                                                 | 950       | 0,025 | 0,030 | 17.000                                                     | 850       | 0,025 | 0,025 | 16.000                                                         | 704       | 0,022 | 0,022 |
| 1,5                               | 18 | 19.000                                                                                                                 | 950       | 0,025 | 0,030 | 17.000                                                     | 850       | 0,025 | 0,025 | 16.000                                                         | 704       | 0,022 | 0,020 |
| 1,5                               | 20 | 19.000                                                                                                                 | 900       | 0,025 | 0,030 | 17.000                                                     | 850       | 0,025 | 0,025 | 16.000                                                         | 700       | 0,022 | 0,020 |
| 1,5                               | 25 | 15.000                                                                                                                 | 450       | 0,015 | 0,025 | 15.000                                                     | 600       | 0,020 | 0,020 | 14.000                                                         | 500       | 0,018 | 0,015 |
| 1,5                               | 30 | 15.000                                                                                                                 | 450       | 0,015 | 0,015 | 12.000                                                     | 350       | 0,015 | 0,010 | –                                                              | –         | –     | –     |
| 1,6                               | 8  | 21.000                                                                                                                 | 1.300     | 0,030 | 0,050 | 19.000                                                     | 1.200     | 0,030 | 0,040 | 17.500                                                         | 900       | 0,025 | 0,040 |
| 1,6                               | 15 | 19.000                                                                                                                 | 900       | 0,025 | 0,030 | 17.000                                                     | 850       | 0,025 | 0,025 | 16.000                                                         | 700       | 0,022 | 0,022 |
| 1,8                               | 10 | 21.000                                                                                                                 | 1.300     | 0,030 | 0,045 | 19.000                                                     | 1.000     | 0,028 | 0,035 | 17.500                                                         | 850       | 0,024 | 0,032 |
| 1,8                               | 20 | 19.000                                                                                                                 | 900       | 0,025 | 0,030 | 17.000                                                     | 850       | 0,025 | 0,021 | 16.000                                                         | 700       | 0,018 | 0,020 |
| 2,0                               | 4  | 17.500                                                                                                                 | 2.100     | 0,060 | 0,160 | 15.500                                                     | 1.550     | 0,050 | 0,130 | 14.500                                                         | 1.450     | 0,050 | 0,120 |
| 2,0                               | 6  | 18.000                                                                                                                 | 2.400     | 0,065 | 0,140 | 16.000                                                     | 1.700     | 0,050 | 0,120 | 15.000                                                         | 1.400     | 0,045 | 0,100 |
| 2,0                               | 8  | 18.000                                                                                                                 | 2.400     | 0,065 | 0,110 | 16.000                                                     | 1.700     | 0,050 | 0,090 | 15.000                                                         | 1.400     | 0,045 | 0,080 |
| 2,0                               | 10 | 16.000                                                                                                                 | 2.000     | 0,060 | 0,060 | 16.000                                                     | 1.700     | 0,050 | 0,050 | 15.000                                                         | 1.400     | 0,045 | 0,060 |
| 2,0                               | 12 | 16.000                                                                                                                 | 2.000     | 0,060 | 0,060 | 14.000                                                     | 1.500     | 0,050 | 0,050 | 13.000                                                         | 1.200     | 0,045 | 0,040 |
| 2,0                               | 15 | 16.000                                                                                                                 | 1.900     | 0,060 | 0,060 | 14.000                                                     | 1.500     | 0,050 | 0,050 | 13.000                                                         | 1.200     | 0,045 | 0,040 |
| 2,0                               | 20 | 16.000                                                                                                                 | 1.900     | 0,060 | 0,040 | 14.000                                                     | 1.500     | 0,050 | 0,030 | 13.000                                                         | 1.200     | 0,045 | 0,030 |
| 2,0                               | 25 | 14.000                                                                                                                 | 1.500     | 0,050 | 0,020 | 13.000                                                     | 1.250     | 0,048 | 0,016 | 11.500                                                         | 900       | 0,040 | 0,015 |
| 2,0                               | 30 | 14.000                                                                                                                 | 1.500     | 0,050 | 0,014 | 13.000                                                     | 1.250     | 0,048 | 0,011 | 11.500                                                         | 900       | 0,040 | 0,010 |
| 2,5                               | 10 | 16.000                                                                                                                 | 2.000     | 0,060 | 0,060 | 16.000                                                     | 1.700     | 0,050 | 0,120 | 12.000                                                         | 1.200     | 0,045 | 0,045 |
| 2,5                               | 15 | 16.000                                                                                                                 | 1.900     | 0,060 | 0,060 | 14.000                                                     | 1.500     | 0,050 | 0,050 | 12.000                                                         | 1.200     | 0,045 | 0,040 |
| 2,5                               | 20 | 16.000                                                                                                                 | 1.900     | 0,060 | 0,040 | 14.000                                                     | 1.500     | 0,050 | 0,030 | 12.000                                                         | 1.200     | 0,045 | 0,035 |
| 2,5                               | 25 | 14.000                                                                                                                 | 1.500     | 0,050 | 0,020 | 13.000                                                     | 1.250     | 0,048 | 0,016 | 11.500                                                         | 900       | 0,040 | 0,020 |
| 3,0                               | 5  | 13.000                                                                                                                 | 1.700     | 0,065 | 0,240 | 12.000                                                     | 1.300     | 0,055 | 0,190 | 11.000                                                         | 1.000     | 0,045 | 0,180 |
| 3,0                               | 10 | 13.000                                                                                                                 | 1.700     | 0,065 | 0,160 | 12.000                                                     | 1.300     | 0,055 | 0,130 | 11.000                                                         | 1.000     | 0,045 | 0,160 |
| 3,0                               | 15 | 13.000                                                                                                                 | 1.700     | 0,065 | 0,160 | 12.000                                                     | 1.300     | 0,055 | 0,070 | 11.000                                                         | 1.000     | 0,045 | 0,070 |
| 3,0                               | 20 | 12.000                                                                                                                 | 1.400     | 0,060 | 0,090 | 11.000                                                     | 1.150     | 0,054 | 0,070 | 10.000                                                         | 950       | 0,045 | 0,070 |
| 3,0                               | 25 | 12.000                                                                                                                 | 1.400     | 0,060 | 0,060 | 11.000                                                     | 1.150     | 0,054 | 0,050 | 10.000                                                         | 950       | 0,045 | 0,055 |
| 3,0                               | 30 | 12.000                                                                                                                 | 1.400     | 0,060 | 0,050 | 11.000                                                     | 1.150     | 0,054 | 0,045 | 10.000                                                         | 950       | 0,045 | 0,045 |
| 4,0                               | 10 | 10.000                                                                                                                 | 2.000     | 0,100 | 0,250 | 9.000                                                      | 1.400     | 0,080 | 0,200 | 8.500                                                          | 1.100     | 0,065 | 0,200 |
| 4,0                               | 15 | 10.000                                                                                                                 | 2.000     | 0,100 | 0,250 | 9.000                                                      | 1.400     | 0,080 | 0,200 | 8.500                                                          | 1.100     | 0,065 | 0,120 |
| 4,0                               | 20 | 9.000                                                                                                                  | 1.600     | 0,090 | 0,120 | 8.000                                                      | 1.150     | 0,070 | 0,100 | 7.500                                                          | 900       | 0,060 | 0,090 |
| 4,0                               | 25 | 9.000                                                                                                                  | 1.600     | 0,090 | 0,120 | 8.000                                                      | 1.150     | 0,070 | 0,100 | 7.500                                                          | 900       | 0,060 | 0,090 |
| 4,0                               | 30 | 6.500                                                                                                                  | 1.200     | 0,090 | 0,080 | 6.000                                                      | 850       | 0,070 | 0,060 | 5.500                                                          | 700       | 0,060 | 0,050 |
| 5,0                               | 10 | 8.000                                                                                                                  | 2.000     | 0,120 | 0,300 | 7.000                                                      | 1.400     | 0,100 | 0,250 | 6.800                                                          | 1.100     | 0,080 | 0,250 |
| 5,0                               | 15 | 8.000                                                                                                                  | 2.000     | 0,120 | 0,250 | 7.000                                                      | 1.400     | 0,100 | 0,200 | 6.800                                                          | 1.100     | 0,080 | 0,220 |
| 5,0                               | 20 | 8.000                                                                                                                  | 2.000     | 0,120 | 0,250 | 7.000                                                      | 1.400     | 0,100 | 0,200 | 6.800                                                          | 1.100     | 0,080 | 0,200 |
| 5,0                               | 30 | 7.300                                                                                                                  | 1.500     | 0,100 | 0,100 | 6.500                                                      | 1.150     | 0,090 | 0,080 | 6.800                                                          | 1.100     | 0,080 | 0,100 |
| 5,0                               | 40 | 7.300                                                                                                                  | 1.500     | 0,100 | 0,080 | 6.500                                                      | 1.150     | 0,090 | 0,070 | 6.000                                                          | 900       | 0,075 | 0,080 |
| 6,0                               | 10 | 7.000                                                                                                                  | 2.000     | 0,150 | 0,280 | 6.000                                                      | 1.400     | 0,120 | 0,240 | 5.500                                                          | 1.100     | 0,10  | 0,250 |
| 6,0                               | 15 | 7.000                                                                                                                  | 2.000     | 0,150 | 0,260 | 6.000                                                      | 1.400     | 0,120 | 0,200 | 5.500                                                          | 1.100     | 0,10  | 0,220 |
| 6,0                               | 20 | 7.000                                                                                                                  | 2.000     | 0,150 | 0,250 | 6.000                                                      | 1.400     | 0,120 | 0,200 | 5.500                                                          | 1.100     | 0,10  | 0,200 |
| 6,0                               | 30 | 6.000                                                                                                                  | 1.500     | 0,120 | 0,180 | 5.500                                                      | 1.150     | 0,100 | 0,150 | 5.000                                                          | 900       | 0,09  | 0,140 |
| 6,0                               | 40 | 4.700                                                                                                                  | 1.200     | 0,120 | 0,120 | 4.100                                                      | 900       | 0,100 | 0,100 | 5.000                                                          | 900       | 0,09  | 0,100 |
| 6,0                               | 50 | 4.700                                                                                                                  | 1.200     | 0,020 | 0,080 | 4.100                                                      | 900       | 0,100 | 0,090 | 4.000                                                          | 700       | 0,09  | 0,080 |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

Art. 30.6264Art. 30.6257

Richtwerte für den Einsatz von Karnasch VHM-Fräsern für HSC/HHC/HPC- Bearbeitung  
Recommended cutting data for solid carbide end mills HSC/HHC/HPC

| Werkstoffgruppe<br>Material group |     | 1.1 – 1.2 – 1.3 – 1.4 – 1.5<br>Unlegierte Stähle / Unalloyed steels<br>< 850 N/mm² |           |       |       |       | 2.1 – 2.2 – 2.3 – 2.4 – 2.5 – 2.6 – 3.1 – 3.2<br>Vergütungsstähle / Heat-treated steels<br>< 35 HRC (1200 N/mm²) |           |       |       |       |  |  |  |  |  |
|-----------------------------------|-----|------------------------------------------------------------------------------------|-----------|-------|-------|-------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|-------|--|--|--|--|--|
| d1                                | Is  | min¹                                                                               | Vf mm/min | fz mm | ap mm | ae mm | min¹                                                                                                             | Vf mm/min | fz mm | ap mm | ae mm |  |  |  |  |  |
| 0,1                               | 0,2 | 50.000                                                                             | 1.000     | 0,010 | 0,100 | 0,030 | 45.000                                                                                                           | 900       | 0,010 | 0,010 | 0,025 |  |  |  |  |  |
| 0,1                               | 0,3 | 50.000                                                                             | 1.000     | 0,010 | 0,100 | 0,020 | 45.000                                                                                                           | 900       | 0,010 | 0,009 | 0,020 |  |  |  |  |  |
| 0,1                               | 0,4 | 50.000                                                                             | 800       | 0,008 | 0,100 | 0,011 | 45.000                                                                                                           | 900       | 0,010 | 0,007 | 0,010 |  |  |  |  |  |
| 0,2                               | 0,5 | 50.000                                                                             | 2.250     | 0,023 | 0,020 | 0,060 | 45.000                                                                                                           | 2.000     | 0,022 | 0,018 | 0,050 |  |  |  |  |  |
| 0,2                               | 1   | 50.000                                                                             | 2.250     | 0,023 | 0,020 | 0,040 | 45.000                                                                                                           | 2.000     | 0,022 | 0,012 | 0,030 |  |  |  |  |  |
| 0,2                               | 1,5 | 50.000                                                                             | 2.300     | 0,023 | 0,020 | 0,020 | 45.000                                                                                                           | 1.800     | 0,020 | 0,010 | 0,025 |  |  |  |  |  |
| 0,3                               | 1   | 50.000                                                                             | 2.250     | 0,023 | 0,020 | 0,060 | 45.000                                                                                                           | 2.000     | 0,022 | 0,018 | 0,050 |  |  |  |  |  |
| 0,3                               | 1,5 | 50.000                                                                             | 2.200     | 0,022 | 0,015 | 0,045 | 45.000                                                                                                           | 1.800     | 0,020 | 0,015 | 0,040 |  |  |  |  |  |
| 0,3                               | 2   | 50.000                                                                             | 2.000     | 0,020 | 0,012 | 0,035 | 45.000                                                                                                           | 1.800     | 0,020 | 0,010 | 0,030 |  |  |  |  |  |
| 0,3                               | 2,5 | 50.000                                                                             | 1.900     | 0,019 | 0,010 | 0,025 | 36.000                                                                                                           | 1.440     | 0,020 | 0,008 | 0,025 |  |  |  |  |  |
| 0,3                               | 3   | 40.000                                                                             | 1.400     | 0,018 | 0,008 | 0,020 | 36.000                                                                                                           | 1.300     | 0,018 | 0,006 | 0,020 |  |  |  |  |  |
| 0,3                               | 5   | 30.000                                                                             | 480       | 0,008 | 0,005 | 0,005 | 30.000                                                                                                           | 700       | 0,012 | 0,003 | 0,010 |  |  |  |  |  |
| 0,4                               | 1   | 40.000                                                                             | 2.400     | 0,030 | 0,030 | 0,080 | 36.000                                                                                                           | 2.520     | 0,035 | 0,030 | 0,070 |  |  |  |  |  |
| 0,4                               | 1,5 | 40.000                                                                             | 2.400     | 0,030 | 0,030 | 0,080 | 36.000                                                                                                           | 2.160     | 0,030 | 0,025 | 0,070 |  |  |  |  |  |
| 0,4                               | 2   | 40.000                                                                             | 2.400     | 0,030 | 0,025 | 0,080 | 36.000                                                                                                           | 2.100     | 0,030 | 0,025 | 0,070 |  |  |  |  |  |
| 0,4                               | 3   | 36.000                                                                             | 2.000     | 0,026 | 0,015 | 0,045 | 32.500                                                                                                           | 1.700     | 0,025 | 0,014 | 0,040 |  |  |  |  |  |
| 0,4                               | 4   | 32.000                                                                             | 1.500     | 0,024 | 0,010 | 0,030 | 29.000                                                                                                           | 1.400     | 0,024 | 0,008 | 0,025 |  |  |  |  |  |
| 0,4                               | 5   | 28.000                                                                             | 850       | 0,015 | 0,008 | 0,020 | 25.000                                                                                                           | 1.000     | 0,010 | 0,005 | 0,015 |  |  |  |  |  |
| 0,4                               | 6   | 20.000                                                                             | 320       | 0,008 | 0,005 | 0,010 | 20.000                                                                                                           | 320       | 0,008 | 0,002 | 0,010 |  |  |  |  |  |
| 0,5                               | 1   | 40.000                                                                             | 2.400     | 0,030 | 0,030 | 0,110 | 36.000                                                                                                           | 2.520     | 0,035 | 0,030 | 0,090 |  |  |  |  |  |
| 0,5                               | 2   | 40.000                                                                             | 2.400     | 0,030 | 0,030 | 0,100 | 36.000                                                                                                           | 2.100     | 0,030 | 0,030 | 0,090 |  |  |  |  |  |
| 0,5                               | 3   | 36.000                                                                             | 1.900     | 0,027 | 0,030 | 0,090 | 32.500                                                                                                           | 1.600     | 0,025 | 0,025 | 0,080 |  |  |  |  |  |
| 0,5                               | 4   | 36.000                                                                             | 1.900     | 0,027 | 0,020 | 0,050 | 32.500                                                                                                           | 1.600     | 0,025 | 0,018 | 0,050 |  |  |  |  |  |
| 0,5                               | 5   | 32.000                                                                             | 1.500     | 0,024 | 0,015 | 0,045 | 29.000                                                                                                           | 1.400     | 0,024 | 0,015 | 0,045 |  |  |  |  |  |
| 0,5                               | 6   | 32.000                                                                             | 1.500     | 0,024 | 0,012 | 0,035 | 29.000                                                                                                           | 1.400     | 0,024 | 0,012 | 0,035 |  |  |  |  |  |
| 0,6                               | 2   | 40.000                                                                             | 3.000     | 0,038 | 0,040 | 0,120 | 36.000                                                                                                           | 2.700     | 0,038 | 0,035 | 0,110 |  |  |  |  |  |
| 0,6                               | 3   | 36.000                                                                             | 2.400     | 0,034 | 0,022 | 0,070 | 36.000                                                                                                           | 2.700     | 0,038 | 0,026 | 0,080 |  |  |  |  |  |
| 0,6                               | 4   | 36.000                                                                             | 2.400     | 0,034 | 0,022 | 0,065 | 32.500                                                                                                           | 2.200     | 0,034 | 0,022 | 0,060 |  |  |  |  |  |
| 0,6                               | 5   | 32.000                                                                             | 2.000     | 0,030 | 0,015 | 0,045 | 29.000                                                                                                           | 1.700     | 0,030 | 0,120 | 0,050 |  |  |  |  |  |
| 0,6                               | 6   | 32.000                                                                             | 2.000     | 0,030 | 0,015 | 0,040 | 29.000                                                                                                           | 1.700     | 0,030 | 0,120 | 0,030 |  |  |  |  |  |
| 0,6                               | 8   | 32.000                                                                             | 2.000     | 0,030 | 0,015 | 0,035 | 29.000                                                                                                           | 1.700     | 0,030 | 0,010 | 0,025 |  |  |  |  |  |
| 0,7                               | 4   | 36.000                                                                             | 2.400     | 0,034 | 0,022 | 0,070 | 36.000                                                                                                           | 2.700     | 0,038 | 0,050 | 0,120 |  |  |  |  |  |
| 0,7                               | 8   | 32.000                                                                             | 2.000     | 0,030 | 0,015 | 0,028 | 29.000                                                                                                           | 1.700     | 0,030 | 0,015 | 0,050 |  |  |  |  |  |
| 0,8                               | 2   | 40.000                                                                             | 3.000     | 0,038 | 0,080 | 0,220 | 36.000                                                                                                           | 2.700     | 0,038 | 0,070 | 0,200 |  |  |  |  |  |
| 0,8                               | 4   | 40.000                                                                             | 3.000     | 0,038 | 0,050 | 0,160 | 36.000                                                                                                           | 2.700     | 0,038 | 0,050 | 0,150 |  |  |  |  |  |
| 0,8                               | 5   | 40.000                                                                             | 3.000     | 0,038 | 0,040 | 0,140 | 35.000                                                                                                           | 2.100     | 0,034 | 0,028 | 0,080 |  |  |  |  |  |
| 0,8                               | 6   | 36.000                                                                             | 2.400     | 0,034 | 0,030 | 0,090 | 35.000                                                                                                           | 2.100     | 0,034 | 0,026 | 0,075 |  |  |  |  |  |
| 0,8                               | 7   | 32.000                                                                             | 1.900     | 0,030 | 0,020 | 0,070 | 29.000                                                                                                           | 1.700     | 0,030 | 0,018 | 0,050 |  |  |  |  |  |
| 0,8                               | 8   | 32.000                                                                             | 1.900     | 0,030 | 0,020 | 0,060 | 29.000                                                                                                           | 1.700     | 0,030 | 0,018 | 0,045 |  |  |  |  |  |
| 0,8                               | 10  | 32.000                                                                             | 1.900     | 0,030 | 0,020 | 0,050 | 29.000                                                                                                           | 1.700     | 0,030 | 0,018 | 0,045 |  |  |  |  |  |
| 0,9                               | 6   | 36.000                                                                             | 2.400     | 0,034 | 0,030 | 0,090 | 32.500                                                                                                           | 2.100     | 0,034 | 0,028 | 0,090 |  |  |  |  |  |
| 0,9                               | 12  | 28.000                                                                             | 2.000     | 0,035 | 0,020 | 0,060 | 29.000                                                                                                           | 1.700     | 0,029 | 0,015 | 0,040 |  |  |  |  |  |
| 1,0                               | 2   | 36.000                                                                             | 3.240     | 0,045 | 0,110 | 0,320 | 33.000                                                                                                           | 2.970     | 0,045 | 0,090 | 0,260 |  |  |  |  |  |
| 1,0                               | 3   | 36.000                                                                             | 3.200     | 0,045 | 0,100 | 0,300 | 32.500                                                                                                           | 2.900     | 0,045 | 0,090 | 0,260 |  |  |  |  |  |
| 1,0                               | 4   | 36.000                                                                             | 3.200     | 0,045 | 0,070 | 0,200 | 32.500                                                                                                           | 2.900     | 0,045 | 0,060 | 0,180 |  |  |  |  |  |
| 1,0                               | 5   | 32.000                                                                             | 2.600     | 0,040 | 0,040 | 0,100 | 29.000                                                                                                           | 2.300     | 0,040 | 0,035 | 0,100 |  |  |  |  |  |
| 1,0                               | 6   | 32.000                                                                             | 2.600     | 0,040 | 0,040 | 0,100 | 29.000                                                                                                           | 2.300     | 0,040 | 0,035 | 0,100 |  |  |  |  |  |
| 1,0                               | 7   | 32.000                                                                             | 2.600     | 0,040 | 0,040 | 0,100 | 29.000                                                                                                           | 2.300     | 0,040 | 0,030 | 0,090 |  |  |  |  |  |
| 1,0                               | 8   | 32.000                                                                             | 2.600     | 0,040 | 0,030 | 0,100 | 29.000                                                                                                           | 2.300     | 0,040 | 0,030 | 0,090 |  |  |  |  |  |
| 1,0                               | 9   | 32.000                                                                             | 2.600     | 0,040 | 0,025 | 0,075 | 29.000                                                                                                           | 2.300     | 0,040 | 0,022 | 0,060 |  |  |  |  |  |
| 1,0                               | 10  | 32.000                                                                             | 2.600     | 0,040 | 0,025 | 0,075 | 29.000                                                                                                           | 2.300     | 0,040 | 0,022 | 0,060 |  |  |  |  |  |
| 1,0                               | 12  | 29.000                                                                             | 2.000     | 0,035 | 0,025 | 0,070 | 26.000                                                                                                           | 1.800     | 0,036 | 0,022 | 0,060 |  |  |  |  |  |
| 1,0                               | 15  | 29.000                                                                             | 2.000     | 0,035 | 0,020 | 0,065 | 26.000                                                                                                           | 1.600     | 0,032 | 0,012 | 0,040 |  |  |  |  |  |
| 1,0                               | 20  | 21.500                                                                             | 1.400     | 0,032 | 0,010 | 0,025 | 19.500                                                                                                           | 1.200     | 0,032 | 0,009 | 0,020 |  |  |  |  |  |
| 1,0                               | 25  | 18.000                                                                             | 900       | 0,025 | 0,010 | 0,015 | 19.500                                                                                                           | 980       | 0,025 | 0,005 | 0,015 |  |  |  |  |  |
| 1,0                               | 30  | 15.000                                                                             | 600       | 0,020 | 0,008 | 0,010 | 19.500                                                                                                           | 780       | 0,020 | 0,003 | 0,010 |  |  |  |  |  |
| 1,2                               | 5   | 32.000                                                                             | 2.600     | 0,040 | 0,040 | 0,120 | 29.000                                                                                                           | 2.300     | 0,040 | 0,036 | 0,100 |  |  |  |  |  |
| 1,2                               | 6   | 32.000                                                                             | 2.600     | 0,040 | 0,040 | 0,120 | 29.000                                                                                                           | 2.300     | 0,040 | 0,036 | 0,100 |  |  |  |  |  |
| 1,2                               | 8   | 28.000                                                                             | 2.300     | 0,040 | 0,040 | 0,110 | 26.000                                                                                                           | 2.100     | 0,040 | 0,036 | 0,100 |  |  |  |  |  |
| 1,2                               | 10  | 28.000                                                                             | 2.300     | 0,040 | 0,040 | 0,090 | 26.000                                                                                                           | 2.100     | 0,040 | 0,030 | 0,090 |  |  |  |  |  |
| 1,2                               | 12  | 28.000                                                                             | 2.300     | 0,040 | 0,030 | 0,080 | 26.000                                                                                                           | 2.100     | 0,040 | 0,025 | 0,080 |  |  |  |  |  |
| 1,2                               | 15  | 28.000                                                                             | 2.000     | 0,035 | 0,025 | 0,065 | 26.000                                                                                                           | 1.600     | 0,032 | 0,012 | 0,040 |  |  |  |  |  |
| 1,2                               | 20  | 21.500                                                                             | 1.400     | 0,032 | 0,010 | 0,025 | 19.500                                                                                                           | 1.200     | 0,032 | 0,005 | 0,020 |  |  |  |  |  |
| 1,2                               | 25  | 18.000                                                                             | 900       | 0,025 | 0,010 | 0,015 | 19.500                                                                                                           | 980       | 0,025 | 0,005 | 0,015 |  |  |  |  |  |
| 1,4                               | 8   | 25.000                                                                             | 2.000     | 0,040 | 0,050 | 0,160 | 23.000                                                                                                           | 1.800     | 0,040 | 0,050 | 0,140 |  |  |  |  |  |
| 1,4                               | 15  | 23.000                                                                             | 1.600     | 0,035 | 0,030 | 0,100 | 20.000                                                                                                           | 1.400     | 0,035 | 0,030 | 0,080 |  |  |  |  |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

| Werkstoffgruppe<br>Material group |    | 1.1 – 1.2 – 1.3 – 1.4 – 1.5<br>Unlegierte Stähle / Unalloyed steels<br>< 850 N/mm² |           |       |       |       | 2.1 – 2.2 – 2.3 – 2.4 – 2.5 – 2.6 – 3.1 – 3.2<br>Vergütungsstähle / Heat-treated steels<br>< 35 HRC (1200 N/mm²) |           |       |       |       |  |  |  |  |
|-----------------------------------|----|------------------------------------------------------------------------------------|-----------|-------|-------|-------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|-------|--|--|--|--|
| d1                                | l3 | min¹                                                                               | Vf mm/min | fz mm | ap mm | ae mm | min¹                                                                                                             | Vf mm/min | fz mm | ap mm | ae mm |  |  |  |  |
| 1,5                               | 4  | 29.000                                                                             | 2.900     | 0,050 | 0,120 | 0,300 | 28.000                                                                                                           | 2.800     | 0,050 | 0,090 | 0,240 |  |  |  |  |
| 1,5                               | 6  | 28.000                                                                             | 2.500     | 0,045 | 0,100 | 0,250 | 25.000                                                                                                           | 2.200     | 0,045 | 0,080 | 0,240 |  |  |  |  |
| 1,5                               | 8  | 25.000                                                                             | 2.000     | 0,040 | 0,060 | 0,160 | 23.000                                                                                                           | 1.800     | 0,040 | 0,050 | 0,150 |  |  |  |  |
| 1,5                               | 10 | 25.000                                                                             | 2.000     | 0,040 | 0,060 | 0,150 | 23.000                                                                                                           | 1.800     | 0,040 | 0,050 | 0,150 |  |  |  |  |
| 1,5                               | 12 | 25.000                                                                             | 2.000     | 0,040 | 0,050 | 0,140 | 23.000                                                                                                           | 1.800     | 0,040 | 0,050 | 0,120 |  |  |  |  |
| 1,5                               | 14 | 23.000                                                                             | 1.610     | 0,035 | 0,035 | 0,100 | 20.000                                                                                                           | 1.440     | 0,036 | 0,040 | 0,100 |  |  |  |  |
| 1,5                               | 15 | 22.000                                                                             | 1.600     | 0,035 | 0,035 | 0,100 | 20.000                                                                                                           | 1.450     | 0,035 | 0,030 | 0,100 |  |  |  |  |
| 1,5                               | 16 | 22.000                                                                             | 1.540     | 0,035 | 0,035 | 0,100 | 20.000                                                                                                           | 1.400     | 0,035 | 0,030 | 0,100 |  |  |  |  |
| 1,5                               | 18 | 22.000                                                                             | 1.540     | 0,035 | 0,035 | 0,100 | 20.000                                                                                                           | 1.400     | 0,035 | 0,030 | 0,100 |  |  |  |  |
| 1,5                               | 20 | 22.000                                                                             | 1.600     | 0,035 | 0,035 | 0,100 | 20.000                                                                                                           | 1.450     | 0,035 | 0,030 | 0,100 |  |  |  |  |
| 1,5                               | 25 | 22.000                                                                             | 1.600     | 0,030 | 0,030 | 0,080 | 18.000                                                                                                           | 1.100     | 0,030 | 0,020 | 0,070 |  |  |  |  |
| 1,5                               | 30 | 20.000                                                                             | 1.000     | 0,025 | 0,030 | 0,060 | 15.000                                                                                                           | 600       | 0,020 | 0,010 | 0,040 |  |  |  |  |
| 1,6                               | 8  | 26.000                                                                             | 2.600     | 0,050 | 0,100 | 0,300 | 23.000                                                                                                           | 2.300     | 0,050 | 0,090 | 0,280 |  |  |  |  |
| 1,6                               | 15 | 21.000                                                                             | 1.600     | 0,040 | 0,040 | 0,110 | 19.000                                                                                                           | 1.500     | 0,040 | 0,030 | 0,090 |  |  |  |  |
| 1,8                               | 10 | 24.000                                                                             | 2.100     | 0,045 | 0,060 | 0,200 | 23.000                                                                                                           | 2.300     | 0,050 | 0,060 | 0,160 |  |  |  |  |
| 1,8                               | 20 | 21.000                                                                             | 1.600     | 0,040 | 0,040 | 0,120 | 19.000                                                                                                           | 1.500     | 0,040 | 0,040 | 0,110 |  |  |  |  |
| 2,0                               | 6  | 21.000                                                                             | 3.100     | 0,070 | 0,200 | 0,600 | 19.000                                                                                                           | 2.800     | 0,075 | 0,180 | 0,500 |  |  |  |  |
| 2,0                               | 8  | 21.000                                                                             | 3.100     | 0,070 | 0,140 | 0,400 | 19.000                                                                                                           | 2.800     | 0,075 | 0,120 | 0,350 |  |  |  |  |
| 2,0                               | 10 | 21.000                                                                             | 3.100     | 0,070 | 0,140 | 0,400 | 19.000                                                                                                           | 2.800     | 0,075 | 0,120 | 0,350 |  |  |  |  |
| 2,0                               | 12 | 19.000                                                                             | 2.300     | 0,060 | 0,080 | 0,200 | 17.000                                                                                                           | 2.300     | 0,068 | 0,070 | 0,200 |  |  |  |  |
| 2,0                               | 15 | 19.000                                                                             | 2.300     | 0,060 | 0,080 | 0,200 | 17.000                                                                                                           | 2.300     | 0,068 | 0,070 | 0,200 |  |  |  |  |
| 2,0                               | 20 | 19.000                                                                             | 2.300     | 0,060 | 0,050 | 0,150 | 17.000                                                                                                           | 2.300     | 0,068 | 0,040 | 0,110 |  |  |  |  |
| 2,0                               | 25 | 17.000                                                                             | 2.000     | 0,060 | 0,050 | 0,120 | 15.000                                                                                                           | 1.800     | 0,060 | 0,040 | 0,110 |  |  |  |  |
| 2,0                               | 30 | 17.000                                                                             | 2.000     | 0,060 | 0,030 | 0,080 | 15.000                                                                                                           | 1.800     | 0,060 | 0,020 | 0,080 |  |  |  |  |
| 2,5                               | 10 | 21.000                                                                             | 3.100     | 0,070 | 0,200 | 0,700 | 19.000                                                                                                           | 2.800     | 0,075 | 0,200 | 0,180 |  |  |  |  |
| 2,5                               | 15 | 19.000                                                                             | 2.300     | 0,060 | 0,080 | 0,250 | 17.000                                                                                                           | 2.300     | 0,070 | 0,080 | 0,180 |  |  |  |  |
| 2,5                               | 20 | 19.000                                                                             | 2.300     | 0,060 | 0,060 | 0,180 | 17.000                                                                                                           | 2.300     | 0,070 | 0,040 | 0,120 |  |  |  |  |
| 2,5                               | 25 | 17.000                                                                             | 2.000     | 0,060 | 0,050 | 0,140 | 15.000                                                                                                           | 1.800     | 0,060 | 0,040 | 0,110 |  |  |  |  |
| 3,0                               | 5  | 17.000                                                                             | 2.500     | 0,075 | 0,300 | 0,800 | 15.000                                                                                                           | 2.100     | 0,070 | 0,250 | 0,800 |  |  |  |  |
| 3,0                               | 10 | 16.000                                                                             | 2.400     | 0,075 | 0,200 | 0,600 | 15.000                                                                                                           | 2.100     | 0,070 | 0,180 | 0,550 |  |  |  |  |
| 3,0                               | 15 | 14.500                                                                             | 2.000     | 0,070 | 0,200 | 0,600 | 13.000                                                                                                           | 1.550     | 0,060 | 0,180 | 0,550 |  |  |  |  |
| 3,0                               | 20 | 14.500                                                                             | 2.000     | 0,070 | 0,120 | 0,250 | 13.000                                                                                                           | 1.550     | 0,060 | 0,150 | 0,500 |  |  |  |  |
| 3,0                               | 25 | 14.500                                                                             | 2.000     | 0,070 | 0,080 | 0,220 | 13.000                                                                                                           | 1.550     | 0,060 | 0,070 | 0,200 |  |  |  |  |
| 3,0                               | 30 | 13.000                                                                             | 1.500     | 0,060 | 0,080 | 0,200 | 11.500                                                                                                           | 1.300     | 0,060 | 0,070 | 0,200 |  |  |  |  |
| 4,0                               | 10 | 11.500                                                                             | 2.200     | 0,095 | 0,400 | 1,000 | 10.500                                                                                                           | 2.000     | 0,100 | 0,350 | 1,000 |  |  |  |  |
| 4,0                               | 15 | 11.500                                                                             | 2.200     | 0,095 | 0,250 | 0,800 | 10.500                                                                                                           | 2.000     | 0,100 | 0,250 | 0,750 |  |  |  |  |
| 4,0                               | 20 | 11.500                                                                             | 2.200     | 0,090 | 0,200 | 0,600 | 10.500                                                                                                           | 2.000     | 0,100 | 0,200 | 0,650 |  |  |  |  |
| 4,0                               | 25 | 10.000                                                                             | 1.800     | 0,090 | 0,150 | 0,450 | 9.500                                                                                                            | 1.600     | 0,090 | 0,150 | 0,400 |  |  |  |  |
| 4,0                               | 30 | 10.000                                                                             | 1.800     | 0,090 | 0,100 | 0,300 | 9.500                                                                                                            | 1.600     | 0,090 | 0,090 | 0,250 |  |  |  |  |
| 5,0                               | 10 | 12.000                                                                             | 3.300     | 0,140 | 0,450 | 1,200 | 9.000                                                                                                            | 2.500     | 0,140 | 0,450 | 1,100 |  |  |  |  |
| 5,0                               | 15 | 12.000                                                                             | 2.800     | 0,120 | 0,350 | 1,100 | 9.000                                                                                                            | 2.500     | 0,140 | 0,380 | 1,000 |  |  |  |  |
| 5,0                               | 20 | 12.000                                                                             | 2.600     | 0,120 | 0,350 | 1,000 | 9.000                                                                                                            | 2.500     | 0,140 | 0,350 | 0,950 |  |  |  |  |
| 5,0                               | 25 | 9.000                                                                              | 2.200     | 0,120 | 0,350 | 0,800 | 8.100                                                                                                            | 2.000     | 0,125 | 0,310 | 0,900 |  |  |  |  |
| 5,0                               | 30 | 8.000                                                                              | 1.800     | 0,110 | 0,200 | 0,600 | 8.100                                                                                                            | 2.000     | 0,125 | 0,200 | 0,700 |  |  |  |  |
| 5,0                               | 40 | 8.000                                                                              | 1.800     | 0,110 | 0,200 | 0,500 | 7.300                                                                                                            | 1.600     | 0,110 | 0,150 | 0,500 |  |  |  |  |
| 6,0                               | 10 | 12.000                                                                             | 3.300     | 0,140 | 0,550 | 1,400 | 9.000                                                                                                            | 2.500     | 0,140 | 0,450 | 1,200 |  |  |  |  |
| 6,0                               | 15 | 12.000                                                                             | 2.800     | 0,120 | 0,400 | 1,200 | 9.000                                                                                                            | 2.500     | 0,140 | 0,400 | 1,100 |  |  |  |  |
| 6,0                               | 20 | 12.000                                                                             | 2.600     | 0,120 | 0,350 | 1,100 | 9.000                                                                                                            | 2.500     | 0,140 | 0,400 | 1,100 |  |  |  |  |
| 6,0                               | 25 | 9.000                                                                              | 2.200     | 0,120 | 0,300 | 0,800 | 9.000                                                                                                            | 2.500     | 0,140 | 0,380 | 1,000 |  |  |  |  |
| 6,0                               | 30 | 8.000                                                                              | 2.000     | 0,125 | 0,400 | 0,700 | 7.200                                                                                                            | 1.700     | 0,120 | 0,370 | 1,000 |  |  |  |  |
| 6,0                               | 40 | 8.000                                                                              | 2.000     | 0,125 | 0,250 | 0,600 | 7.200                                                                                                            | 1.700     | 0,120 | 0,200 | 0,600 |  |  |  |  |
| 6,0                               | 50 | 7.200                                                                              | 1.600     | 0,110 | 0,150 | 0,400 | 6.500                                                                                                            | 1.400     | 0,110 | 0,120 | 0,400 |  |  |  |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

Art. 30.6264Art. 30.6257

Richtwerte für den Einsatz von Karnasch VHM-Fräsern für HSC/HHC/HPC- Bearbeitung  
Recommended cutting data for solid carbide end mills HSC/HHC/HPC

| Werkstoffgruppe<br>Material group |     | 4.1 – 4.2 – 4.3<br>Rostfreie Stähle / Stainless steels<br>austenitisch/ferritisch / austenitic/ferritic<br>35 - 45 HRC |           |       |       |       | 8.1 –<br>gehärtete Stähle / Hardened steels<br>45 - 55 HRC |           |       |       |       | 8.2 – 8.3<br>gehärtete Stähle / Hardened steels<br>55 - 70 HRC |           |       |       |       |
|-----------------------------------|-----|------------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|-------|------------------------------------------------------------|-----------|-------|-------|-------|----------------------------------------------------------------|-----------|-------|-------|-------|
| d1                                | ls  | min <sup>1</sup>                                                                                                       | Vf mm/min | fz mm | ap mm | ae mm | min <sup>1</sup>                                           | Vf mm/min | fz mm | ap mm | ae mm | min <sup>1</sup>                                               | Vf mm/min | fz mm | ap mm | ae mm |
| 0,1                               | 0,2 | 45.000                                                                                                                 | 900       | 0,010 | 0,010 | 0,030 | 40.000                                                     | 720       | 0,009 | 0,008 | 0,015 | 40.000                                                         | 640       | 0,008 | 0,008 | 0,013 |
| 0,1                               | 0,3 | 45.000                                                                                                                 | 900       | 0,010 | 0,008 | 0,020 | 40.000                                                     | 720       | 0,009 | 0,006 | 0,013 | 40.000                                                         | 640       | 0,008 | 0,006 | 0,011 |
| 0,1                               | 0,4 | 45.000                                                                                                                 | 900       | 0,010 | 0,005 | 0,010 | 40.000                                                     | 720       | 0,009 | 0,004 | 0,010 | 40.000                                                         | 640       | 0,008 | 0,004 | 0,008 |
| 0,2                               | 0,5 | 43.000                                                                                                                 | 1.700     | 0,020 | 0,015 | 0,045 | 38.000                                                     | 1.350     | 0,018 | 0,012 | 0,030 | 38.000                                                         | 1.350     | 0,018 | 0,012 | 0,035 |
| 0,2                               | 1   | 43.000                                                                                                                 | 1.700     | 0,020 | 0,010 | 0,030 | 38.000                                                     | 1.350     | 0,018 | 0,008 | 0,025 | 38.000                                                         | 1.350     | 0,018 | 0,008 | 0,025 |
| 0,2                               | 1,5 | 43.000                                                                                                                 | 1.720     | 0,020 | 0,008 | 0,020 | 38.000                                                     | 1.368     | 0,018 | 0,006 | 0,020 | 38.000                                                         | 1.368     | 0,018 | 0,006 | 0,020 |
| 0,3                               | 1   | 43.000                                                                                                                 | 1.700     | 0,020 | 0,015 | 0,040 | 38.000                                                     | 1.350     | 0,018 | 0,014 | 0,040 | 37.500                                                         | 1.350     | 0,018 | 0,012 | 0,040 |
| 0,3                               | 1,5 | 43.000                                                                                                                 | 1.720     | 0,020 | 0,012 | 0,030 | 38.000                                                     | 1.368     | 0,018 | 0,010 | 0,030 | 37.500                                                         | 1.350     | 0,018 | 0,010 | 0,030 |
| 0,3                               | 2   | 43.000                                                                                                                 | 1.700     | 0,020 | 0,010 | 0,025 | 38.000                                                     | 1.350     | 0,018 | 0,008 | 0,020 | 37.500                                                         | 1.350     | 0,018 | 0,008 | 0,020 |
| 0,3                               | 2,5 | 38.000                                                                                                                 | 1.520     | 0,020 | 0,009 | 0,020 | 34.000                                                     | 1.156     | 0,017 | 0,006 | 0,015 | 30.000                                                         | 960       | 0,016 | 0,006 | 0,016 |
| 0,3                               | 3   | 34.000                                                                                                                 | 1.050     | 0,016 | 0,006 | 0,018 | 30.000                                                     | 950       | 0,016 | 0,005 | 0,015 | 30.000                                                         | 950       | 0,016 | 0,005 | 0,015 |
| 0,3                               | 5   | 30.000                                                                                                                 | 480       | 0,008 | 0,003 | 0,008 | 30.000                                                     | 950       | 0,016 | 0,002 | 0,006 | –                                                              | –         | –     | –     | –     |
| 0,4                               | 1   | 35.000                                                                                                                 | 1.890     | 0,027 | 0,025 | 0,060 | 32.000                                                     | 1.536     | 0,024 | 0,020 | 0,050 | 32.000                                                         | 1.536     | 0,024 | 0,020 | 0,050 |
| 0,4                               | 1,5 | 35.000                                                                                                                 | 1.890     | 0,027 | 0,025 | 0,060 | 32.000                                                     | 1.536     | 0,024 | 0,020 | 0,050 | 32.000                                                         | 1.536     | 0,024 | 0,020 | 0,050 |
| 0,4                               | 2   | 34.000                                                                                                                 | 1.800     | 0,027 | 0,020 | 0,060 | 30.000                                                     | 1.450     | 0,024 | 0,018 | 0,050 | 30.000                                                         | 1.450     | 0,024 | 0,018 | 0,050 |
| 0,4                               | 3   | 30.500                                                                                                                 | 1.650     | 0,027 | 0,012 | 0,035 | 27.000                                                     | 1.300     | 0,024 | 0,010 | 0,030 | 27.000                                                         | 1.300     | 0,024 | 0,010 | 0,025 |
| 0,4                               | 4   | 27.000                                                                                                                 | 1.150     | 0,021 | 0,008 | 0,022 | 24.000                                                     | 1.000     | 0,020 | 0,006 | 0,020 | 24.000                                                         | 1.000     | 0,020 | 0,006 | 0,020 |
| 0,4                               | 5   | 24.000                                                                                                                 | 480       | 0,010 | 0,004 | 0,012 | 20.000                                                     | 480       | 0,012 | 0,004 | 0,010 | –                                                              | –         | –     | –     | –     |
| 0,4                               | 6   | 24.000                                                                                                                 | 480       | 0,010 | 0,004 | 0,008 | 20.000                                                     | 480       | 0,012 | 0,002 | 0,006 | –                                                              | –         | –     | –     | –     |
| 0,5                               | 1   | 35.000                                                                                                                 | 1.890     | 0,027 | 0,028 | 0,080 | 32.000                                                     | 1.536     | 0,024 | 0,020 | 0,060 | 32.000                                                         | 1.536     | 0,024 | 0,020 | 0,060 |
| 0,5                               | 2   | 34.000                                                                                                                 | 1.800     | 0,027 | 0,026 | 0,080 | 30.000                                                     | 1.450     | 0,024 | 0,020 | 0,060 | 30.000                                                         | 1.450     | 0,024 | 0,020 | 0,060 |
| 0,5                               | 3   | 30.500                                                                                                                 | 1.600     | 0,026 | 0,022 | 0,070 | 27.000                                                     | 1.300     | 0,024 | 0,020 | 0,050 | 27.000                                                         | 1.300     | 0,024 | 0,020 | 0,045 |
| 0,5                               | 4   | 30.500                                                                                                                 | 1.600     | 0,026 | 0,015 | 0,045 | 27.000                                                     | 1.300     | 0,024 | 0,012 | 0,035 | 27.000                                                         | 1.300     | 0,024 | 0,010 | 0,030 |
| 0,5                               | 5   | 27.000                                                                                                                 | 1.150     | 0,021 | 0,012 | 0,040 | 24.000                                                     | 1.000     | 0,020 | 0,010 | 0,030 | 24.000                                                         | 1.000     | 0,020 | 0,010 | 0,025 |
| 0,5                               | 6   | 27.000                                                                                                                 | 1.150     | 0,021 | 0,010 | 0,030 | 24.000                                                     | 1.000     | 0,020 | 0,006 | 0,020 | 24.000                                                         | 1.000     | 0,020 | 0,008 | 0,020 |
| 0,6                               | 2   | 34.000                                                                                                                 | 2.300     | 0,034 | 0,032 | 0,090 | 30.000                                                     | 1.800     | 0,030 | 0,025 | 0,080 | 28.000                                                         | 1.450     | 0,025 | 0,025 | 0,060 |
| 0,6                               | 3   | 34.000                                                                                                                 | 2.300     | 0,034 | 0,025 | 0,065 | 30.000                                                     | 1.800     | 0,030 | 0,020 | 0,060 | 28.000                                                         | 1.450     | 0,025 | 0,018 | 0,050 |
| 0,6                               | 4   | 30.500                                                                                                                 | 2.000     | 0,033 | 0,018 | 0,050 | 27.000                                                     | 1.600     | 0,030 | 0,015 | 0,040 | 25.000                                                         | 1.300     | 0,025 | 0,014 | 0,040 |
| 0,6                               | 5   | 27.000                                                                                                                 | 1.400     | 0,026 | 0,012 | 0,035 | 27.000                                                     | 1.600     | 0,030 | 0,011 | 0,030 | 25.000                                                         | 1.300     | 0,025 | 0,010 | 0,030 |
| 0,6                               | 6   | 27.000                                                                                                                 | 1.400     | 0,026 | 0,012 | 0,035 | 24.000                                                     | 1.200     | 0,025 | 0,010 | 0,025 | 22.500                                                         | 1.000     | 0,022 | 0,008 | 0,030 |
| 0,6                               | 8   | 27.000                                                                                                                 | 1.400     | 0,026 | 0,010 | 0,030 | 24.000                                                     | 1.200     | 0,025 | 0,010 | 0,020 | 22.500                                                         | 1.000     | 0,022 | 0,006 | 0,020 |
| 0,7                               | 4   | 30.500                                                                                                                 | 2.000     | 0,033 | 0,018 | 0,050 | 27.000                                                     | 1.600     | 0,030 | 0,015 | 0,040 | 25.000                                                         | 1.300     | 0,025 | 0,014 | 0,040 |
| 0,7                               | 8   | 27.000                                                                                                                 | 1.400     | 0,026 | 0,010 | 0,035 | 24.000                                                     | 1.200     | 0,025 | 0,010 | 0,020 | 22.500                                                         | 1.000     | 0,022 | 0,007 | 0,020 |
| 0,8                               | 2   | 34.000                                                                                                                 | 2.300     | 0,034 | 0,060 | 0,180 | 30.000                                                     | 1.800     | 0,030 | 0,050 | 0,140 | 28.000                                                         | 1.460     | 0,025 | 0,045 | 0,120 |
| 0,8                               | 4   | 34.000                                                                                                                 | 2.300     | 0,034 | 0,040 | 0,130 | 30.000                                                     | 1.800     | 0,030 | 0,035 | 0,100 | 28.000                                                         | 1.460     | 0,025 | 0,030 | 0,100 |
| 0,8                               | 5   | 34.000                                                                                                                 | 2.300     | 0,034 | 0,030 | 0,100 | 30.000                                                     | 1.800     | 0,030 | 0,025 | 0,080 | 28.000                                                         | 1.460     | 0,025 | 0,020 | 0,070 |
| 0,8                               | 6   | 30.500                                                                                                                 | 2.050     | 0,034 | 0,025 | 0,070 | 27.000                                                     | 1.600     | 0,030 | 0,020 | 0,050 | 25.000                                                         | 1.250     | 0,025 | 0,018 | 0,050 |
| 0,8                               | 7   | 30.500                                                                                                                 | 2.050     | 0,034 | 0,018 | 0,060 | 27.000                                                     | 1.600     | 0,030 | 0,015 | 0,040 | 25.000                                                         | 1.250     | 0,025 | 0,018 | 0,050 |
| 0,8                               | 8   | 27.000                                                                                                                 | 1.400     | 0,025 | 0,015 | 0,040 | 24.000                                                     | 1.250     | 0,025 | 0,010 | 0,030 | 22.500                                                         | 1.000     | 0,022 | 0,010 | 0,030 |
| 0,8                               | 10  | 27.000                                                                                                                 | 1.400     | 0,025 | 0,014 | 0,040 | 24.000                                                     | 1.250     | 0,025 | 0,010 | 0,025 | 22.500                                                         | 1.000     | 0,022 | 0,010 | 0,025 |
| 0,9                               | 6   | 30.500                                                                                                                 | 2.050     | 0,034 | 0,025 | 0,070 | 27.000                                                     | 1.600     | 0,030 | 0,020 | 0,050 | 25.000                                                         | 1.250     | 0,025 | 0,018 | 0,050 |
| 0,9                               | 12  | 27.000                                                                                                                 | 1.400     | 0,025 | 0,012 | 0,040 | 24.000                                                     | 1.250     | 0,025 | 0,010 | 0,020 | 22.500                                                         | 1.000     | 0,022 | 0,010 | 0,020 |
| 1,0                               | 2   | 30.500                                                                                                                 | 2.440     | 0,040 | 0,090 | 0,225 | 27.000                                                     | 1.890     | 0,035 | 0,070 | 0,200 | 25.000                                                         | 1.600     | 0,032 | 0,060 | 0,018 |
| 1,0                               | 3   | 30.500                                                                                                                 | 2.400     | 0,040 | 0,080 | 0,220 | 27.000                                                     | 1.950     | 0,035 | 0,060 | 0,018 | 25.000                                                         | 1.600     | 0,032 | 0,050 | 0,150 |
| 1,0                               | 4   | 30.500                                                                                                                 | 2.400     | 0,040 | 0,050 | 0,160 | 27.000                                                     | 1.950     | 0,035 | 0,040 | 0,012 | 25.000                                                         | 1.600     | 0,032 | 0,040 | 0,120 |
| 1,0                               | 5   | 30.500                                                                                                                 | 2.400     | 0,040 | 0,040 | 0,100 | 27.000                                                     | 1.950     | 0,035 | 0,025 | 0,008 | 25.000                                                         | 1.600     | 0,032 | 0,030 | 0,080 |
| 1,0                               | 6   | 27.500                                                                                                                 | 2.200     | 0,040 | 0,030 | 0,080 | 24.000                                                     | 1.750     | 0,035 | 0,025 | 0,070 | 23.000                                                         | 1.400     | 0,030 | 0,020 | 0,060 |
| 1,0                               | 7   | 27.500                                                                                                                 | 2.200     | 0,040 | 0,030 | 0,080 | 24.000                                                     | 1.750     | 0,035 | 0,025 | 0,070 | 23.000                                                         | 1.400     | 0,030 | 0,020 | 0,055 |
| 1,0                               | 8   | 27.500                                                                                                                 | 2.200     | 0,040 | 0,030 | 0,080 | 24.000                                                     | 1.750     | 0,035 | 0,025 | 0,070 | 23.000                                                         | 1.400     | 0,030 | 0,020 | 0,050 |
| 1,0                               | 9   | 27.500                                                                                                                 | 2.200     | 0,040 | 0,020 | 0,060 | 24.000                                                     | 1.750     | 0,035 | 0,020 | 0,060 | 23.000                                                         | 1.400     | 0,030 | 0,020 | 0,045 |
| 1,0                               | 10  | 27.500                                                                                                                 | 2.200     | 0,040 | 0,020 | 0,050 | 24.000                                                     | 1.750     | 0,035 | 0,015 | 0,045 | 23.000                                                         | 1.400     | 0,030 | 0,015 | 0,040 |
| 1,0                               | 12  | 24.500                                                                                                                 | 1.500     | 0,032 | 0,020 | 0,050 | 21.500                                                     | 1.350     | 0,032 | 0,015 | 0,040 | 20.000                                                         | 1.000     | 0,025 | 0,015 | 0,040 |
| 1,0                               | 15  | 24.500                                                                                                                 | 1.400     | 0,028 | 0,012 | 0,030 | 21.500                                                     | 1.150     | 0,027 | 0,010 | 0,025 | 20.000                                                         | 900       | 0,022 | 0,009 | 0,025 |
| 1,0                               | 20  | 18.000                                                                                                                 | 1.000     | 0,028 | 0,008 | 0,020 | 16.000                                                     | 800       | 0,025 | 0,006 | 0,018 | 15.000                                                         | 700       | 0,022 | 0,006 | 0,015 |
| 1,0                               | 25  | 18.000                                                                                                                 | 1.000     | 0,028 | 0,004 | 0,010 | 16.000                                                     | 800       | 0,025 | 0,004 | 0,012 | –                                                              | –         | –     | –     | –     |
| 1,0                               | 30  | 18.000                                                                                                                 | 1.000     | 0,028 | 0,003 | 0,006 | 16.000                                                     | 800       | 0,025 | 0,002 | 0,006 | –                                                              | –         | –     | –     | –     |
| 1,2                               | 5   | 26.000                                                                                                                 | 2.600     | 0,050 | 0,040 | 0,140 | 21.500                                                     | 1.500     | 0,035 | 0,025 | 0,070 | 20.000                                                         | 1.300     | 0,032 | 0,020 | 0,080 |
| 1,2                               | 6   | 26.000                                                                                                                 | 2.600     | 0,050 | 0,030 | 0,100 | 21.500                                                     | 1.500     | 0,035 | 0,025 | 0,070 | 20.000                                                         | 1.300     | 0,032 | 0,020 | 0,080 |
| 1,2                               | 8   | 24.500                                                                                                                 | 2.000     | 0,040 | 0,030 | 0,090 | 21.500                                                     | 1.500     | 0,035 | 0,025 | 0,070 | 20.000                                                         | 1.250     | 0,032 | 0,020 | 0,070 |
| 1,2                               | 10  | 24.500                                                                                                                 | 2.000     | 0,040 | 0,025 | 0,080 | 21.500                                                     | 1.500     | 0,035 | 0,020 | 0,060 | 20.000                                                         | 1.250     | 0,032 | 0,015 | 0,060 |
| 1,2                               | 12  | 24.500                                                                                                                 | 2.000     | 0,040 | 0,022 | 0,070 | 21.500                                                     | 1.500     | 0,035 | 0,020 | 0,050 | 20.000                                                         | 1.250     | 0,032 | 0,015 | 0,050 |
| 1,2                               | 15  | 19.000                                                                                                                 | 1.100     | 0,030 | 0,020 | 0,060 | 18.000                                                     | 720       | 0,020 | 0,015 | 0,030 | 16.000                                                         | 850       | 0,027 | 0,020 | 0,060 |
| 1,2                               | 20  | 19.000                                                                                                                 | 1.100     | 0,030 | 0,010 | 0,040 | 18.000                                                     | 720       | 0,020 | 0,010 | 0,015 | 16.000                                                         | 850       | 0,027 | 0,020 | 0,060 |
| 1,2                               | 25  | 19.000                                                                                                                 | 1.100     | 0,030 | 0,005 | 0,020 | –                                                          | –         | –     | –     | –     | –                                                              | –         | –     | –     | –     |
| 1,4                               | 8   | 24.500                                                                                                                 | 2.000     | 0,040 | 0,004 | 0,110 | 19.000                                                     | 1.350     | 0,035 | 0,032 | 0,100 | 17.500                                                         | 1.100     | 0,032 | 0,030 | 0,080 |
| 1,4                               | 15  | 19.000                                                                                                                 | 1.100     | 0,030 | 0,020 | 0,080 | 17.000                                                     | 1.050     | 0,032 | 0,020 | 0,060 | 16.000                                                         | 850       | 0,026 | 0,020 | 0,050 |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.



Richtwerte für den Einsatz von Karnasch VHM-Fräsern für HSC/HHC/HPC- Bearbeitung  
Recommended cutting data for solid carbide end mills HSC/HHC/HPC

Art. 30.6264

Art. 30.6257

| Werkstoffgruppe<br>Material group |    | 4.1 – 4.2 – 4.3<br>Rostfreie Stähle / Stainless steels<br>austenitisch/ferritisch / austenitic/ferritic<br>35 - 45 HRC |           |       |       |       |  | 8.1 –<br>gehärtete Stähle / Hardened steels<br>45 - 55 HRC |           |       |       |       |  | 8.2 – 8.3<br>gehärtete Stähle / Hardened steels<br>55 - 70 HRC |           |       |       |       |  |
|-----------------------------------|----|------------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|-------|--|------------------------------------------------------------|-----------|-------|-------|-------|--|----------------------------------------------------------------|-----------|-------|-------|-------|--|
|                                   |    | min <sup>1</sup>                                                                                                       | Vf mm/min | fz mm | ap mm | ae mm |  | min <sup>1</sup>                                           | Vf mm/min | fz mm | ap mm | ae mm |  | min <sup>1</sup>                                               | Vf mm/min | fz mm | ap mm | ae mm |  |
| 1,5                               | 4  | 25.000                                                                                                                 | 2.000     | 0,040 | 0,100 | 0,250 |  | 22.000                                                     | 1.540     | 0,035 | 0,070 | 0,200 |  | 18.000                                                         | 936       | 0,026 | 0,045 | 0,090 |  |
| 1,5                               | 6  | 24.000                                                                                                                 | 1.900     | 0,040 | 0,080 | 0,200 |  | 21.000                                                     | 1.500     | 0,035 | 0,060 | 0,170 |  | 17.500                                                         | 1.100     | 0,026 | 0,040 | 0,080 |  |
| 1,5                               | 8  | 21.500                                                                                                                 | 1.700     | 0,040 | 0,040 | 0,120 |  | 19.000                                                     | 1.350     | 0,035 | 0,040 | 0,100 |  | 17.500                                                         | 1.100     | 0,026 | 0,030 | 0,070 |  |
| 1,5                               | 10 | 21.500                                                                                                                 | 1.700     | 0,040 | 0,040 | 0,100 |  | 19.000                                                     | 1.350     | 0,035 | 0,040 | 0,100 |  | 17.500                                                         | 1.100     | 0,026 | 0,030 | 0,070 |  |
| 1,5                               | 12 | 21.500                                                                                                                 | 1.700     | 0,040 | 0,030 | 0,100 |  | 19.000                                                     | 1.350     | 0,035 | 0,040 | 0,100 |  | 17.500                                                         | 1.100     | 0,026 | 0,030 | 0,070 |  |
| 1,5                               | 14 | 19.000                                                                                                                 | 1.216     | 0,032 | 0,030 | 0,090 |  | 17.000                                                     | 1.088     | 0,032 | 0,025 | 0,080 |  | 16.000                                                         | 832       | 0,026 | 0,025 | 0,055 |  |
| 1,5                               | 15 | 19.000                                                                                                                 | 1.200     | 0,032 | 0,030 | 0,080 |  | 17.000                                                     | 1.050     | 0,032 | 0,020 | 0,070 |  | 15.500                                                         | 800       | 0,026 | 0,020 | 0,050 |  |
| 1,5                               | 16 | 19.000                                                                                                                 | 1.216     | 0,032 | 0,030 | 0,080 |  | 17.000                                                     | 1.088     | 0,032 | 0,020 | 0,070 |  | 15.500                                                         | 806       | 0,026 | 0,020 | 0,050 |  |
| 1,5                               | 18 | 19.000                                                                                                                 | 1.216     | 0,032 | 0,030 | 0,070 |  | 17.000                                                     | 1.088     | 0,032 | 0,020 | 0,070 |  | 15.500                                                         | 806       | 0,026 | 0,015 | 0,040 |  |
| 1,5                               | 20 | 19.000                                                                                                                 | 1.200     | 0,032 | 0,030 | 0,070 |  | 17.000                                                     | 1.050     | 0,032 | 0,020 | 0,070 |  | 15.500                                                         | 800       | 0,026 | 0,015 | 0,040 |  |
| 1,5                               | 25 | 19.000                                                                                                                 | 1.200     | 0,032 | 0,020 | 0,060 |  | –                                                          | –         | –     | –     | –     |  | –                                                              | –         | –     | –     | –     |  |
| 1,5                               | 30 | 19.000                                                                                                                 | 1.200     | 0,032 | 0,020 | 0,050 |  | –                                                          | –         | –     | –     | –     |  | –                                                              | –         | –     | –     | –     |  |
| 1,6                               | 8  | 22.000                                                                                                                 | 2.000     | 0,045 | 0,080 | 0,250 |  | 19.500                                                     | 1.550     | 0,040 | 0,060 | 0,200 |  | 18.000                                                         | 1.250     | 0,035 | 0,060 | 0,160 |  |
| 1,6                               | 15 | 18.000                                                                                                                 | 1.200     | 0,033 | 0,030 | 0,080 |  | 15.500                                                     | 1.100     | 0,035 | 0,020 | 0,060 |  | 14.500                                                         | 850       | 0,024 | 0,060 | 0,070 |  |
| 1,8                               | 10 | 20.000                                                                                                                 | 1.800     | 0,045 | 0,050 | 0,150 |  | 17.500                                                     | 1.400     | 0,040 | 0,040 | 0,120 |  | 16.000                                                         | 1.150     | 0,030 | 0,040 | 0,110 |  |
| 1,8                               | 20 | 18.000                                                                                                                 | 1.200     | 0,035 | 0,030 | 0,100 |  | 15.500                                                     | 1.100     | 0,035 | 0,025 | 0,080 |  | 14.500                                                         | 850       | 0,030 | 0,025 | 0,070 |  |
| 2,0                               | 6  | 18.000                                                                                                                 | 2.600     | 0,072 | 0,150 | 0,450 |  | 16.000                                                     | 1.900     | 0,060 | 0,120 | 0,350 |  | 14.500                                                         | 1.500     | 0,050 | 0,100 | 0,300 |  |
| 2,0                               | 8  | 18.000                                                                                                                 | 2.600     | 0,072 | 0,100 | 0,300 |  | 16.000                                                     | 1.900     | 0,060 | 0,080 | 0,250 |  | 14.500                                                         | 1.500     | 0,050 | 0,080 | 0,250 |  |
| 2,0                               | 10 | 18.000                                                                                                                 | 2.600     | 0,072 | 0,100 | 0,300 |  | 16.000                                                     | 1.900     | 0,060 | 0,080 | 0,250 |  | 14.500                                                         | 1.500     | 0,050 | 0,070 | 0,240 |  |
| 2,0                               | 12 | 16.000                                                                                                                 | 2.100     | 0,065 | 0,060 | 0,180 |  | 14.000                                                     | 1.700     | 0,060 | 0,050 | 0,140 |  | 13.000                                                         | 1.300     | 0,050 | 0,040 | 0,140 |  |
| 2,0                               | 15 | 16.000                                                                                                                 | 2.100     | 0,065 | 0,050 | 0,150 |  | 14.000                                                     | 1.700     | 0,060 | 0,050 | 0,140 |  | 13.000                                                         | 1.300     | 0,050 | 0,040 | 0,140 |  |
| 2,0                               | 20 | 16.000                                                                                                                 | 2.100     | 0,065 | 0,040 | 0,120 |  | 14.000                                                     | 1.700     | 0,060 | 0,030 | 0,080 |  | 13.000                                                         | 1.300     | 0,050 | 0,030 | 0,080 |  |
| 2,0                               | 25 | 14.000                                                                                                                 | 1.400     | 0,050 | 0,040 | 0,120 |  | 12.500                                                     | 1.300     | 0,050 | 0,030 | 0,080 |  | 11.500                                                         | 1.050     | 0,045 | 0,030 | 0,070 |  |
| 2,0                               | 30 | 14.000                                                                                                                 | 1.400     | 0,050 | 0,020 | 0,070 |  | 12.500                                                     | 1.300     | 0,050 | 0,020 | 0,050 |  | 11.500                                                         | 1.050     | 0,045 | 0,016 | 0,050 |  |
| 2,5                               | 10 | 18.000                                                                                                                 | 2.600     | 0,072 | 0,150 | 0,500 |  | 16.000                                                     | 1.900     | 0,060 | 0,050 | 0,150 |  | 14.500                                                         | 1.500     | 0,050 | 0,080 | 0,260 |  |
| 2,5                               | 15 | 16.000                                                                                                                 | 2.100     | 0,065 | 0,060 | 0,200 |  | 14.000                                                     | 1.700     | 0,060 | 0,050 | 0,140 |  | 13.000                                                         | 1.300     | 0,050 | 0,040 | 0,120 |  |
| 2,5                               | 20 | 16.000                                                                                                                 | 2.100     | 0,065 | 0,050 | 0,180 |  | 14.000                                                     | 1.700     | 0,060 | 0,030 | 0,090 |  | 13.000                                                         | 1.300     | 0,050 | 0,030 | 0,100 |  |
| 2,5                               | 25 | 14.000                                                                                                                 | 1.400     | 0,050 | 0,050 | 0,160 |  | 12.500                                                     | 1.300     | 0,050 | 0,030 | 0,085 |  | 11.500                                                         | 1.050     | 0,045 | 0,030 | 0,080 |  |
| 3,0                               | 5  | 13.500                                                                                                                 | 1.800     | 0,068 | 0,220 | 0,700 |  | 12.000                                                     | 1.450     | 0,060 | 0,180 | 0,500 |  | 11.000                                                         | 1.150     | 0,052 | 0,125 | 0,310 |  |
| 3,0                               | 10 | 13.500                                                                                                                 | 1.800     | 0,068 | 0,160 | 0,500 |  | 12.000                                                     | 1.450     | 0,060 | 0,120 | 0,400 |  | 11.000                                                         | 1.150     | 0,052 | 0,120 | 0,300 |  |
| 3,0                               | 15 | 12.000                                                                                                                 | 1.500     | 0,060 | 0,160 | 0,450 |  | 11.000                                                     | 1.300     | 0,060 | 0,120 | 0,400 |  | 10.000                                                         | 1.050     | 0,052 | 0,120 | 0,300 |  |
| 3,0                               | 20 | 12.000                                                                                                                 | 1.500     | 0,060 | 0,120 | 0,400 |  | 11.000                                                     | 1.300     | 0,060 | 0,050 | 0,120 |  | 10.000                                                         | 1.050     | 0,052 | 0,060 | 0,200 |  |
| 3,0                               | 25 | 12.000                                                                                                                 | 1.500     | 0,060 | 0,060 | 0,200 |  | 11.000                                                     | 1.300     | 0,060 | 0,050 | 0,120 |  | 10.000                                                         | 1.050     | 0,052 | 0,045 | 0,120 |  |
| 3,0                               | 30 | 11.000                                                                                                                 | 1.100     | 0,050 | 0,050 | 0,180 |  | 9.500                                                      | 1.000     | 0,050 | 0,050 | 0,120 |  | 9.000                                                          | 800       | 0,045 | 0,045 | 0,100 |  |
| 4,0                               | 10 | 10.000                                                                                                                 | 1.700     | 0,090 | 0,300 | 0,900 |  | 8.500                                                      | 1.400     | 0,080 | 0,250 | 0,700 |  | 8.000                                                          | 1.100     | 0,070 | 0,022 | 0,600 |  |
| 4,0                               | 15 | 10.000                                                                                                                 | 1.600     | 0,080 | 0,200 | 0,600 |  | 8.500                                                      | 1.400     | 0,080 | 0,150 | 0,500 |  | 8.000                                                          | 1.100     | 0,070 | 0,016 | 0,500 |  |
| 4,0                               | 20 | 10.000                                                                                                                 | 1.600     | 0,080 | 0,150 | 0,450 |  | 7.500                                                      | 1.200     | 0,080 | 0,120 | 0,350 |  | 8.000                                                          | 1.100     | 0,070 | 0,012 | 0,300 |  |
| 4,0                               | 25 | 9.000                                                                                                                  | 1.600     | 0,090 | 0,120 | 0,350 |  | 7.500                                                      | 1.200     | 0,080 | 0,100 | 0,280 |  | 7.000                                                          | 1.000     | 0,070 | 0,009 | 0,250 |  |
| 4,0                               | 30 | 9.000                                                                                                                  | 1.600     | 0,090 | 0,080 | 0,200 |  | 7.500                                                      | 1.200     | 0,080 | 0,060 | 0,150 |  | 7.000                                                          | 1.000     | 0,070 | 0,008 | 0,180 |  |
| 5,0                               | 10 | 8.500                                                                                                                  | 2.500     | 0,150 | 0,350 | 1,000 |  | 7.500                                                      | 1.200     | 0,080 | 0,280 | 0,750 |  | 6.300                                                          | 1.000     | 0,080 | 0,350 | 0,800 |  |
| 5,0                               | 15 | 8.500                                                                                                                  | 2.500     | 0,150 | 0,300 | 0,900 |  | 7.500                                                      | 1.200     | 0,080 | 0,200 | 0,600 |  | 6.300                                                          | 1.000     | 0,080 | 0,300 | 0,700 |  |
| 5,0                               | 20 | 8.500                                                                                                                  | 2.500     | 0,150 | 0,300 | 0,900 |  | 7.500                                                      | 1.200     | 0,080 | 0,200 | 0,600 |  | 6.300                                                          | 1.000     | 0,080 | 0,250 | 0,600 |  |
| 5,0                               | 25 | 7.500                                                                                                                  | 1.800     | 0,120 | 0,250 | 0,800 |  | 6.500                                                      | 1.300     | 0,100 | 0,200 | 0,600 |  | 6.300                                                          | 1.000     | 0,080 | 0,200 | 0,600 |  |
| 5,0                               | 30 | 7.500                                                                                                                  | 1.800     | 0,120 | 0,200 | 0,600 |  | 6.500                                                      | 1.300     | 0,100 | 0,150 | 0,450 |  | 6.300                                                          | 1.000     | 0,080 | 0,150 | 0,400 |  |
| 5,0                               | 40 | 7.000                                                                                                                  | 1.500     | 0,110 | 0,150 | 0,400 |  | 6.000                                                      | 1.200     | 0,100 | 0,120 | 0,350 |  | 5.500                                                          | 1.000     | 0,080 | 0,100 | 0,350 |  |
| 6,0                               | 10 | 7.000                                                                                                                  | 2.250     | 0,160 | 0,450 | 1,250 |  | 6.000                                                      | 1.200     | 0,100 | 0,300 | 0,800 |  | 6.200                                                          | 1.000     | 0,080 | 0,400 | 0,900 |  |
| 6,0                               | 15 | 7.000                                                                                                                  | 2.250     | 0,160 | 0,400 | 1,100 |  | 6.000                                                      | 1.200     | 0,100 | 0,300 | 0,800 |  | 6.200                                                          | 1.000     | 0,080 | 0,400 | 0,900 |  |
| 6,0                               | 20 | 7.000                                                                                                                  | 2.250     | 0,160 | 0,350 | 1,100 |  | 6.000                                                      | 1.200     | 0,100 | 0,300 | 0,750 |  | 6.200                                                          | 1.000     | 0,080 | 0,300 | 0,800 |  |
| 6,0                               | 25 | 7.000                                                                                                                  | 2.250     | 0,160 | 0,300 | 1,000 |  | 6.000                                                      | 1.200     | 0,100 | 0,300 | 0,750 |  | 6.200                                                          | 1.000     | 0,080 | 0,250 | 0,700 |  |
| 6,0                               | 30 | 7.000                                                                                                                  | 1.700     | 0,125 | 0,300 | 1,000 |  | 6.000                                                      | 1.200     | 0,100 | 0,250 | 0,700 |  | 5.500                                                          | 1.000     | 0,080 | 0,250 | 0,700 |  |
| 6,0                               | 40 | 7.000                                                                                                                  | 1.700     | 0,125 | 0,150 | 0,600 |  | 6.000                                                      | 1.200     | 0,100 | 0,150 | 0,400 |  | 5.500                                                          | 1.000     | 0,080 | 0,100 | 0,350 |  |
| 6,0                               | 50 | 6.100                                                                                                                  | 1.350     | 0,110 | 0,110 | 0,320 |  | 5.400                                                      | 1.050     | 0,100 | 0,080 | 0,200 |  | 5.000                                                          | 1.000     | 0,080 | 0,080 | 0,250 |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

| Werkstoffgruppe<br>Material group |      |    | 1.1 - 1.2 - 1.3 - 1.4 - 1.5<br>Unlegierte Stähle / Unalloyed steels<br>< 850 N/mm² |           |       |       |       | 2.1 - 2.2 - 2.3 - 2.4 - 2.5 - 2.6 - 3.1 - 3.2<br>Vergütungsstähle / Heat-treated steels<br>< 35 HRC (1200 N/mm²) |           |       |       |       |  |
|-----------------------------------|------|----|------------------------------------------------------------------------------------|-----------|-------|-------|-------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|-------|--|
| d1                                | r    | ls | min¹                                                                               | Vf mm/min | fz mm | ap mm | ae mm | min¹                                                                                                             | Vf mm/min | fz mm | ap mm | ae mm |  |
| 1,0                               | 0,05 | 4  | 32.000                                                                             | 2304      | 0,018 | 0,011 | 0,032 | 27.000                                                                                                           | 1620      | 0,015 | 0,01  | 0,020 |  |
| 1,0                               | 0,05 | 6  | 26.000                                                                             | 1664      | 0,016 | 0,010 | 0,028 | 22.000                                                                                                           | 1232      | 0,014 | 0,007 | 0,020 |  |
| 1,0                               | 0,05 | 8  | 23.000                                                                             | 1472      | 0,016 | 0,070 | 0,020 | 20.000                                                                                                           | 1120      | 0,014 | 0,005 | 0,018 |  |
| 1,0                               | 0,05 | 10 | 20.000                                                                             | 1280      | 0,016 | 0,006 | 0,015 | 17.000                                                                                                           | 952       | 0,014 | 0,004 | 0,010 |  |
| 1,0                               | 0,05 | 12 | 18.000                                                                             | 1080      | 0,015 | 0,005 | 0,010 | 16.000                                                                                                           | 768       | 0,012 | 0,003 | 0,009 |  |
| 1,0                               | 0,05 | 16 | 18.000                                                                             | 936       | 0,013 | 0,004 | 0,090 | 15.000                                                                                                           | 600       | 0,010 | 0,002 | 0,006 |  |
| 1,0                               | 0,05 | 20 | 14.000                                                                             | 728       | 0,013 | 0,003 | 0,007 | 12.000                                                                                                           | 480       | 0,010 | 0,002 | 0,005 |  |
| 1,0                               | 0,1  | 4  | 32.000                                                                             | 2304      | 0,018 | 0,017 | 0,050 | 27.000                                                                                                           | 1620      | 0,015 | 0,012 | 0,030 |  |
| 1,0                               | 0,1  | 6  | 26.000                                                                             | 1664      | 0,016 | 0,015 | 0,040 | 22.000                                                                                                           | 1232      | 0,014 | 0,012 | 0,030 |  |
| 1,0                               | 0,1  | 8  | 23.000                                                                             | 1472      | 0,016 | 0,012 | 0,032 | 20.000                                                                                                           | 1120      | 0,014 | 0,008 | 0,020 |  |
| 1,0                               | 0,1  | 10 | 20.000                                                                             | 1280      | 0,016 | 0,010 | 0,025 | 17.000                                                                                                           | 952       | 0,014 | 0,007 | 0,018 |  |
| 1,0                               | 0,1  | 12 | 18.000                                                                             | 1080      | 0,015 | 0,008 | 0,024 | 16.000                                                                                                           | 768       | 0,012 | 0,006 | 0,016 |  |
| 1,0                               | 0,1  | 16 | 18.000                                                                             | 936       | 0,013 | 0,006 | 0,017 | 15.000                                                                                                           | 600       | 0,010 | 0,005 | 0,012 |  |
| 1,0                               | 0,1  | 20 | 14.000                                                                             | 728       | 0,013 | 0,004 | 0,011 | 12.000                                                                                                           | 480       | 0,010 | 0,003 | 0,008 |  |
| 1,5                               | 0,1  | 4  | 24.000                                                                             | 1920      | 0,020 | 0,024 | 0,070 | 21.000                                                                                                           | 1512      | 0,018 | 0,018 | 0,040 |  |
| 1,5                               | 0,1  | 8  | 22.000                                                                             | 1760      | 0,020 | 0,020 | 0,050 | 19.000                                                                                                           | 1216      | 0,016 | 0,014 | 0,030 |  |
| 1,5                               | 0,1  | 12 | 18.000                                                                             | 1440      | 0,020 | 0,015 | 0,040 | 16.000                                                                                                           | 1024      | 0,016 | 0,013 | 0,022 |  |
| 1,5                               | 0,1  | 15 | 14.000                                                                             | 1008      | 0,018 | 0,012 | 0,035 | 12.000                                                                                                           | 672       | 0,014 | 0,01  | 0,020 |  |
| 1,5                               | 0,1  | 20 | 14.000                                                                             | 840       | 0,015 | 0,010 | 0,025 | 12.000                                                                                                           | 768       | 0,016 | 0,007 | 0,016 |  |
| 2,0                               | 0,05 | 4  | 21.000                                                                             | 2520      | 0,030 | 0,032 | 0,090 | 18.000                                                                                                           | 2160      | 0,030 | 0,025 | 0,060 |  |
| 2,0                               | 0,05 | 8  | 19.000                                                                             | 2280      | 0,030 | 0,023 | 0,065 | 17.000                                                                                                           | 2040      | 0,030 | 0,02  | 0,040 |  |
| 2,0                               | 0,05 | 12 | 16.000                                                                             | 1792      | 0,028 | 0,018 | 0,050 | 14.000                                                                                                           | 1680      | 0,030 | 0,015 | 0,035 |  |
| 2,0                               | 0,05 | 16 | 14.000                                                                             | 1568      | 0,028 | 0,013 | 0,040 | 12.000                                                                                                           | 1440      | 0,030 | 0,01  | 0,022 |  |
| 2,0                               | 0,05 | 20 | 12.000                                                                             | 1344      | 0,028 | 0,010 | 0,025 | 11.000                                                                                                           | 1320      | 0,030 | 0,008 | 0,016 |  |
| 2,0                               | 0,1  | 4  | 21.000                                                                             | 2520      | 0,030 | 0,040 | 0,110 | 18.000                                                                                                           | 2160      | 0,030 | 0,03  | 0,080 |  |
| 2,0                               | 0,1  | 8  | 19.000                                                                             | 2280      | 0,030 | 0,034 | 0,095 | 17.000                                                                                                           | 2040      | 0,030 | 0,026 | 0,060 |  |
| 2,0                               | 0,1  | 12 | 16.000                                                                             | 1792      | 0,028 | 0,034 | 0,095 | 14.000                                                                                                           | 1680      | 0,030 | 0,03  | 0,060 |  |
| 2,0                               | 0,1  | 16 | 14.000                                                                             | 1568      | 0,028 | 0,020 | 0,050 | 12.000                                                                                                           | 1440      | 0,030 | 0,016 | 0,040 |  |
| 2,0                               | 0,1  | 20 | 12.000                                                                             | 1344      | 0,028 | 0,016 | 0,045 | 11.000                                                                                                           | 1232      | 0,028 | 0,012 | 0,030 |  |
| 2,5                               | 0,1  | 8  | 19.000                                                                             | 2660      | 0,035 | 0,045 | 0,013 | 17.000                                                                                                           | 2380      | 0,035 | 0,035 | 0,090 |  |
| 2,5                               | 0,1  | 16 | 14.000                                                                             | 1680      | 0,030 | 0,035 | 0,100 | 12.000                                                                                                           | 1440      | 0,030 | 0,03  | 0,065 |  |
| 2,5                               | 0,1  | 20 | 12.000                                                                             | 1440      | 0,030 | 0,023 | 0,060 | 11.000                                                                                                           | 1320      | 0,030 | 0,02  | 0,050 |  |
| 2,5                               | 0,2  | 8  | 17.000                                                                             | 2380      | 0,035 | 0,080 | 0,200 | 14.000                                                                                                           | 1960      | 0,035 | 0,06  | 0,130 |  |
| 2,5                               | 0,2  | 16 | 15.000                                                                             | 1800      | 0,030 | 0,043 | 0,150 | 13.000                                                                                                           | 1560      | 0,030 | 0,035 | 0,080 |  |
| 2,5                               | 0,2  | 20 | 12.800                                                                             | 1536      | 0,030 | 0,040 | 0,110 | 11.000                                                                                                           | 1320      | 0,030 | 0,032 | 0,080 |  |
| 3,0                               | 0,2  | 8  | 15.000                                                                             | 2.400     | 0,040 | 0,088 | 0,250 | 13.000                                                                                                           | 2080      | 0,040 | 0,07  | 0,150 |  |
| 3,0                               | 0,2  | 12 | 15.000                                                                             | 2.400     | 0,040 | 0,068 | 0,020 | 13.000                                                                                                           | 2080      | 0,040 | 0,05  | 0,120 |  |
| 3,0                               | 0,2  | 16 | 15.000                                                                             | 2400      | 0,040 | 0,050 | 0,013 | 13.000                                                                                                           | 2080      | 0,040 | 0,04  | 0,100 |  |
| 3,0                               | 0,2  | 20 | 12.000                                                                             | 1920      | 0,040 | 0,050 | 0,013 | 10.000                                                                                                           | 1600      | 0,040 | 0,04  | 0,090 |  |
| 3,0                               | 0,2  | 25 | 12.000                                                                             | 1920      | 0,040 | 0,043 | 0,110 | 10.000                                                                                                           | 1600      | 0,040 | 0,035 | 0,080 |  |
| 3,0                               | 0,2  | 30 | 10.000                                                                             | 2000      | 0,050 | 0,040 | 0,100 | 8.000                                                                                                            | 1600      | 0,050 | 0,03  | 0,070 |  |
| 4,0                               | 0,2  | 12 | 11.000                                                                             | 3080      | 0,070 | 0,126 | 0,350 | 9.000                                                                                                            | 2160      | 0,060 | 0,1   | 0,220 |  |
| 4,0                               | 0,2  | 20 | 11.000                                                                             | 3080      | 0,070 | 0,090 | 0,260 | 9.000                                                                                                            | 2160      | 0,060 | 0,08  | 0,180 |  |
| 4,0                               | 0,2  | 30 | 10.000                                                                             | 2800      | 0,070 | 0,080 | 0,210 | 8.000                                                                                                            | 1920      | 0,060 | 0,06  | 0,150 |  |
| 4,0                               | 0,2  | 40 | 10.000                                                                             | 2800      | 0,070 | 0,060 | 0,160 | 8.000                                                                                                            | 1920      | 0,060 | 0,045 | 0,110 |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.

*These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.*

Richtwerte für den Einsatz von VHM-Gesenkräser mit Eckenradius  
Recommended cutting data for solid carbide end mills with corner radius

Schlichten  
Finishing  
Art. 30.6267

| 4.1 - 4.2 - 4.3<br>Rostfreie Stähle / Stainless steels<br>austenitisch / ferritisch - austenitic / ferritic<br>35 - 45 HRC |                  |           |       |       |       | 8.1<br>Gehärtete Stähle / Hardened steels<br>45 - 55 HRC |           |       |       |       | 8.2 - 8.3<br>Gehärtete Stähle / Hardened steels<br>55 - 70 HRC |           |       |       |       |
|----------------------------------------------------------------------------------------------------------------------------|------------------|-----------|-------|-------|-------|----------------------------------------------------------|-----------|-------|-------|-------|----------------------------------------------------------------|-----------|-------|-------|-------|
|                                                                                                                            | min <sup>1</sup> | Vf mm/min | fz mm | ap mm | ae mm | min <sup>1</sup>                                         | Vf mm/min | fz mm | ap mm | ae mm | min <sup>1</sup>                                               | Vf mm/min | fz mm | ap mm | ae mm |
|                                                                                                                            | 28.000           | 2016      | 0,018 | 0,010 | 0,028 | 25.000                                                   | 1500      | 0,015 | 0,006 | 0,02  | 23.000                                                         | 1196      | 0,013 | 0,006 | 0,016 |
|                                                                                                                            | 23.000           | 1380      | 0,015 | 0,008 | 0,020 | 20.000                                                   | 1200      | 0,015 | 0,060 | 0,02  | 19.000                                                         | 988       | 0,013 | 0,006 | 0,013 |
|                                                                                                                            | 21.000           | 1260      | 0,015 | 0,006 | 0,018 | 18.000                                                   | 1080      | 0,015 | 0,005 | 0,01  | 17.000                                                         | 884       | 0,013 | 0,004 | 0,010 |
|                                                                                                                            | 18.000           | 1080      | 0,015 | 0,004 | 0,012 | 16.000                                                   | 960       | 0,015 | 0,004 | 0,01  | 15.000                                                         | 780       | 0,013 | 0,003 | 0,008 |
|                                                                                                                            | 16.000           | 960       | 0,015 | 0,004 | 0,010 | 14.000                                                   | 672       | 0,012 | 0,003 | 0,01  | 13.000                                                         | 520       | 0,010 | 0,002 | 0,007 |
|                                                                                                                            | 16.000           | 832       | 0,013 | 0,003 | 0,008 | 14.000                                                   | 560       | 0,010 | 0,003 | 0,01  | 13.000                                                         | 416       | 0,008 | 0,002 | 0,005 |
|                                                                                                                            | 12.000           | 624       | 0,013 | 0,003 | 0,006 | 11.000                                                   | 440       | 0,010 | 0,002 | 0,01  | 10.000                                                         | 320       | 0,008 | 0,002 | 0,004 |
|                                                                                                                            | 28.000           | 2016      | 0,018 | 0,015 | 0,040 | 25.000                                                   | 1500      | 0,015 | 0,011 | 0,03  | 23.000                                                         | 1196      | 0,013 | 0,010 | 0,026 |
|                                                                                                                            | 23.000           | 1380      | 0,015 | 0,012 | 0,038 | 20.000                                                   | 1200      | 0,015 | 0,010 | 0,02  | 19.000                                                         | 988       | 0,013 | 0,010 | 0,021 |
|                                                                                                                            | 21.000           | 1260      | 0,015 | 0,010 | 0,030 | 20.000                                                   | 1200      | 0,015 | 0,008 | 0,02  | 17.000                                                         | 884       | 0,013 | 0,007 | 0,019 |
|                                                                                                                            | 18.000           | 1080      | 0,015 | 0,008 | 0,021 | 16.000                                                   | 960       | 0,015 | 0,060 | 0,02  | 15.000                                                         | 780       | 0,013 | 0,005 | 0,014 |
|                                                                                                                            | 16.000           | 832       | 0,013 | 0,007 | 0,019 | 14.000                                                   | 560       | 0,010 | 0,005 | 0,01  | 13.000                                                         | 520       | 0,010 | 0,004 | 0,012 |
|                                                                                                                            | 16.000           | 832       | 0,013 | 0,005 | 0,015 | 14.000                                                   | 560       | 0,010 | 0,004 | 0,01  | 13.000                                                         | 416       | 0,008 | 0,003 | 0,010 |
|                                                                                                                            | 12.000           | 624       | 0,013 | 0,005 | 0,011 | 11.000                                                   | 440       | 0,010 | 0,003 | 0,01  | 10.000                                                         | 320       | 0,008 | 0,003 | 0,006 |
|                                                                                                                            | 22.000           | 1760      | 0,020 | 0,020 | 0,060 | 19.000                                                   | 1140      | 0,015 | 0,015 | 0,03  | 18.000                                                         | 1080      | 0,015 | 0,014 | 0,035 |
|                                                                                                                            | 20.000           | 1600      | 0,020 | 0,018 | 0,045 | 17.000                                                   | 1020      | 0,015 | 0,012 | 0,03  | 16.000                                                         | 896       | 0,014 | 0,011 | 0,030 |
|                                                                                                                            | 16.000           | 1280      | 0,020 | 0,014 | 0,038 | 14.000                                                   | 840       | 0,015 | 0,010 | 0,02  | 13.000                                                         | 728       | 0,014 | 0,010 | 0,025 |
|                                                                                                                            | 13.000           | 884       | 0,017 | 0,012 | 0,030 | 11.000                                                   | 660       | 0,015 | 0,008 | 0,02  | 10.000                                                         | 520       | 0,013 | 0,007 | 0,020 |
|                                                                                                                            | 13.000           | 780       | 0,015 | 0,008 | 0,020 | 11.000                                                   | 660       | 0,015 | 0,006 | 0,01  | 10.000                                                         | 480       | 0,012 | 0,005 | 0,015 |
|                                                                                                                            | 19.000           | 2280      | 0,030 | 0,030 | 0,085 | 16.000                                                   | 1600      | 0,025 | 0,020 | 0,05  | 15.000                                                         | 1500      | 0,025 | 0,020 | 0,050 |
|                                                                                                                            | 17.000           | 2040      | 0,030 | 0,021 | 0,060 | 15.000                                                   | 1500      | 0,025 | 0,015 | 0,04  | 14.000                                                         | 1400      | 0,025 | 0,014 | 0,036 |
|                                                                                                                            | 14.000           | 1680      | 0,030 | 0,016 | 0,048 | 12.000                                                   | 1200      | 0,025 | 0,012 | 0,03  | 11.000                                                         | 1100      | 0,025 | 0,011 | 0,030 |
|                                                                                                                            | 13.000           | 1560      | 0,030 | 0,014 | 0,035 | 11.000                                                   | 1100      | 0,025 | 0,010 | 0,02  | 10.000                                                         | 1000      | 0,025 | 0,008 | 0,020 |
|                                                                                                                            | 11.000           | 1320      | 0,030 | 0,008 | 0,024 | 10.000                                                   | 1000      | 0,025 | 0,006 | 0,02  | 9.000                                                          | 900       | 0,025 | 0,005 | 0,015 |
|                                                                                                                            | 19.000           | 2280      | 0,030 | 0,036 | 0,100 | 16.000                                                   | 1600      | 0,025 | 0,025 | 0,07  | 15.000                                                         | 1500      | 0,025 | 0,024 | 0,060 |
|                                                                                                                            | 17.000           | 2040      | 0,030 | 0,030 | 0,090 | 15.000                                                   | 1500      | 0,025 | 0,021 | 0,06  | 14.000                                                         | 1400      | 0,025 | 0,021 | 0,055 |
|                                                                                                                            | 14.000           | 1680      | 0,030 | 0,030 | 0,090 | 12.000                                                   | 1200      | 0,025 | 0,020 | 0,06  | 11.000                                                         | 1100      | 0,025 | 0,020 | 0,055 |
|                                                                                                                            | 13.000           | 1560      | 0,030 | 0,020 | 0,058 | 11.000                                                   | 1100      | 0,025 | 0,015 | 0,03  | 10.000                                                         | 1000      | 0,025 | 0,013 | 0,035 |
|                                                                                                                            | 11.000           | 1320      | 0,030 | 0,015 | 0,040 | 10.000                                                   | 1000      | 0,025 | 0,012 | 0,03  | 9.000                                                          | 900       | 0,025 | 0,010 | 0,026 |
|                                                                                                                            | 17.000           | 2380      | 0,035 | 0,040 | 0,115 | 15.000                                                   | 1500      | 0,025 | 0,030 | 0,08  | 14.000                                                         | 1400      | 0,025 | 0,026 | 0,070 |
|                                                                                                                            | 13.000           | 1560      | 0,030 | 0,031 | 0,090 | 13.000                                                   | 1300      | 0,025 | 0,023 | 0,06  | 12.000                                                         | 1200      | 0,025 | 0,021 | 0,055 |
|                                                                                                                            | 11.000           | 1320      | 0,030 | 0,021 | 0,060 | 11.000                                                   | 1100      | 0,025 | 0,015 | 0,04  | 10.000                                                         | 1000      | 0,025 | 0,014 | 0,035 |
|                                                                                                                            | 15.000           | 2100      | 0,035 | 0,070 | 0,200 | 11.000                                                   | 1100      | 0,025 | 0,050 | 0,13  | 10.000                                                         | 1000      | 0,025 | 0,046 | 0,120 |
|                                                                                                                            | 13.000           | 1560      | 0,030 | 0,040 | 0,115 | 9.000                                                    | 900       | 0,025 | 0,030 | 0,07  | 9.000                                                          | 900       | 0,025 | 0,026 | 0,070 |
|                                                                                                                            | 11.000           | 1320      | 0,030 | 0,036 | 0,105 | 9.000                                                    | 900       | 0,025 | 0,025 | 0,06  | 9.000                                                          | 900       | 0,025 | 0,024 | 0,065 |
|                                                                                                                            | 13.000           | 2.080     | 0,040 | 0,080 | 0,230 | 11.000                                                   | 1320      | 0,030 | 0,056 | 0,15  | 11.000                                                         | 1320      | 0,030 | 0,052 | 0,140 |
|                                                                                                                            | 13.000           | 2.080     | 0,040 | 0,061 | 0,180 | 11.000                                                   | 1320      | 0,030 | 0,045 | 0,12  | 11.000                                                         | 1320      | 0,030 | 0,040 | 0,110 |
|                                                                                                                            | 13.000           | 2080      | 0,040 | 0,043 | 0,125 | 11.000                                                   | 1320      | 0,030 | 0,030 | 0,08  | 11.000                                                         | 1320      | 0,030 | 0,030 | 0,075 |
|                                                                                                                            | 11.000           | 1760      | 0,040 | 0,043 | 0,125 | 9.000                                                    | 1260      | 0,035 | 0,030 | 0,08  | 9.000                                                          | 1080      | 0,030 | 0,030 | 0,075 |
|                                                                                                                            | 11.000           | 1760      | 0,040 | 0,040 | 0,115 | 9.000                                                    | 1260      | 0,035 | 0,026 | 0,08  | 9.000                                                          | 1080      | 0,030 | 0,026 | 0,070 |
|                                                                                                                            | 9.000            | 1800      | 0,050 | 0,034 | 0,100 | 7.000                                                    | 1260      | 0,045 | 0,026 | 0,07  | 7.000                                                          | 1120      | 0,040 | 0,022 | 0,060 |
|                                                                                                                            | 10.000           | 2800      | 0,070 | 0,115 | 0,330 | 8.000                                                    | 1920      | 0,060 | 0,083 | 0,23  | 8.000                                                          | 1600      | 0,050 | 0,075 | 0,200 |
|                                                                                                                            | 10.000           | 2800      | 0,070 | 0,090 | 0,250 | 8.000                                                    | 1920      | 0,060 | 0,063 | 0,17  | 8.000                                                          | 1600      | 0,050 | 0,060 | 0,160 |
|                                                                                                                            | 9.000            | 2160      | 0,060 | 0,070 | 0,200 | 7.000                                                    | 1540      | 0,055 | 0,050 | 0,13  | 7.000                                                          | 1400      | 0,050 | 0,045 | 0,120 |
|                                                                                                                            | 9.000            | 2160      | 0,060 | 0,052 | 0,150 | 7.000                                                    | 1540      | 0,055 | 0,036 | 0,1   | 7.000                                                          | 1400      | 0,050 | 0,034 | 0,100 |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

| Werkstoffgruppe<br>Material group |      |    | 1.1 - 1.2 - 1.3 - 1.4 - 1.5<br>Unlegierte Stähle / Unalloyed steels<br>< 850 N/mm² |           |       |       |               | 2.1 - 2.2 - 2.3 - 2.4 - 2.5 - 2.6 - 3.1 - 3.2<br>Vergütungsstähle / Heat-treated steels<br>< 35 HRC (1200 N/mm²) |           |       |       |               |  |
|-----------------------------------|------|----|------------------------------------------------------------------------------------|-----------|-------|-------|---------------|------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|---------------|--|
| d1                                | r    | l3 | min <sup>1</sup>                                                                   | Vf mm/min | fz mm | ap mm | ae mm         | min <sup>1</sup>                                                                                                 | Vf mm/min | fz mm | ap mm | ae mm         |  |
| 1,0                               | 0,05 | 4  | 36.000                                                                             | 3600      | 0,025 | 0,047 | 0,150 - 0,600 | 31.000                                                                                                           | 3100      | 0,025 | 0,038 | 0,120 - 0,600 |  |
| 1,0                               | 0,05 | 6  | 33.000                                                                             | 3300      | 0,025 | 0,026 | 0,085 - 0,600 | 28.000                                                                                                           | 2800      | 0,025 | 0,020 | 0,070 - 0,600 |  |
| 1,0                               | 0,05 | 8  | 33.000                                                                             | 3300      | 0,025 | 0,026 | 0,085 - 0,600 | 28.000                                                                                                           | 2800      | 0,025 | 0,020 | 0,070 - 0,600 |  |
| 1,0                               | 0,05 | 10 | 33.000                                                                             | 3300      | 0,025 | 0,016 | 0,055 - 0,600 | 28.000                                                                                                           | 2800      | 0,025 | 0,012 | 0,050 - 0,600 |  |
| 1,0                               | 0,05 | 12 | 29.000                                                                             | 2552      | 0,022 | 0,016 | 0,055 - 0,600 | 25.000                                                                                                           | 2000      | 0,020 | 0,012 | 0,050 - 0,600 |  |
| 1,0                               | 0,05 | 16 | 29.000                                                                             | 2320      | 0,02  | 0,01  | 0,035 - 0,600 | 25.000                                                                                                           | 2000      | 0,020 | 0,008 | 0,030 - 0,600 |  |
| 1,0                               | 0,05 | 20 | 22.000                                                                             | 1760      | 0,02  | 0,005 | 0,024 - 0,600 | 19.000                                                                                                           | 1520      | 0,020 | 0,005 | 0,020 - 0,600 |  |
| 1,0                               | 0,1  | 4  | 36.000                                                                             | 4320      | 0,03  | 0,068 | 0,215 - 0,600 | 31.000                                                                                                           | 3348      | 0,027 | 0,055 | 0,180 - 0,600 |  |
| 1,0                               | 0,1  | 6  | 33.000                                                                             | 3300      | 0,025 | 0,038 | 0,125 - 0,600 | 28.000                                                                                                           | 3024      | 0,027 | 0,030 | 0,100 - 0,600 |  |
| 1,0                               | 0,1  | 8  | 33.000                                                                             | 3300      | 0,025 | 0,038 | 0,125 - 0,600 | 28.000                                                                                                           | 3024      | 0,027 | 0,030 | 0,100 - 0,600 |  |
| 1,0                               | 0,1  | 10 | 33.000                                                                             | 3300      | 0,025 | 0,023 | 0,080 - 0,600 | 28.000                                                                                                           | 3024      | 0,027 | 0,020 | 0,070 - 0,600 |  |
| 1,0                               | 0,1  | 12 | 29.000                                                                             | 2900      | 0,025 | 0,023 | 0,080 - 0,600 | 25.000                                                                                                           | 2000      | 0,020 | 0,020 | 0,060 - 0,600 |  |
| 1,0                               | 0,1  | 16 | 29.000                                                                             | 2552      | 0,022 | 0,013 | 0,050 - 0,600 | 25.000                                                                                                           | 2000      | 0,020 | 0,010 | 0,040 - 0,600 |  |
| 1,0                               | 0,1  | 20 | 22.000                                                                             | 1936      | 0,022 | 0,008 | 0,030 - 0,600 | 19.000                                                                                                           | 1520      | 0,020 | 0,007 | 0,030 - 0,600 |  |
| 1,5                               | 0,1  | 4  | 28.000                                                                             | 3360      | 0,03  | 0,068 | 0,220 - 0,800 | 24.000                                                                                                           | 2880      | 0,030 | 0,055 | 0,170 - 0,800 |  |
| 1,5                               | 0,1  | 8  | 26.000                                                                             | 2600      | 0,025 | 0,058 | 0,180 - 0,800 | 22.000                                                                                                           | 2200      | 0,025 | 0,045 | 0,150 - 0,800 |  |
| 1,5                               | 0,1  | 12 | 26.000                                                                             | 2600      | 0,025 | 0,058 | 0,180 - 0,800 | 22.000                                                                                                           | 2200      | 0,025 | 0,045 | 0,150 - 0,800 |  |
| 1,5                               | 0,1  | 15 | 23.000                                                                             | 2300      | 0,025 | 0,035 | 0,118 - 0,800 | 20.000                                                                                                           | 1600      | 0,020 | 0,030 | 0,100 - 0,800 |  |
| 1,5                               | 0,1  | 20 | 23.000                                                                             | 2300      | 0,025 | 0,035 | 0,118 - 0,800 | 20.000                                                                                                           | 1600      | 0,020 | 0,300 | 0,100 - 0,800 |  |
| 2,0                               | 0,05 | 4  | 21.000                                                                             | 4200      | 0,05  | 0,138 | 0,430 - 1,100 | 18.000                                                                                                           | 3600      | 0,050 | 0,110 | 0,350 - 1,100 |  |
| 2,0                               | 0,05 | 8  | 21.000                                                                             | 4200      | 0,05  | 0,095 | 0,310 - 1,100 | 18.000                                                                                                           | 3600      | 0,050 | 0,080 | 0,250 - 1,100 |  |
| 2,0                               | 0,05 | 12 | 19.000                                                                             | 3420      | 0,045 | 0,054 | 0,170 - 1,100 | 17.000                                                                                                           | 2720      | 0,040 | 0,045 | 0,140 - 1,100 |  |
| 2,0                               | 0,05 | 16 | 19.000                                                                             | 3420      | 0,045 | 0,054 | 0,170 - 1,100 | 17.000                                                                                                           | 2720      | 0,040 | 0,042 | 0,140 - 1,100 |  |
| 2,0                               | 0,05 | 20 | 19.000                                                                             | 3420      | 0,045 | 0,03  | 0,110 - 1,100 | 17.000                                                                                                           | 2720      | 0,040 | 0,025 | 0,090 - 1,100 |  |
| 2,0                               | 0,1  | 4  | 21.000                                                                             | 4620      | 0,055 | 0,2   | 0,620 - 1,100 | 18.000                                                                                                           | 3600      | 0,050 | 0,160 | 0,500 - 1,100 |  |
| 2,0                               | 0,1  | 8  | 21.000                                                                             | 4620      | 0,055 | 0,138 | 0,430 - 1,100 | 18.000                                                                                                           | 3600      | 0,050 | 0,110 | 0,340 - 1,100 |  |
| 2,0                               | 0,1  | 12 | 19.000                                                                             | 3800      | 0,05  | 0,077 | 0,250 - 1,100 | 17.000                                                                                                           | 3400      | 0,050 | 0,060 | 0,200 - 1,100 |  |
| 2,0                               | 0,1  | 16 | 19.000                                                                             | 3800      | 0,05  | 0,077 | 0,250 - 1,100 | 17.000                                                                                                           | 3400      | 0,050 | 0,060 | 0,200 - 1,100 |  |
| 2,0                               | 0,1  | 20 | 19.000                                                                             | 3800      | 0,05  | 0,047 | 0,16 - 1,100  | 17.000                                                                                                           | 3400      | 0,050 | 0,040 | 0,120 - 1,100 |  |
| 2,5                               | 0,1  | 8  | 19.000                                                                             | 3800      | 0,05  | 0,175 | 0,550 - 1,400 | 16.000                                                                                                           | 3200      | 0,050 | 0,140 | 0,440 - 1,400 |  |
| 2,5                               | 0,1  | 16 | 18.000                                                                             | 2880      | 0,04  | 0,075 | 0,250 - 1,400 | 15.000                                                                                                           | 2400      | 0,040 | 0,060 | 0,200 - 1,400 |  |
| 2,5                               | 0,1  | 20 | 17.000                                                                             | 3060      | 0,045 | 0,06  | 0,200 - 1,400 | 15.000                                                                                                           | 2400      | 0,040 | 0,050 | 0,170 - 1,400 |  |
| 2,5                               | 0,2  | 8  | 16.000                                                                             | 3520      | 0,055 | 0,022 | 0,670 - 1,400 | 16.000                                                                                                           | 3200      | 0,050 | 0,175 | 0,540 - 1,400 |  |
| 2,5                               | 0,2  | 16 | 15.000                                                                             | 2700      | 0,045 | 0,1   | 0,300 - 1,400 | 15.000                                                                                                           | 2700      | 0,045 | 0,075 | 0,250 - 1,400 |  |
| 2,5                               | 0,2  | 20 | 14.000                                                                             | 2800      | 0,05  | 0,075 | 0,25 - 1,400  | 15.000                                                                                                           | 3000      | 0,050 | 0,060 | 0,200 - 1,400 |  |
| 3,0                               | 0,2  | 8  | 17.000                                                                             | 3740      | 0,055 | 0,295 | 0,920 - 1,600 | 14.000                                                                                                           | 3.080     | 0,055 | 0,235 | 0,750 - 1,600 |  |
| 3,0                               | 0,2  | 12 | 17.000                                                                             | 3740      | 0,055 | 0,2   | 0,640 - 1,600 | 14.000                                                                                                           | 3.080     | 0,055 | 0,165 | 0,520 - 1,600 |  |
| 3,0                               | 0,2  | 16 | 17.000                                                                             | 3400      | 0,05  | 0,115 | 0,370 - 1,600 | 14.000                                                                                                           | 3080      | 0,055 | 0,094 | 0,300 - 1,600 |  |
| 3,0                               | 0,2  | 20 | 15.000                                                                             | 3000      | 0,05  | 0,115 | 0,370 - 1,600 | 13.000                                                                                                           | 2600      | 0,050 | 0,094 | 0,300 - 1,600 |  |
| 3,0                               | 0,2  | 25 | 15.000                                                                             | 3000      | 0,05  | 0,09  | 0,320 - 1,600 | 13.000                                                                                                           | 2600      | 0,050 | 0,075 | 0,250 - 1,600 |  |
| 3,0                               | 0,2  | 30 | 15.000                                                                             | 3000      | 0,05  | 0,075 | 0,25 - 1,600  | 13.000                                                                                                           | 2600      | 0,050 | 0,060 | 0,200 - 1,600 |  |
| 4,0                               | 0,2  | 12 | 13.000                                                                             | 4160      | 0,08  | 0,34  | 1,080 - 2,00  | 11.000                                                                                                           | 3520      | 0,080 | 0,280 | 0,860 - 2,000 |  |
| 4,0                               | 0,2  | 20 | 11.000                                                                             | 3080      | 0,07  | 0,17  | 0,550 - 2,000 | 10.000                                                                                                           | 2800      | 0,070 | 0,142 | 0,450 - 2,000 |  |
| 4,0                               | 0,2  | 30 | 8.000                                                                              | 2240      | 0,07  | 0,12  | 0,400 - 2,000 | 7.000                                                                                                            | 1960      | 0,070 | 0,100 | 0,330 - 2,000 |  |
| 4,0                               | 0,2  | 40 | 7.000                                                                              | 1960      | 0,07  | 0,09  | 0,320 - 2,000 | 6.000                                                                                                            | 1680      | 0,070 | 0,075 | 0,250 - 2,000 |  |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.

*These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.*



Richtwerte für den Einsatz von VHM-Gesenkfräser mit Eckenradius  
Recommended cutting data for solid carbide end mills with corner radius

Schruppen  
Roughing

Art. 30.6267

| 4.1 - 4.2 - 4.3<br>Rostfreie Stähle / Stainless steels<br>austenitisch / ferritisch - austenitic / ferritic<br>35 - 45 HRC |                  |           |       |       |               | 8.1<br>Gehärtete Stähle / Hardened steels<br>45 - 55 HRC |           |       |       |               | 8.2 - 8.3<br>Gehärtete Stähle / Hardened steels<br>55 - 70 HRC |           |       |       |               |
|----------------------------------------------------------------------------------------------------------------------------|------------------|-----------|-------|-------|---------------|----------------------------------------------------------|-----------|-------|-------|---------------|----------------------------------------------------------------|-----------|-------|-------|---------------|
|                                                                                                                            | min <sup>1</sup> | Vf mm/min | fz mm | ap mm | ae mm         | min <sup>1</sup>                                         | Vf mm/min | fz mm | ap mm | ae mm         | min <sup>1</sup>                                               | Vf mm/min | fz mm | ap mm | ae mm         |
|                                                                                                                            | 33.000           | 3300      | 0,025 | 0,042 | 0,135 - 0,600 | 28.000                                                   | 2240      | 0,020 | 0,030 | 0,1 - 0,600   | 26.000                                                         | 2080      | 0,020 | 0,027 | 0,090 - 0,600 |
|                                                                                                                            | 30.000           | 3000      | 0,025 | 0,023 | 0,080 - 0,600 | 25.000                                                   | 2000      | 0,020 | 0,016 | 0,06 - 0,600  | 23.000                                                         | 1840      | 0,020 | 0,015 | 0,050 - 0,600 |
|                                                                                                                            | 30.000           | 3000      | 0,025 | 0,023 | 0,080 - 0,600 | 25.000                                                   | 2000      | 0,020 | 0,016 | 0,06 - 0,600  | 23.000                                                         | 1840      | 0,020 | 0,015 | 0,050 - 0,600 |
|                                                                                                                            | 30.000           | 3000      | 0,025 | 0,014 | 0,050 - 0,600 | 25.000                                                   | 2000      | 0,020 | 0,010 | 0,04 - 0,600  | 23.000                                                         | 1840      | 0,020 | 0,010 | 0,040 - 0,600 |
|                                                                                                                            | 26.000           | 2080      | 0,020 | 0,014 | 0,050 - 0,600 | 22.000                                                   | 2640      | 0,030 | 0,010 | 0,04 - 0,600  | 21.000                                                         | 1260      | 0,015 | 0,010 | 0,035 - 0,600 |
|                                                                                                                            | 26.000           | 2080      | 0,020 | 0,008 | 0,032 - 0,600 | 22.000                                                   | 2200      | 0,025 | 0,060 | 0,02 - 0,600  | 21.000                                                         | 1260      | 0,015 | 0,060 | 0,020 - 0,600 |
|                                                                                                                            | 20.000           | 1600      | 0,020 | 0,005 | 0,020 - 0,600 | 17.000                                                   | 1224      | 0,018 | 0,010 | 0,03 - 0,600  | 16.000                                                         | 960       | 0,015 | 0,004 | 0,015 - 0,600 |
|                                                                                                                            | 33.000           | 3960      | 0,030 | 0,060 | 0,190 - 0,600 | 28.000                                                   | 2800      | 0,025 | 0,045 | 0,15 - 0,600  | 26.000                                                         | 2080      | 0,020 | 0,040 | 0,140 - 0,600 |
|                                                                                                                            | 30.000           | 3000      | 0,025 | 0,035 | 0,110 - 0,600 | 25.000                                                   | 2500      | 0,025 | 0,025 | 0,08 - 0,600  | 23.000                                                         | 1840      | 0,020 | 0,022 | 0,080 - 0,600 |
|                                                                                                                            | 30.000           | 3000      | 0,025 | 0,035 | 0,110 - 0,600 | 25.000                                                   | 2500      | 0,025 | 0,025 | 0,08 - 0,600  | 23.000                                                         | 1840      | 0,020 | 0,022 | 0,080 - 0,600 |
|                                                                                                                            | 30.000           | 3000      | 0,025 | 0,020 | 0,070 - 0,600 | 25.000                                                   | 2500      | 0,025 | 0,015 | 0,05 - 0,600  | 23.000                                                         | 1840      | 0,020 | 0,012 | 0,050 - 0,600 |
|                                                                                                                            | 26.000           | 2600      | 0,025 | 0,020 | 0,070 - 0,600 | 22.000                                                   | 1760      | 0,020 | 0,015 | 0,05 - 0,600  | 21.000                                                         | 1512      | 0,018 | 0,013 | 0,050 - 0,600 |
|                                                                                                                            | 26.000           | 2080      | 0,020 | 0,012 | 0,045 - 0,600 | 22.000                                                   | 1584      | 0,018 | 0,008 | 0,03 - 0,600  | 21.000                                                         | 1260      | 0,015 | 0,008 | 0,030 - 0,600 |
|                                                                                                                            | 20.000           | 1600      | 0,020 | 0,008 | 0,030 - 0,600 | 17.000                                                   | 1224      | 0,018 | 0,006 | 0,023 - 0,600 | 16.000                                                         | 960       | 0,015 | 0,005 | 0,020 - 0,600 |
|                                                                                                                            | 25.000           | 3000      | 0,030 | 0,060 | 0,190 - 0,800 | 21.000                                                   | 2100      | 0,025 | 0,045 | 0,150 - 0,800 | 20.000                                                         | 1600      | 0,020 | 0,040 | 0,140 - 0,800 |
|                                                                                                                            | 23.000           | 2300      | 0,025 | 0,051 | 0,168 - 0,800 | 19.000                                                   | 1900      | 0,025 | 0,037 | 0,130 - 0,800 | 18.000                                                         | 1440      | 0,020 | 0,035 | 0,120 - 0,800 |
|                                                                                                                            | 23.000           | 2300      | 0,025 | 0,053 | 0,168 - 0,800 | 19.000                                                   | 1900      | 0,025 | 0,036 | 0,130 - 0,800 | 18.000                                                         | 1440      | 0,020 | 0,035 | 0,110 - 0,800 |
|                                                                                                                            | 21.000           | 2016      | 0,024 | 0,031 | 0,110 - 0,800 | 17.000                                                   | 1360      | 0,020 | 0,023 | 0,080 - 0,800 | 16.000                                                         | 1152      | 0,018 | 0,020 | 0,070 - 0,800 |
|                                                                                                                            | 21.000           | 2016      | 0,024 | 0,031 | 0,110 - 0,800 | 17.000                                                   | 1360      | 0,020 | 0,022 | 0,080 - 0,800 | 16.000                                                         | 1152      | 0,018 | 0,020 | 0,070 - 0,800 |
|                                                                                                                            | 19.000           | 3800      | 0,050 | 0,125 | 0,390 - 1,100 | 16.000                                                   | 2560      | 0,040 | 0,090 | 0,290 - 1,100 | 15.000                                                         | 2100      | 0,035 | 0,080 | 0,270 - 1,100 |
|                                                                                                                            | 19.000           | 3800      | 0,050 | 0,090 | 0,280 - 1,100 | 16.000                                                   | 2560      | 0,040 | 0,062 | 0,200 - 1,100 | 15.000                                                         | 2100      | 0,035 | 0,057 | 0,190 - 1,100 |
|                                                                                                                            | 18.000           | 3240      | 0,045 | 0,048 | 0,160 - 1,100 | 15.000                                                   | 2400      | 0,040 | 0,034 | 0,120 - 1,100 | 14.000                                                         | 1960      | 0,035 | 0,030 | 0,110 - 1,100 |
|                                                                                                                            | 18.000           | 3240      | 0,045 | 0,047 | 0,160 - 1,100 | 15.000                                                   | 2400      | 0,040 | 0,034 | 0,120 - 1,100 | 14.000                                                         | 1960      | 0,035 | 0,030 | 0,110 - 1,100 |
|                                                                                                                            | 18.000           | 3240      | 0,045 | 0,030 | 0,100 - 1,100 | 15.000                                                   | 2400      | 0,040 | 0,050 | 0,170 - 1,100 | 14.000                                                         | 1960      | 0,035 | 0,020 | 0,070 - 1,100 |
|                                                                                                                            | 19.000           | 3800      | 0,050 | 0,180 | 0,550 - 1,100 | 16.000                                                   | 2880      | 0,045 | 0,130 | 0,400 - 1,100 | 16.000                                                         | 2240      | 0,035 | 0,120 | 0,380 - 1,100 |
|                                                                                                                            | 19.000           | 4180      | 0,055 | 0,125 | 0,380 - 1,100 | 16.000                                                   | 2560      | 0,040 | 0,090 | 0,290 - 1,100 | 15.000                                                         | 2100      | 0,035 | 0,080 | 0,270 - 1,100 |
|                                                                                                                            | 18.000           | 3600      | 0,050 | 0,700 | 0,230 - 1,100 | 15.000                                                   | 2400      | 0,040 | 0,050 | 0,170 - 1,100 | 15.000                                                         | 2280      | 0,038 | 0,045 | 0,150 - 1,100 |
|                                                                                                                            | 18.000           | 3600      | 0,050 | 0,070 | 0,230 - 1,100 | 15.000                                                   | 2400      | 0,040 | 0,050 | 0,160 - 1,100 | 14.000                                                         | 2128      | 0,038 | 0,045 | 0,150 - 1,100 |
|                                                                                                                            | 18.000           | 3600      | 0,050 | 0,040 | 0,145 - 1,100 | 15.000                                                   | 2400      | 0,040 | 0,030 | 0,105 - 1,100 | 14.000                                                         | 2128      | 0,038 | 0,030 | 0,090 - 1,100 |
|                                                                                                                            | 17.000           | 3400      | 0,050 | 0,160 | 0,500 - 1,400 | 14.000                                                   | 2240      | 0,040 | 0,115 | 0,370 - 1,400 | 13.000                                                         | 1820      | 0,035 | 0,105 | 0,340 - 1,400 |
|                                                                                                                            | 17.000           | 2720      | 0,040 | 0,070 | 0,230 - 1,400 | 14.000                                                   | 1960      | 0,035 | 0,050 | 0,170 - 1,400 | 13.000                                                         | 1560      | 0,030 | 0,045 | 0,150 - 1,400 |
|                                                                                                                            | 16.000           | 2560      | 0,040 | 0,055 | 0,180 - 1,400 | 13.000                                                   | 2080      | 0,040 | 0,040 | 0,140 - 1,400 | 12.000                                                         | 1680      | 0,035 | 0,035 | 0,120 - 1,400 |
|                                                                                                                            | 16.000           | 3520      | 0,055 | 0,195 | 0,600 - 1,400 | 14.000                                                   | 2240      | 0,040 | 0,014 | 0,440 - 1,400 | 13.000                                                         | 1820      | 0,035 | 0,130 | 0,400 - 1,400 |
|                                                                                                                            | 15.000           | 2700      | 0,045 | 0,090 | 0,280 - 1,400 | 14.000                                                   | 2240      | 0,040 | 0,060 | 0,200 - 1,400 | 13.000                                                         | 1820      | 0,035 | 0,060 | 0,190 - 1,400 |
|                                                                                                                            | 15.000           | 3000      | 0,050 | 0,070 | 0,220 - 1,400 | 13.000                                                   | 2080      | 0,040 | 0,050 | 0,170 - 1,400 | 12.000                                                         | 1824      | 0,038 | 0,045 | 0,150 - 1,400 |
|                                                                                                                            | 15.000           | 3300      | 0,055 | 0,265 | 0,840 - 1,600 | 12.000                                                   | 2064      | 0,043 | 0,190 | 0,600 - 1,600 | 12.000                                                         | 1920      | 0,040 | 0,180 | 0,550 - 1,600 |
|                                                                                                                            | 15.000           | 3300      | 0,055 | 0,185 | 0,580 - 1,600 | 12.000                                                   | 2064      | 0,043 | 0,135 | 0,430 - 1,600 | 12.000                                                         | 1920      | 0,040 | 0,125 | 0,380 - 1,600 |
|                                                                                                                            | 15.000           | 3300      | 0,055 | 0,105 | 0,340 - 1,600 | 12.000                                                   | 2064      | 0,043 | 0,075 | 0,250 - 1,600 | 12.000                                                         | 1920      | 0,040 | 0,070 | 0,230 - 1,600 |
|                                                                                                                            | 13.000           | 2600      | 0,050 | 0,105 | 0,330 - 1,600 | 11.000                                                   | 1892      | 0,043 | 0,075 | 0,250 - 1,600 | 11.000                                                         | 1760      | 0,040 | 0,070 | 0,230 - 1,600 |
|                                                                                                                            | 13.000           | 2600      | 0,050 | 0,085 | 0,300 - 1,600 | 11.000                                                   | 1892      | 0,043 | 0,063 | 0,200 - 1,600 | 11.000                                                         | 1760      | 0,040 | 0,060 | 0,190 - 1,60  |
|                                                                                                                            | 13.000           | 2600      | 0,050 | 0,070 | 0,220 - 1,600 | 11.000                                                   | 1892      | 0,043 | 0,050 | 0,170 - 1,600 | 11.000                                                         | 1760      | 0,040 | 0,045 | 0,150 - 1,600 |
|                                                                                                                            | 11.000           | 3520      | 0,080 | 0,310 | 0,980 - 2,000 | 9.000                                                    | 2160      | 0,060 | 0,225 | 0,700 - 2,000 | 9.000                                                          | 1980      | 0,055 | 0,200 | 0,650 - 2,000 |
|                                                                                                                            | 10.000           | 2800      | 0,070 | 0,160 | 0,500 - 2,000 | 9.000                                                    | 1980      | 0,055 | 0,115 | 0,360 - 2,000 | 8.000                                                          | 1600      | 0,050 | 0,105 | 0,330 - 2,000 |
|                                                                                                                            | 8.000            | 2240      | 0,070 | 0,115 | 0,360 - 2,000 | 6.000                                                    | 1320      | 0,055 | 0,080 | 0,270 - 2,000 | 6.000                                                          | 1200      | 0,050 | 0,075 | 0,240 - 2,000 |
|                                                                                                                            | 7.000            | 1960      | 0,070 | 0,085 | 0,280 - 2,000 | 5.000                                                    |           | 0,055 | 0,060 | 0,200 - 2,000 | 5.000                                                          | 1000      | 0,050 | 0,060 | 0,190 - 2,000 |

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

Art. 30.6265

Empfohlene Schnittdaten für Karnasch Micro-Schaftfräser  
Recommended cutting data for Karnasch solid carbide micro end mills

| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup> | 0,2 x 0,05 rp x 2        | 0,2 x 0,05 rp x 3 | 0,4x 0,05 rp x 4 | 0,4 x 0,05 rp x 5 | 0,4 x 0,05 rp x 6 | 0,5 x 0,05 rp x 5 | 0,5 x 0,05 rp x 8 | 0,5 x 0,05 rp x 10 |  |
|-----------------------------------|-------------------------------------------------------------------|--------------------------|-------------------|------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--|
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )                  | ap = 0,005<br>n = 45.000 | 0,004<br>40.000   | 0,006<br>36.000  | 0,006<br>32.000   | 0,004<br>28.000   | 0,010<br>34.000   | 0,006<br>27.000   | 0,005<br>20.000    |  |
|                                   | Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )                 | fz = 0,015<br>Vf = 1.200 | 0,010<br>800      | 0,018<br>1.200   | 0,016<br>1.000    | 0,012<br>800      | 0,02<br>1.500     | 0,015<br>1.000    | 0,014<br>700       |  |
|                                   |                                                                   |                          |                   |                  |                   |                   |                   |                   |                    |  |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )                  | ap = 0,005<br>n = 42.000 | 0,004<br>38.000   | 0,005<br>33.000  | 0,005<br>30.000   | 0,003<br>26.000   | 0,010<br>32.000   | 0,005<br>25.000   | 0,004<br>19.000    |  |
|                                   | Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )                 | fz = 0,014<br>Vf = 1.100 | 0,008<br>700      | 0,016<br>1.200   | 0,015<br>900      | 0,010<br>700      | 0,018<br>1.200    | 0,012<br>700      | 0,012<br>500       |  |
|                                   |                                                                   |                          |                   |                  |                   |                   |                   |                   |                    |  |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )            | ap = 0,005<br>n = 37.000 | 0,003<br>36.000   | 0,004<br>30.000  | 0,004<br>27.000   | 0,003<br>25.000   | 0,007<br>28.000   | 0,004<br>22.000   | 0,003<br>17.000    |  |
|                                   | Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> )             | fz = 0,012<br>Vf = 1.000 | 0,007<br>600      | 0,015<br>1.000   | 0,014<br>800      | 0,008<br>600      | 0,015<br>900      | 0,010<br>500      | 0,010<br>400       |  |
|                                   |                                                                   |                          |                   |                  |                   |                   |                   |                   |                    |  |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC                                         | ap = 0,003<br>n = 35.000 | 0,002<br>34.000   | 0,003<br>27.000  | 0,003<br>24.000   | 0,002<br>22.000   | 0,006<br>26.000   | 0,003<br>20.000   | 0,0025<br>15.000   |  |
|                                   | Hardened steels < 72 HRC                                          | fz = 0,010<br>Vf = 800   | 0,006<br>500      | 0,013<br>700     | 0,012<br>600      | 0,001<br>400      | 0,012<br>600      | 0,008<br>400      | 0,008<br>300       |  |
|                                   |                                                                   |                          |                   |                  |                   |                   |                   |                   |                    |  |

| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup> | 0,6 x 0,06 rp x 6        | 0,6 x 0,06 rp x 8 | 0,6 x 0,06 rp x 10 | 0,6 x 0,06 rp x 12 | 0,6 x 0,06 rp x 15 | 0,8 x 0,08 rp x 6 | 0,8 x 0,08 rp x 12 | 0,8 x 0,08 rp x 16 |  |
|-----------------------------------|-------------------------------------------------------------------|--------------------------|-------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|--|
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )                  | ap = 0,036<br>n = 30.000 | 0,030<br>26.000   | 0,020<br>24.000    | 0,008<br>22.000    | 0,004<br>18.000    | 0,04<br>36.000    | 0,016<br>31.000    | 0,008<br>27.000    |  |
|                                   | Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )                 | fz = 0,026<br>Vf = 1.400 | 0,018<br>1.400    | 0,015<br>1.200     | 0,025<br>1.100     | 0,024<br>900       | 0,022<br>1.600    | 0,020<br>1.400     | 0,015<br>1.100     |  |
|                                   |                                                                   |                          |                   |                    |                    |                    |                   |                    |                    |  |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )                  | ap = 0,035<br>n = 28.000 | 0,010<br>25.000   | 0,008<br>23.000    | 0,007<br>21.000    | 0,004<br>17.000    | 0,032<br>33.000   | 0,014<br>30.000    | 0,006<br>26.000    |  |
|                                   | Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )                 | fz = 0,022<br>Vf = 1.200 | 0,022<br>1.100    | 0,020<br>1.000     | 0,020<br>900       | 0,020<br>700       | 0,020<br>1.500    | 0,018<br>1.100     | 0,012<br>900       |  |
|                                   |                                                                   |                          |                   |                    |                    |                    |                   |                    |                    |  |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )            | ap = 0,028<br>n = 27.000 | 0,020<br>24.000   | 0,010<br>21.000    | 0,006<br>19.000    | 0,003<br>15.000    | 0,028<br>30.000   | 0,012<br>26.000    | 0,005<br>23.000    |  |
|                                   | Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> )             | fz = 0,020<br>Vf = 1.100 | 0,016<br>1.000    | 0,015<br>900       | 0,018<br>700       | 0,018<br>500       | 0,018<br>1.200    | 0,016<br>1.100     | 0,010<br>900       |  |
|                                   |                                                                   |                          |                   |                    |                    |                    |                   |                    |                    |  |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC                                         | ap = 0,025<br>n = 27.000 | 0,015<br>23.000   | 0,010<br>20.000    | 0,005<br>17.000    | 0,003<br>14.000    | 0,025<br>27.000   | 0,010<br>24.000    | 0,004<br>21.000    |  |
|                                   | Hardened steels < 72 HRC                                          | fz = 0,016<br>Vf = 900   | 0,015<br>700      | 0,015<br>600       | 0,015<br>500       | 0,015<br>400       | 0,015<br>1.000    | 0,014<br>800       | 0,009<br>600       |  |
|                                   |                                                                   |                          |                   |                    |                    |                    |                   |                    |                    |  |

| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup> | 1,0 x 0,1 rp x 8         | 1,0 x 0,1 rp x 10 | 1,0 x 0,1 rp x 15 | 1,0 x 0,1 rp x 20 | 1,0 x 0,1 rp x 25 | 1,0 x 0,1 rp x 30 | 1,5 x 0,15 rp x 15 | 1,5 x 0,15 rp x 25 | 1,5 x 0,15 rp x 30 |
|-----------------------------------|-------------------------------------------------------------------|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )                  | ap = 0,035<br>n = 32.000 | 0,032<br>32.000   | 0,025<br>28.000   | 0,018<br>22.000   | 0,015<br>17.000   | 0,012<br>17.000   | 0,04<br>22.000     | 0,028<br>16.000    | 0,025<br>14.000    |
|                                   | Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )                 | fz = 0,032<br>Vf = 2.100 | 0,030<br>2.000    | 0,028<br>1.800    | 0,026<br>1.200    | 0,025<br>1.000    | 0,025<br>1.000    | 0,03<br>1.400      | 0,03<br>1.000      | 0,03<br>800        |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                    |                    |                    |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )                  | ap = 0,030<br>n = 30.000 | 0,028<br>30.000   | 0,022<br>26.000   | 0,016<br>20.000   | 0,014<br>16.000   | 0,012<br>16.000   | 0,035<br>21.000    | 0,025<br>15.000    | 0,020<br>13.000    |
|                                   | Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )                 | fz = 0,032<br>Vf = 2.000 | 0,032<br>1.900    | 0,026<br>1.600    | 0,024<br>1.100    | 0,023<br>900      | 0,022<br>800      | 0,028<br>1.200     | 0,025<br>800       | 0,025<br>700       |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                    |                    |                    |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )            | ap = 0,025<br>n = 25.000 | 0,022<br>26.000   | 0,018<br>23.000   | 0,012<br>17.000   | 0,010<br>15.000   | 0,011<br>14.000   | 0,028<br>18.000    | 0,018<br>14.000    | 0,016<br>12.000    |
|                                   | Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> )             | fz = 0,030<br>Vf = 1.600 | 0,030<br>1.700    | 0,025<br>1.400    | 0,022<br>900      | 0,021<br>700      | 0,021<br>600      | 0,024<br>1.100     | 0,024<br>700       | 0,022<br>600       |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                    |                    |                    |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC                                         | ap = 0,022<br>n = 25.000 | 0,020<br>24.000   | 0,016<br>22.000   | 0,010<br>16.000   | 0,009<br>14.000   | 0,010<br>13.000   | 0,025<br>17.000    | 0,016<br>13.000    | 0,014<br>11.000    |
|                                   | Hardened steels < 72 HRC                                          | fz = 0,026<br>Vf = 1.200 | 0,028<br>1.500    | 0,24<br>1.200     | 0,020<br>700      | 0,020<br>600      | 0,020<br>500      | 0,024<br>900       | 0,022<br>600       | 0,02<br>400        |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                    |                    |                    |

| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup> | 2,0 x 0,2 rp x 20        | 2,0 x 0,2 rp x 25 | 2,0 x 0,2 rp x 30 | 2,0 x 0,2 rp x 40 | 2,0 x 0,2 rp x 50 | 3,0 x 0,3 rp x 30 | 3,0 x 0,3 rp x 40 | 3,0 x 0,3 rp x 50 | 3,0 x 0,3 rp x 60 |
|-----------------------------------|-------------------------------------------------------------------|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )                  | ap = 0,045<br>n = 17.000 | 0,045<br>16.000   | 0,04<br>15.000    | 0,030<br>11.000   | 0,015<br>9.000    | 0,065<br>1.300    | 0,06<br>12.000    | 0,045<br>9.000    | 0,025<br>7.000    |
|                                   | Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )                 | fz = 0,07<br>Vf = 2.200  | 0,06<br>2.100     | 0,06<br>1.900     | 0,05<br>1.200     | 0,05<br>1.000     | 0,065<br>1.500    | 0,06<br>1.400     | 0,05<br>900       | 0,05<br>800       |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                   |                   |                   |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )                  | ap = 0,040<br>n = 18.000 | 0,038<br>16.000   | 0,035<br>14.000   | 0,028<br>10.000   | 0,014<br>9.000    | 0,06<br>12.000    | 0,05<br>11.000    | 0,04<br>8.000     | 0,02<br>6.000     |
|                                   | Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )                 | fz = 0,06<br>Vf = 1.800  | 0,05<br>1.700     | 0,05<br>1.600     | 0,045<br>1.100    | 0,045<br>900      | 0,055<br>1.300    | 0,05<br>1.200     | 0,045<br>800      | 0,045<br>700      |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                   |                   |                   |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )            | ap = 0,032<br>n = 14.000 | 0,030<br>13.000   | 0,028<br>12.000   | 0,022<br>9.000    | 0,010<br>8.000    | 0,05<br>12.000    | 0,045<br>10.000   | 0,03<br>7.000     | 0,02<br>6.000     |
|                                   | Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> )             | fz = 0,06<br>Vf = 1.600  | 0,05<br>1.500     | 0,05<br>1.400     | 0,04<br>900       | 0,040<br>800      | 0,05<br>1.100     | 0,045<br>1.000    | 0,04<br>700       | 0,04<br>600       |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                   |                   |                   |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC                                         | ap = 0,030<br>n = 13.000 | 0,028<br>12.000   | 0,025<br>11.000   | 0,020<br>8.000    | 0,008<br>7.000    | 0,045<br>11.000   | 0,040<br>9.000    | 0,025<br>6.000    | 0,016<br>5.500    |
|                                   | Hardened steels < 72 HRC                                          | fz = 0,05<br>Vf = 1.300  | 0,045<br>1.200    | 0,04<br>1.100     | 0,038<br>800      | 0,035<br>600      | 0,045<br>900      | 0,04<br>800       | 0,035<br>500      | 0,035<br>450      |
|                                   |                                                                   |                          |                   |                   |                   |                   |                   |                   |                   |                   |

Modifizierung der Schnittdaten für Kupfer  
Modification of the cutting conditions for copper

n = + 25 % / fz = + 25 %

Sind die Ihnen zur Verfügung stehenden Drehzahlen geringer als in dieser Tabelle vorgegebenen ist der Vorschub im gleichen Verhältnis zu reduzieren.  
If the rpm available in lower than recommended, reduce the feed rate to the same ratio.

Empfohlene Schnittdaten für Karnasch Micro-Schaftfräser  
Recommended cutting data for Karnasch solid carbide micro end mills

Art. 30.6266

| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup>                                               | 0,2 x 1,0                                                     | 0,2 x 1,5                                  | 0,2 x 2,0                                  | 0,2 x 3,0                                  | 0,4 x 2                                    | 0,4 x 3                                    | 0,4 x 4                                    | 0,4 x 5                                     | 0,4 x 6                                     | 0,5 x 2                                   | 0,5 x 4                                    | 0,6 x 6                                   | 0,6 x 8                                    | 0,6 x 10                                   | 0,6 x 12                                   | 0,6 x 15                                   |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------|--------------------------------------------|-------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )<br>Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )           | ap= 0,015<br>ae= 0,045<br>n= 42.000<br>fz= 0,022<br>Vf= 2.200 | 0,008<br>0,023<br>44.000<br>0,020<br>1.900 | 0,005<br>0,018<br>44.000<br>0,020<br>1.900 | 0,004<br>0,010<br>39.000<br>0,020<br>1.700 | 0,030<br>0,090<br>39.000<br>0,030<br>2.600 | 0,018<br>0,050<br>35.000<br>0,030<br>2.100 | 0,008<br>0,022<br>35.000<br>0,028<br>2.000 | 0,006<br>0,018<br>32.000<br>0,027<br>1.800  | 0,005<br>0,016<br>30.000<br>0,025<br>1.600  | 0,040<br>0,12<br>39.000<br>0,030<br>2.700 | 0,035<br>0,01<br>36.000<br>0,028<br>2.200  | 0,018<br>0,05<br>36.000<br>0,028<br>2.000 | 0,017<br>0,05<br>32.000<br>0,028<br>1.800  | 0,014<br>0,04<br>32.000<br>0,025<br>1.600  | 0,009<br>0,025<br>24.000<br>0,024<br>1.200 | 0,004<br>0,015<br>20.000<br>0,022<br>1.000 |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )<br>Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )           | ap= 0,012<br>ae= 0,040<br>n= 42.000<br>fz= 0,020<br>Vf= 1.800 | 0,006<br>0,020<br>40.000<br>0,020<br>1.700 | 0,005<br>0,016<br>42.000<br>0,017<br>1.500 | 0,003<br>0,010<br>37.000<br>0,018<br>1.400 | 0,027<br>0,080<br>37.000<br>0,030<br>2.200 | 0,016<br>0,045<br>33.000<br>0,030<br>2.000 | 0,006<br>0,020<br>33.000<br>0,024<br>1.700 | 0,005<br>0,016<br>29.000<br>0,024<br>1.500  | 0,004<br>0,014<br>27.000<br>0,022<br>1.300  | 0,035<br>0,10<br>38.000<br>0,025<br>2.000 | 0,030<br>0,09<br>34.000<br>0,025<br>2.000  | 0,015<br>0,05<br>33.000<br>0,022<br>1.700 | 0,015<br>0,05<br>30.000<br>0,022<br>1.600  | 0,012<br>0,03<br>30.000<br>0,021<br>1.400  | 0,008<br>0,023<br>22.000<br>0,022<br>1.000 | 0,004<br>0,012<br>19.000<br>0,020<br>900   |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )<br>Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> ) | ap= 0,10<br>ae= 0,30<br>n= 37.000<br>fz= 0,020<br>Vf= 1.400   | 0,005<br>0,015<br>37.000<br>0,018<br>1.400 | 0,005<br>0,012<br>37.000<br>0,016<br>1.400 | 0,003<br>0,007<br>32.000<br>0,018<br>1.200 | 0,022<br>0,065<br>33.000<br>0,025<br>1.700 | 0,012<br>0,038<br>30.000<br>0,025<br>1.500 | 0,006<br>0,018<br>30.000<br>0,023<br>1.500 | 0,004<br>0,013<br>26.000<br>0,021<br>13.000 | 0,003<br>0,010<br>24.000<br>0,024<br>12.000 | 0,030<br>0,09<br>34.000<br>0,024<br>1.400 | 0,026<br>0,08<br>30.000<br>0,024<br>1.600  | 0,012<br>0,04<br>29.000<br>0,023<br>1.500 | 0,012<br>0,035<br>27.000<br>0,023<br>1.300 | 0,010<br>0,024<br>26.000<br>0,022<br>1.100 | 0,007<br>0,020<br>20.000<br>0,020<br>900   | 0,003<br>0,011<br>17.000<br>0,020<br>700   |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC<br>Hardened steels < 72 HRC                                                           | ap= 0,09<br>ae= 0,025<br>n= 34.000<br>fz= 0,015<br>Vf= 1.200  | 0,004<br>0,015<br>34.000<br>0,015<br>1.100 | 0,003<br>0,012<br>34.000<br>0,014<br>1.000 | 0,002<br>0,006<br>30.000<br>0,015<br>900   | 0,020<br>0,060<br>30.000<br>0,022<br>1.400 | 0,012<br>0,035<br>27.000<br>0,022<br>1.200 | 0,005<br>0,015<br>27.000<br>0,020<br>1.200 | 0,004<br>0,012<br>24.000<br>0,020<br>1.000  | 0,003<br>0,010<br>22.000<br>0,018<br>1.000  | 0,028<br>0,08<br>31.000<br>0,020<br>1.200 | 0,025<br>0,07<br>28.000<br>0,022<br>1.200  | 0,011<br>0,03<br>27.000<br>0,02<br>1.200  | 0,012<br>0,032<br>25.000<br>0,02<br>1.000  | 0,009<br>0,025<br>25.000<br>0,017<br>800   | 0,005<br>0,016<br>18.000<br>0,016<br>600   | 0,003<br>0,010<br>16.000<br>0,015<br>500   |
| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup>                                               | 0,8 x 4                                                       | 0,8 x 6                                    | 0,8 x 8                                    | 0,8 x 12                                   | 0,8 x 16                                   | 1,0 x 6                                    | 1,0 x 8                                    | 1,0 x 10                                    | 1,0 x 15                                    | 1,0 x 20                                  | 1,0 x 25                                   | 1,0 x 30                                  | 1,0 x 35                                   |                                            |                                            |                                            |
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )<br>Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )           | ap= 0,050<br>ae= 0,15<br>n= 40.000<br>fz= 0,039<br>Vf= 3.000  | 0,040<br>0,12<br>36.000<br>0,035<br>2.600  | 0,02<br>0,07<br>36.000<br>0,032<br>2.500   | 0,016<br>0,05<br>32.000<br>0,030<br>2.200  | 0,015<br>0,045<br>24.000<br>0,028<br>1.400 | 0,05<br>0,14<br>33.000<br>0,04<br>2.700    | 0,05<br>0,14<br>33.000<br>0,04<br>27.000   | 0,03<br>0,09<br>32.000<br>0,04<br>2.700     | 0,025<br>0,07<br>28.000<br>0,04<br>2.500    | 0,018<br>0,05<br>22.000<br>0,035<br>1.600 | 0,015<br>0,045<br>18.000<br>0,033<br>1.300 | 0,014<br>0,04<br>17.000<br>0,03<br>1.300  | 0,008<br>0,025<br>17.000<br>0,03<br>1.300  |                                            |                                            |                                            |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )<br>Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )           | ap= 0,045<br>ae= 0,14<br>n= 37.000<br>fz= 0,035<br>Vf= 2.600  | 0,035<br>0,10<br>33.000<br>0,035<br>2.400  | 0,020<br>0,05<br>33.000<br>0,03<br>2.200   | 0,015<br>0,045<br>30.000<br>0,028<br>1.800 | 0,013<br>0,04<br>23.000<br>0,025<br>1.200  | 0,04<br>0,12<br>30.000<br>0,04<br>2.500    | 0,04<br>0,12<br>30.000<br>0,04<br>2.500    | 0,025<br>0,08<br>30.000<br>0,03<br>2.200    | 0,02<br>0,06<br>27.000<br>0,03<br>2.000     | 0,015<br>0,04<br>21.000<br>0,03<br>1.400  | 0,014<br>0,04<br>17.000<br>0,03<br>1.200   | 0,014<br>0,04<br>17.000<br>0,03<br>1.200  | 0,008<br>0,02<br>17.000<br>0,03<br>1.200   |                                            |                                            |                                            |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )<br>Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> ) | ap= 0,040<br>ae= 0,12<br>n= 33.000<br>fz= 0,030<br>Vf= 2.100  | 0,028<br>0,08<br>30.000<br>0,03<br>2.000   | 0,015<br>0,05<br>30.000<br>0,028<br>1.800  | 0,012<br>0,04<br>26.000<br>0,026<br>1.700  | 0,010<br>0,03<br>20.000<br>0,025<br>1.000  | 0,03<br>0,09<br>27.000<br>0,035<br>2.000   | 0,03<br>0,09<br>27.000<br>0,035<br>2.000   | 0,02<br>0,06<br>27.000<br>0,035<br>2.000    | 0,016<br>0,05<br>24.000<br>0,033<br>1.800   | 0,012<br>0,035<br>18.000<br>0,03<br>1.200 | 0,009<br>0,03<br>15.000<br>0,03<br>900     | 0,009<br>0,03<br>15.000<br>0,03<br>900    | 0,005<br>0,015<br>15.000<br>0,03<br>900    |                                            |                                            |                                            |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC<br>Hardened steels < 72 HRC                                                           | ap= 0,035<br>ae= 0,10<br>n= 30.000<br>fz= 0,028<br>Vf= 1.700  | 0,020<br>0,07<br>27.000<br>0,024<br>1.500  | 0,015<br>0,04<br>27.000<br>0,022<br>1.400  | 0,011<br>0,034<br>25.000<br>0,024<br>1.200 | 0,010<br>0,030<br>19.000<br>0,020<br>800   | 0,03<br>0,09<br>25.000<br>0,030<br>1.600   | 0,03<br>0,09<br>25.000<br>0,030<br>1.600   | 0,02<br>0,06<br>25.000<br>0,03<br>1.600     | 0,016<br>0,05<br>22.000<br>0,03<br>1.400    | 0,012<br>0,035<br>17.000<br>0,025<br>900  | 0,009<br>0,03<br>14.000<br>0,025<br>700    | 0,009<br>0,03<br>14.000<br>0,025<br>700   | 0,005<br>0,015<br>14.000<br>0,025<br>700   |                                            |                                            |                                            |
| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup>                                               | 1,5 x 8                                                       | 1,5 x 10                                   | 1,5 x 12                                   | 1,5 x 15                                   | 1,5 x 20                                   | 1,5 x 30                                   | 2,0 x 8                                    | 2,0 x 12                                    | 2,0 x 16                                    | 2,0 x 20                                  | 2,0 x 25                                   | 2,0 x 30                                  | 2,0 x 35                                   | 2,0 x 40                                   | 2,0 x 50                                   |                                            |
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )<br>Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )           | ap= 0,060<br>ae= 0,18<br>n= 25.000<br>fz= 0,045<br>Vf= 2.200  | 0,060<br>0,18<br>25.000<br>0,045<br>2.200  | 0,060<br>0,18<br>25.000<br>0,045<br>2.200  | 0,040<br>0,12<br>25.000<br>0,040<br>2.100  | 0,035<br>0,10<br>22.000<br>0,040<br>1.900  | 0,025<br>0,070<br>22.000<br>0,040<br>1.900 | 0,12<br>0,40<br>21.000<br>0,08<br>3.200    | 0,08<br>0,22<br>19.000<br>0,07<br>2.700     | 0,08<br>0,21<br>19.000<br>0,07<br>2.600     | 0,06<br>0,18<br>18.000<br>0,06<br>2.500   | 0,06<br>0,18<br>16.000<br>0,06<br>2.200    | 0,04<br>0,12<br>16.000<br>0,06<br>2.200   | 0,04<br>0,12<br>13.000<br>0,06<br>1.500    | 0,03<br>0,09<br>13.000<br>0,06<br>1.500    | 0,015<br>0,04<br>10.000<br>0,05<br>1.300   |                                            |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )<br>Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )           | ap= 0,055<br>ae= 0,16<br>n= 24.000<br>fz= 0,040<br>Vf= 2.000  | 0,055<br>0,15<br>24.000<br>0,040<br>2.000  | 0,055<br>0,14<br>24.000<br>0,040<br>2.000  | 0,035<br>0,10<br>24.000<br>0,035<br>1.700  | 0,030<br>0,09<br>21.000<br>0,034<br>1.500  | 0,020<br>0,06<br>21.000<br>0,032<br>1.500  | 0,12<br>0,35<br>20.000<br>0,07<br>2.800    | 0,07<br>0,2<br>18.000<br>0,06<br>2.500      | 0,07<br>0,18<br>18.000<br>0,06<br>2.400     | 0,05<br>0,15<br>17.000<br>0,05<br>2.200   | 0,05<br>0,10<br>16.000<br>0,05<br>1.900    | 0,03<br>0,08<br>15.000<br>0,05<br>1.800   | 0,03<br>0,10<br>12.000<br>0,04<br>1.300    | 0,025<br>0,08<br>12.000<br>0,04<br>1.300   | 0,12<br>0,04<br>10.000<br>0,04<br>1.100    |                                            |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )<br>Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> ) | ap= 0,045<br>ae= 0,12<br>n= 21.000<br>fz= 0,035<br>Vf= 1.600  | 0,045<br>0,11<br>21.000<br>0,035<br>1.600  | 0,045<br>0,11<br>21.000<br>0,035<br>1.600  | 0,028<br>0,08<br>21.000<br>0,032<br>1.500  | 0,025<br>0,07<br>19.000<br>0,030<br>1.300  | 0,017<br>0,05<br>18.000<br>0,06<br>1.300   | 0,09<br>0,25<br>17.000<br>0,06<br>2.100    | 0,05<br>0,16<br>16.000<br>0,06<br>2.000     | 0,04<br>0,15<br>16.000<br>0,05<br>1.900     | 0,04<br>0,12<br>16.000<br>0,05<br>1.800   | 0,04<br>0,12<br>13.000<br>0,05<br>1.700    | 0,025<br>0,08<br>13.000<br>0,05<br>1.700  | 0,025<br>0,08<br>11.000<br>0,05<br>1.100   | 0,22<br>0,06<br>11.000<br>0,05<br>1.100    | 0,11<br>0,03<br>8.000<br>0,04<br>900       |                                            |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC<br>Hardened steels < 72 HRC                                                           | ap= 0,040<br>ae= 0,10<br>n= 20.000<br>fz= 0,030<br>Vf= 1.300  | 0,040<br>0,10<br>20.000<br>0,030<br>1.300  | 0,045<br>0,07<br>19.000<br>0,028<br>1.300  | 0,025<br>0,07<br>18.000<br>0,027<br>1.200  | 0,022<br>0,06<br>17.000<br>0,025<br>1.100  | 0,015<br>0,05<br>17.000<br>0,025<br>1.100  | 0,09<br>0,25<br>16.000<br>0,05<br>1.800    | 0,05<br>0,16<br>15.000<br>0,04<br>1.600     | 0,04<br>0,15<br>15.000<br>0,04<br>1.500     | 0,038<br>0,12<br>15.000<br>0,04<br>1.400  | 0,038<br>0,11<br>12.000<br>0,04<br>1.300   | 0,025<br>0,08<br>12.000<br>0,04<br>1.300  | 0,024<br>0,07<br>10.000<br>0,04<br>800     | 0,02<br>0,06<br>10.000<br>0,04<br>800      | 0,08<br>0,03<br>8.000<br>0,03<br>700       |                                            |
| Werkstoffgruppe<br>Material group | Werkstoff HRC N/mm <sup>2</sup><br>Material HRC N/mm <sup>2</sup>                                               | 3,0 x 8                                                       | 3,0 x 16                                   | 3,0 x 20                                   | 3,0 x 30                                   | 3,0 x 40                                   | 3,0 x 50                                   | 3,0 x 60                                   |                                             |                                             |                                           |                                            |                                           |                                            |                                            |                                            |                                            |
| 3.1-3.2                           | Werkstähle < 35 HRC<br>(1140 N/mm <sup>2</sup> )<br>Tool steels < 35 HRC<br>(1140 N/mm <sup>2</sup> )           | ap= 0,29<br>ae= 0,80<br>n= 16.000<br>fz= 0,08<br>Vf= 2.500    | 0,18<br>0,55<br>14.000<br>0,07<br>2.000    | 0,12<br>0,40<br>14.000<br>0,06<br>2.000    | 0,08<br>0,23<br>14.000<br>0,06<br>2.000    | 0,06<br>0,18<br>12.000<br>0,06<br>1.800    | 0,04<br>0,12<br>10.000<br>0,05<br>1.100    | 0,025<br>0,08<br>10.000<br>0,05<br>1100    |                                             |                                             |                                           |                                            |                                           |                                            |                                            |                                            |                                            |
| 4.1-4.2-4.3                       | Werkstähle < 45 HRC<br>(1460 N/mm <sup>2</sup> )<br>Tool steels < 45 HRC<br>(1460 N/mm <sup>2</sup> )           | ap= 0,24<br>ae= 0,70<br>n= 15.000<br>fz= 0,07<br>Vf= 2.100    | 0,17<br>0,50<br>13.000<br>0,06<br>1.800    | 0,11<br>0,35<br>13.000<br>0,06<br>1.800    | 0,07<br>0,20<br>13.000<br>0,05<br>1.600    | 0,05<br>0,16<br>12.000<br>0,05<br>1.500    | 0,04<br>0,12<br>9.000<br>0,04<br>1.000     | 0,02<br>0,07<br>9.000<br>0,04<br>900       |                                             |                                             |                                           |                                            |                                           |                                            |                                            |                                            |                                            |
| 8.1                               | Gehärtete Stähle < 55 HRC<br>(1930 N/mm <sup>2</sup> )<br>Hardened steels < 55 HRC<br>(1930 N/mm <sup>2</sup> ) | ap= 0,20<br>ae= 0,60<br>n= 13.000<br>fz= 0,06<br>Vf= 1.600    | 0,14<br>0,40<br>12.000<br>0,05<br>1.500    | 0,09<br>0,27<br>11.000<br>0,045<br>1.400   | 0,05<br>0,16<br>11.000<br>0,045<br>1.300   | 0,04<br>0,12<br>10.000<br>0,045<br>1.300   | 0,03<br>0,09<br>8.000<br>0,04<br>800       | 0,02<br>0,06<br>8.000<br>0,04<br>800       |                                             |                                             |                                           |                                            |                                           |                                            |                                            |                                            |                                            |
| 8.2-8.3                           | Gehärtete Stähle < 72 HRC<br>Hardened steels < 72 HRC                                                           | ap= 0,18<br>ae= 0,50<br>n= 12.000<br>fz= 0,04<br>Vf= 1.300    | 0,10<br>0,30<br>11.000<br>0,04<br>1.200    | 0,08<br>0,25<br>11.000<br>0,04<br>1.200    | 0,05<br>0,16<br>11.000<br>0,04<br>1.100    | 0,04<br>0,12<br>10.000<br>0,03<br>1.000    | 0,03<br>0,08<br>7.000<br>0,03<br>600       | 0,015<br>0,05<br>7.000<br>0,03<br>500      |                                             |                                             |                                           |                                            |                                           |                                            |                                            |                                            |                                            |

Modifizierung der Schnittdaten für Kupfer  
Modification of the cutting conditions for copper

n = + 25 % / fz = + 25 %

Sind die Ihnen zur Verfügung stehenden Drehzahlen geringer als in dieser Tabelle vorgegeben ist der Vorschub im gleichen Verhältnis zu reduzieren.  
If the rpm available in lower than recommended, reduce the feed rate to the same ratio.

Art. **30.6284**

Empfohlene Richtwerte für Vollhartmetall Universalfräser  
Recommended cutting data for solid carbide end mills

| Werkstoff<br>Material                                                                                                              |    |   | Guss<br>cast iron<br><150HB                     |          |             |          |              | Guss<br>cast iron<br>150-200HB                         |          |             |          |              | Guss<br>cast iron<br><200-250HB               |          |             |          |              | Guss<br>cast iron<br><250-300HB                |          |             |          |              | Rostfreier Stahl<br>stainless steels<br><800N/mm² |          |             |          |              |  |
|------------------------------------------------------------------------------------------------------------------------------------|----|---|-------------------------------------------------|----------|-------------|----------|--------------|--------------------------------------------------------|----------|-------------|----------|--------------|-----------------------------------------------|----------|-------------|----------|--------------|------------------------------------------------|----------|-------------|----------|--------------|---------------------------------------------------|----------|-------------|----------|--------------|--|
|                                                                                                                                    |    |   | unlegierter Stahl<br>carbon steels<br><850N/mm² |          |             |          |              | Vergütungsstahl<br>heat treatable steels<br><1200N/mm² |          |             |          |              | Werkzeugstahl<br>tool steels<br>800-1350N/mm² |          |             |          |              | Werkzeugstahl<br>tool steels<br>1350-1620N/mm² |          |             |          |              |                                                   |          |             |          |              |  |
| Schnittwerte: Nuten / Schruppen / ~ ap= 50-150 % - ae= 100 %<br>Cutting data: Slot milling / Roughing / ~ ap= 50-150 % - ae= 100 % |    |   |                                                 |          |             |          |              |                                                        |          |             |          |              |                                               |          |             |          |              |                                                |          |             |          |              |                                                   |          |             |          |              |  |
| Werkstoffgruppe<br>Material group                                                                                                  |    |   | 1.1-1.5                                         |          |             |          |              | 2.1-2.6                                                |          |             |          |              | 3.1                                           |          |             |          |              | 3.2                                            |          |             |          |              | 4.1/4.2                                           |          |             |          |              |  |
| d                                                                                                                                  | l2 | Z | ae<br>mm                                        | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                               | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                      | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                       | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                          | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min |  |
| 0,4                                                                                                                                | 3  | 2 | 0,400                                           | 0,200    | 65          | 0,007    | 1.117        | 0,400                                                  | 0,200    | 50          | 0,006    | 716          | 0,400                                         | 0,160    | 43          | 0,005    | 487          | 0,400                                          | 0,100    | 38          | 0,004    | 376          | 0,400                                             | 0,100    | 35          | 0,004    | 326          |  |
| 0,6                                                                                                                                | 3  | 2 | 0,600                                           | 0,300    | 65          | 0,007    | 745          | 0,600                                                  | 0,300    | 50          | 0,006    | 477          | 0,600                                         | 0,240    | 43          | 0,005    | 325          | 0,600                                          | 0,150    | 38          | 0,004    | 251          | 0,600                                             | 0,150    | 35          | 0,004    | 217          |  |
| 0,8                                                                                                                                | 3  | 2 | 0,800                                           | 0,400    | 65          | 0,007    | 559          | 0,800                                                  | 0,400    | 50          | 0,006    | 358          | 0,800                                         | 0,320    | 43          | 0,005    | 244          | 0,800                                          | 0,200    | 38          | 0,004    | 188          | 0,800                                             | 0,200    | 35          | 0,004    | 163          |  |
| 1,0                                                                                                                                | 5  | 2 | 1,000                                           | 0,500    | 65          | 0,007    | 447          | 1,000                                                  | 0,500    | 50          | 0,006    | 286          | 1,000                                         | 0,400    | 43          | 0,005    | 195          | 1,000                                          | 0,250    | 38          | 0,004    | 150          | 1,000                                             | 0,250    | 35          | 0,004    | 130          |  |
| 1,5                                                                                                                                | 5  | 2 | 1,500                                           | 0,750    | 65          | 0,007    | 298          | 1,500                                                  | 0,750    | 50          | 0,006    | 191          | 1,500                                         | 0,600    | 43          | 0,005    | 130          | 1,500                                          | 0,380    | 38          | 0,004    | 100          | 1,500                                             | 0,380    | 35          | 0,004    | 87           |  |

| Schnittwerte: Konturfräsen / Schruppen / ~ ap= 100-150 % - ae= 25-50 %<br>Cutting data: Contour milling / Roughing / ~ ap= 100-150 % - ae= 25-50 % |    |   |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|
| Werkstoffgruppe<br>Material group                                                                                                                  |    |   | 1.1-1.5  |          |             |          |              | 2.1-2.6  |          |             |          |              | 3.1      |          |             |          |              | 3.2      |          |             |          |              | 4.1/4.2  |          |             |          |              |
| d                                                                                                                                                  | l2 | Z | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min |
| 0,4                                                                                                                                                | 3  | 2 | 0,200    | 0,600    | 72          | 0,012    | 2.130        | 0,200    | 0,600    | 55          | 0,010    | 1.366        | 0,140    | 0,600    | 47          | 0,008    | 929          | 0,100    | 0,400    | 41          | 0,007    | 717          | 0,200    | 0,600    | 39          | 0,007    | 621          |
| 0,6                                                                                                                                                | 3  | 2 | 0,300    | 0,900    | 72          | 0,012    | 1.420        | 0,300    | 0,900    | 55          | 0,010    | 910          | 0,210    | 0,900    | 47          | 0,008    | 619          | 0,150    | 0,600    | 41          | 0,007    | 478          | 0,300    | 0,900    | 39          | 0,007    | 414          |
| 0,8                                                                                                                                                | 3  | 2 | 0,400    | 1,200    | 72          | 0,012    | 1.065        | 0,400    | 1,200    | 55          | 0,010    | 683          | 0,280    | 1,200    | 47          | 0,008    | 464          | 0,200    | 0,800    | 41          | 0,007    | 358          | 0,400    | 1,200    | 39          | 0,007    | 311          |
| 1,0                                                                                                                                                | 5  | 2 | 0,500    | 1,500    | 72          | 0,012    | 852          | 0,500    | 1,500    | 55          | 0,010    | 546          | 0,350    | 1,500    | 47          | 0,008    | 371          | 0,250    | 1,000    | 41          | 0,007    | 287          | 0,500    | 1,500    | 39          | 0,007    | 249          |
| 1,5                                                                                                                                                | 5  | 2 | 0,750    | 2,250    | 72          | 0,012    | 568          | 0,750    | 2,250    | 55          | 0,010    | 364          | 0,530    | 2,250    | 47          | 0,008    | 248          | 0,380    | 1,500    | 41          | 0,007    | 191          | 0,750    | 2,250    | 39          | 0,007    | 166          |

| Schnittwerte: Konturfräsen / Schlichten (HSC) / ~ ap= 100-150 % - ae= 10-25 %<br>Cutting data: Countour millig / Finishing (HS) / ~ ap= 100-150 % - ae= 10-25 % |    |   |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|
| Werkstoffgruppe<br>Material group                                                                                                                               |    |   | 1.1-1.5  |          |             |          |              | 2.1-2.6  |          |             |          |              | 3.1      |          |             |          |              | 3.2      |          |             |          |              | 4.1/4.2  |          |             |          |              |
| d                                                                                                                                                               | l2 | Z | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min |
| 0,4                                                                                                                                                             | 3  | 2 | 0,060    | 0,500    | 34          | 0,007    | 599          | 0,008    | 0,600    | 55          | 0,014    | 2.458        | 0,070    | 0,600    | 47          | 0,010    | 1071         | 0,050    | 0,400    | 41          | 0,008    | 827          | 0,090    | 0,600    | 39          | 0,008    | 717          |
| 0,6                                                                                                                                                             | 3  | 2 | 0,090    | 0,750    | 34          | 0,007    | 400          | 0,120    | 0,900    | 55          | 0,014    | 1.639        | 0,110    | 0,900    | 47          | 0,010    | 714          | 0,070    | 0,600    | 41          | 0,008    | 551          | 0,130    | 0,900    | 39          | 0,008    | 478          |
| 0,8                                                                                                                                                             | 3  | 2 | 0,120    | 1,000    | 34          | 0,007    | 300          | 0,160    | 1,200    | 55          | 0,014    | 1.229        | 0,140    | 1,200    | 47          | 0,010    | 536          | 0,100    | 0,800    | 41          | 0,008    | 414          | 0,180    | 1,200    | 39          | 0,008    | 358          |
| 1,0                                                                                                                                                             | 5  | 2 | 0,150    | 1,250    | 34          | 0,007    | 240          | 0,200    | 1,500    | 55          | 0,014    | 983          | 0,180    | 1,500    | 47          | 0,010    | 429          | 0,120    | 1,000    | 41          | 0,008    | 331          | 0,220    | 1,500    | 39          | 0,008    | 287          |
| 1,5                                                                                                                                                             | 5  | 2 | 0,230    | 1,880    | 34          | 0,007    | 160          | 0,300    | 2,250    | 55          | 0,014    | 655          | 0,270    | 2,250    | 47          | 0,010    | 286          | 0,180    | 1,500    | 41          | 0,008    | 221          | 0,330    | 2,250    | 39          | 0,008    | 191          |



Empfohlene Richtwerte für Vollhartmetall Universalfräser  
Recommended cutting data for solid carbide end mills

Art. 30.6284

|  | Rostfreier Stahl<br>stainless steels<br>>800N/mm² |          |             |          |                  | Titan/Inconell/Nickel-Legierung<br>titan/inconel/nickel-alloy |          |             |          |                  | Aluminiumlegierung<br>aluminium alloy<br><6 % SI. |          |             |          |                  | Aluminiumlegierung<br>aluminium alloy<br>6-12 % SI. |          |             |          |                  | Aluminiumlegierung<br>aluminium alloy<br>>12 % SI. |          |             |          |                  |
|--|---------------------------------------------------|----------|-------------|----------|------------------|---------------------------------------------------------------|----------|-------------|----------|------------------|---------------------------------------------------|----------|-------------|----------|------------------|-----------------------------------------------------|----------|-------------|----------|------------------|----------------------------------------------------|----------|-------------|----------|------------------|
|  |                                                   |          |             |          |                  |                                                               |          |             |          |                  |                                                   |          |             |          |                  |                                                     |          |             |          |                  |                                                    |          |             |          |                  |
|  | 4.3                                               |          |             |          |                  | 5.1-5.5/6.1-6.2                                               |          |             |          |                  | 9.1-9.2                                           |          |             |          |                  | 9.1-9.2                                             |          |             |          |                  | 9.1-9.2                                            |          |             |          |                  |
|  | ae<br>mm                                          | ap<br>mm | Vc<br>m/min | fz<br>mm | Vi<br>mm/<br>min | ae<br>mm                                                      | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                          | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                            | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                           | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min |
|  | 0,400                                             | 0,080    | 31          | 0,004    | 272              | 0,400                                                         | 0,020    | 50          | 0,003    | 191              | 0,400                                             | 0,050    | 60          | 0,009    | 1.289            | 0,400                                               | 0,400    | 60          | 0,007    | 1.031            | 0,400                                              | 0,300    | 50          | 0,006    | 714              |
|  | 0,600                                             | 0,120    | 31          | 0,004    | 182              | 0,600                                                         | 0,030    | 50          | 0,003    | 127              | 0,600                                             | 0,750    | 65          | 0,009    | 933              | 0,600                                               | 0,600    | 75          | 0,008    | 895              | 0,600                                              | 0,450    | 65          | 0,006    | 814              |
|  | 0,800                                             | 0,160    | 31          | 0,004    | 136              | 0,800                                                         | 0,040    | 50          | 0,003    | 96               | 0,800                                             | 1,000    | 100         | 0,009    | 1.117            | 0,800                                               | 0,800    | 100         | 0,008    | 931              | 0,800                                              | 0,600    | 85          | 0,006    | 584              |
|  | 1,000                                             | 0,200    | 31          | 0,004    | 109              | 1,000                                                         | 0,050    | 50          | 0,003    | 76               | 1,000                                             | 1,250    | 150         | 0,010    | 1.392            | 1,000                                               | 1,000    | 150         | 0,008    | 1.160            | 1,000                                              | 0,750    | 130         | 0,006    | 745              |
|  | 1,500                                             | 0,300    | 31          | 0,004    | 73               | 1,500                                                         | 0,080    | 50          | 0,003    | 51               | 1,500                                             | 1,880    | 200         | 0,010    | 1.283            | 1,500                                               | 1,500    | 200         | 0,008    | 1.070            | 1,500                                              | 1,130    | 170         | 0,006    | 623              |

|  | 4.3      |          |             |          |                  | 5.1-5.5/6.1-6.2 |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  |
|--|----------|----------|-------------|----------|------------------|-----------------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|
|  | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm        | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min |
|  | 0,140    | 0,500    | 34          | 0,006    | 519              | 0,100           | 0,400    | 28          | 0,005    | 364              | 0,200    | 0,800    | 65          | 0,016    | 2.476            | 0,200    | 0,700    | 65          | 0,012    | 1.857            | 0,200    | 0,600    | 55          | 0,010    | 1.310            |
|  | 0,210    | 0,750    | 34          | 0,006    | 346              | 0,150           | 0,600    | 28          | 0,005    | 243              | 0,300    | 1,200    | 70          | 0,016    | 1.787            | 0,300    | 1,050    | 85          | 0,013    | 1.763            | 0,300    | 0,900    | 70          | 0,010    | 1.114            |
|  | 0,280    | 1,000    | 34          | 0,006    | 260              | 0,200           | 0,800    | 28          | 0,005    | 182              | 0,400    | 1,600    | 110         | 0,016    | 2.130            | 0,400    | 1,400    | 110         | 0,014    | 1.775            | 0,400    | 1,200    | 95          | 0,010    | 1.135            |
|  | 0,350    | 1,250    | 34          | 0,006    | 208              | 0,250           | 1,000    | 28          | 0,005    | 146              | 0,500    | 2,000    | 165         | 0,017    | 2.655            | 0,500    | 1,750    | 165         | 0,014    | 2.212            | 0,500    | 1,500    | 140         | 0,010    | 1.337            |
|  | 0,530    | 1,880    | 34          | 0,006    | 139              | 0,380           | 1,500    | 28          | 0,005    | 97               | 0,750    | 3,000    | 220         | 0,017    | 2.447            | 0,750    | 2,630    | 220         | 0,015    | 2.039            | 0,750    | 2,250    | 190         | 0,010    | 1.210            |

|  | 4.3      |          |             |          |                  | 5.1-5.5/6.1-6.2 |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  |
|--|----------|----------|-------------|----------|------------------|-----------------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|
|  | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm        | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min |
|  | 0,060    | 0,500    | 34          | 0,007    | 599              | 0,020           | 0,400    | 28          | 0,006    | 420              | 0,120    | 0,800    | 65          | 0,018    | 2.786            | 0,100    | 0,700    | 65          | 0,014    | 2.167            | 0,080    | 0,600    | 55          | 0,012    | 1.571            |
|  | 0,090    | 0,750    | 34          | 0,007    | 400              | 0,040           | 0,600    | 28          | 0,006    | 280              | 0,180    | 1,200    | 70          | 0,018    | 2.011            | 0,150    | 1,050    | 85          | 0,015    | 2.035            | 0,120    | 0,900    | 70          | 0,012    | 1.286            |
|  | 0,120    | 1,000    | 34          | 0,007    | 300              | 0,050           | 0,800    | 28          | 0,006    | 210              | 0,280    | 1,600    | 110         | 0,019    | 2.458            | 0,200    | 1,400    | 110         | 0,016    | 2.048            | 0,160    | 1,200    | 95          | 0,012    | 1.363            |
|  | 0,150    | 1,250    | 34          | 0,007    | 240              | 0,060           | 1,000    | 28          | 0,006    | 168              | 0,300    | 2,000    | 165         | 0,019    | 3.063            | 0,250    | 1,750    | 165         | 0,016    | 2.553            | 0,200    | 1,500    | 140         | 0,012    | 1.543            |
|  | 0,230    | 1,880    | 34          | 0,007    | 160              | 0,090           | 1,500    | 28          | 0,006    | 112              | 0,450    | 3,000    | 220         | 0,020    | 2.824            | 0,380    | 2,630    | 220         | 0,017    | 2.353            | 0,300    | 2,250    | 190         | 0,012    | 1.452            |

Art. 30.6286

Empfohlene Richtwerte für Vollhartmetall Universalfräser, Kugel  
Recommendet cutting data for solid carbide ball nose end mills

| Werkstoff<br>Material                                                                                                          |    |   | Guss<br>cast iron<br><150HB                     |          |             |          |              | Guss<br>cast iron<br>150-200HB                         |          |             |          |              | Guss<br>cast iron<br><200-250HB               |          |             |          |              | Guss<br>cast iron<br><250-300HB                |          |             |          |              | Rostfreier Stahl<br>stainless steels<br><800N/mm² |          |             |          |              |  |
|--------------------------------------------------------------------------------------------------------------------------------|----|---|-------------------------------------------------|----------|-------------|----------|--------------|--------------------------------------------------------|----------|-------------|----------|--------------|-----------------------------------------------|----------|-------------|----------|--------------|------------------------------------------------|----------|-------------|----------|--------------|---------------------------------------------------|----------|-------------|----------|--------------|--|
|                                                                                                                                |    |   | unlegierter Stahl<br>carbon steels<br><850N/mm² |          |             |          |              | Vergütungsstahl<br>heat treatable steels<br><1200N/mm² |          |             |          |              | Werkzeugstahl<br>tool steels<br>800-1350N/mm² |          |             |          |              | Werkzeugstahl<br>tool steels<br>1350-1620N/mm² |          |             |          |              |                                                   |          |             |          |              |  |
| Schnittwerte: Nuten / Schruppen / ~ ap= 5-10 % - ae= 100 %<br>Cutting data: Slot milling / Roughing / ~ ap= 5-10 % - ae= 100 % |    |   |                                                 |          |             |          |              |                                                        |          |             |          |              |                                               |          |             |          |              |                                                |          |             |          |              |                                                   |          |             |          |              |  |
| Werkstoffgruppe<br>Material group                                                                                              |    |   | 1.1-1.5                                         |          |             |          |              | 2.1-2.6                                                |          |             |          |              | 3.1                                           |          |             |          |              | 3.2                                            |          |             |          |              | 4.1/4.2                                           |          |             |          |              |  |
| d                                                                                                                              | l2 | Z | ae<br>mm                                        | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                               | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                      | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                       | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm                                          | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min |  |
| 0,4                                                                                                                            | 3  | 2 | 0,400                                           | 0,020    | 60          | 0,010    | 917          | 0,400                                                  | 0,020    | 45          | 0,008    | 573          | 0,400                                         | 0,016    | 40          | 0,006    | 408          | 0,400                                          | 0,012    | 35          | 0,006    | 312          | 0,400                                             | 0,012    | 35          | 0,005    | 290          |  |
| 0,6                                                                                                                            | 3  | 2 | 0,600                                           | 0,030    | 90          | 0,013    | 1.261        | 0,600                                                  | 0,030    | 70          | 0,011    | 817          | 0,600                                         | 0,024    | 60          | 0,009    | 561          | 0,600                                          | 0,018    | 50          | 0,008    | 409          | 0,600                                             | 0,018    | 50          | 0,007    | 380          |  |
| 0,8                                                                                                                            | 3  | 2 | 0,800                                           | 0,040    | 120         | 0,017    | 1.605        | 0,800                                                  | 0,040    | 90          | 0,014    | 1.003        | 0,800                                         | 0,032    | 80          | 0,011    | 713          | 0,800                                          | 0,024    | 70          | 0,010    | 546          | 0,800                                             | 0,024    | 65          | 0,009    | 471          |  |
| 1,0                                                                                                                            | 5  | 2 | 1,000                                           | 0,050    | 150         | 0,020    | 1.949        | 1,000                                                  | 0,050    | 115         | 0,017    | 1.245        | 1,000                                         | 0,040    | 100         | 0,014    | 866          | 1,000                                          | 0,030    | 85          | 0,012    | 644          | 1,000                                             | 0,030    | 80          | 0,011    | 563          |  |
| 1,5                                                                                                                            | 5  | 2 | 1,500                                           | 0,075    | 180         | 0,029    | 2.201        | 1,500                                                  | 0,075    | 135         | 0,024    | 1.376        | 1,500                                         | 0,060    | 115         | 0,019    | 938          | 1,500                                          | 0,045    | 105         | 0,017    | 749          | 1,500                                             | 0,045    | 95          | 0,016    | 629          |  |

| Schnittwerte: Konturfräsen / Schruppen / ~ ap= 15-30 % - ae= 16-40 %<br>Cutting data: Contour milling / Roughing / ~ ap= 15-30 % - ae= 16-40 % |    |   |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |
|------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|
| Werkstoffgruppe<br>Material group                                                                                                              |    |   | 1.1-1.5  |          |             |          |              | 2.1-2.6  |          |             |          |              | 3.1      |          |             |          |              | 3.2      |          |             |          |              | 4.1/4.2  |          |             |          |              |
| d                                                                                                                                              | l2 | Z | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min |
| 0,4                                                                                                                                            | 3  | 2 | 0,200    | 0,100    | 75          | 0,032    | 3.687        | 0,200    | 0,080    | 55          | 0,027    | 2.364        | 0,152    | 0,072    | 50          | 0,022    | 1.720        | 0,144    | 0,064    | 45          | 0,019    | 1.354        | 0,200    | 0,080    | 40          | 0,018    | 1.118        |
| 0,6                                                                                                                                            | 3  | 2 | 0,300    | 0,150    | 105         | 0,043    | 4.767        | 0,300    | 0,120    | 80          | 0,036    | 3.056        | 0,228    | 0,108    | 70          | 0,029    | 2.140        | 0,216    | 0,096    | 60          | 0,025    | 1.605        | 0,300    | 0,120    | 55          | 0,023    | 1.366        |
| 0,8                                                                                                                                            | 3  | 2 | 0,400    | 0,200    | 140         | 0,054    | 5.866        | 0,400    | 0,160    | 105         | 0,045    | 3.760        | 0,304    | 0,144    | 90          | 0,036    | 2.580        | 0,288    | 0,128    | 80          | 0,032    | 2.006        | 0,400    | 0,160    | 75          | 0,029    | 1.747        |
| 1,0                                                                                                                                            | 5  | 2 | 0,500    | 0,250    | 170         | 0,065    | 6.972        | 0,500    | 0,200    | 130         | 0,054    | 4.469        | 0,380    | 0,180    | 115         | 0,043    | 3.164        | 0,360    | 0,160    | 100         | 0,038    | 2.408        | 0,500    | 0,200    | 95          | 0,035    | 2.124        |
| 1,5                                                                                                                                            | 5  | 2 | 0,750    | 0,375    | 195         | 0,090    | 7.449        | 0,750    | 0,300    | 150         | 0,075    | 4.775        | 0,570    | 0,270    | 130         | 0,060    | 3.312        | 0,540    | 0,240    | 115         | 0,053    | 2.564        | 0,750    | 0,300    | 105         | 0,049    | 2.174        |

| Schnittwerte: Konturfräsen / Schlichten (HSC) / ~ ap= 5 % - ae= 5 %<br>Cutting data: Countour millig / Finishing (HS) / ~ ap= 5 % - ae= 5 % |    |   |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |          |          |             |          |              |
|---------------------------------------------------------------------------------------------------------------------------------------------|----|---|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|----------|----------|-------------|----------|--------------|
| Werkstoffgruppe<br>Material group                                                                                                           |    |   | 1.1-1.5  |          |             |          |              | 2.1-2.6  |          |             |          |              | 3.1      |          |             |          |              | 3.2      |          |             |          |              | 4.1/4.2  |          |             |          |              |
| d                                                                                                                                           | l2 | Z | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/min |
| 0,4                                                                                                                                         | 3  | 2 | 0,020    | 0,020    | 75          | 0,038    | 4.370        | 0,020    | 0,020    | 55          | 0,032    | 2.801        | 0,020    | 0,020    | 50          | 0,026    | 2.038        | 0,020    | 0,020    | 40          | 0,022    | 1.427        | 0,020    | 0,020    | 40          | 0,021    | 1.325        |
| 0,6                                                                                                                                         | 3  | 2 | 0,030    | 0,030    | 110         | 0,058    | 6.515        | 0,030    | 0,030    | 85          | 0,048    | 4.176        | 0,030    | 0,030    | 70          | 0,038    | 2.854        | 0,030    | 0,030    | 65          | 0,034    | 2.318        | 0,030    | 0,030    | 60          | 0,031    | 1.987        |
| 0,8                                                                                                                                         | 3  | 2 | 0,040    | 0,040    | 145         | 0,077    | 8.660        | 0,040    | 0,040    | 110         | 0,064    | 5.551        | 0,040    | 0,040    | 95          | 0,051    | 3.873        | 0,040    | 0,040    | 85          | 0,045    | 3.032        | 0,040    | 0,040    | 80          | 0,042    | 2.650        |
| 1,0                                                                                                                                         | 5  | 2 | 0,050    | 0,050    | 180         | 0,096    | 10.806       | 0,050    | 0,050    | 140         | 0,080    | 6.927        | 0,050    | 0,050    | 120         | 0,064    | 4.892        | 0,050    | 0,050    | 105         | 0,056    | 3.745        | 0,050    | 0,050    | 95          | 0,052    | 3.146        |
| 1,5                                                                                                                                         | 5  | 2 | 0,075    | 0,075    | 215         | 0,144    | 12.951       | 0,075    | 0,075    | 165         | 0,120    | 8.302        | 0,075    | 0,075    | 140         | 0,096    | 5.707        | 0,075    | 0,075    | 125         | 0,084    | 4.459        | 0,075    | 0,075    | 115         | 0,078    | 3.809        |

Empfohlene Richtwerte für Vollhartmetall Universalfräser, Kugel  
Recommendet cutting data for solid carbide ball nose end mills

Art. 30.6286

| Rostfreier Stahl<br>stainless steels<br>>800N/mm² |          |             |          |                  | Titan/Inconel/Nickel-Legierung<br>titan/inconel/nickel-alloy |          |             |          |                  | Aluminiumlegierung<br>aluminium alloy<br><6 % SI. |          |             |          |                  | Aluminiumlegierung<br>aluminium alloy<br>6-12 % SI. |          |             |          |                  | Aluminiumlegierung<br>aluminium alloy<br>>12 % SI. |          |             |          |                  |
|---------------------------------------------------|----------|-------------|----------|------------------|--------------------------------------------------------------|----------|-------------|----------|------------------|---------------------------------------------------|----------|-------------|----------|------------------|-----------------------------------------------------|----------|-------------|----------|------------------|----------------------------------------------------|----------|-------------|----------|------------------|
| 4.3                                               |          |             |          |                  | 5.1-5.5/6.1-6.2                                              |          |             |          |                  | 9.1-9.2                                           |          |             |          |                  | 9.1-9.2                                             |          |             |          |                  | 9.1-9.2                                            |          |             |          |                  |
| ae<br>mm                                          | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                                     | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                          | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                            | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm                                           | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min |
| 0,400                                             | 0,010    | 30          | 0,005    | 236              | 0,400                                                        | 0,008    | 25          | 0,004    | 167              | 0,400                                             | 0,100    | 55          | 0,012    | 1.051            | 0,400                                               | 0,080    | 55          | 0,010    | 841              | 0,400                                              | 0,060    | 50          | 0,008    | 611              |
| 0,600                                             | 0,014    | 45          | 0,007    | 324              | 0,600                                                        | 0,012    | 35          | 0,006    | 215              | 0,600                                             | 0,150    | 85          | 0,017    | 1.489            | 0,600                                               | 0,120    | 105         | 0,014    | 1.533            | 0,600                                              | 0,090    | 90          | 0,011    | 1.009            |
| 0,800                                             | 0,019    | 55          | 0,009    | 379              | 0,800                                                        | 0,015    | 50          | 0,007    | 293              | 0,800                                             | 0,200    | 180         | 0,022    | 3.130            | 0,800                                               | 0,160    | 180         | 0,018    | 2.608            | 0,800                                              | 0,120    | 155         | 0,013    | 1.659            |
| 1,000                                             | 0,024    | 70          | 0,010    | 468              | 1,000                                                        | 0,019    | 60          | 0,009    | 341              | 1,000                                             | 0,250    | 340         | 0,028    | 5.964            | 1,000                                               | 0,200    | 340         | 0,023    | 4.970            | 1,000                                              | 0,150    | 290         | 0,016    | 3.015            |
| 1,500                                             | 0,036    | 85          | 0,015    | 535              | 1,500                                                        | 0,029    | 70          | 0,013    | 374              | 1,500                                             | 0,375    | 540         | 0,040    | 9.245            | 1,500                                               | 0,300    | 540         | 0,034    | 7.704            | 1,500                                              | 0,230    | 460         | 0,023    | 4.500            |

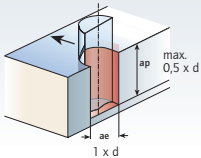
| 4.3      |          |             |          |                  | 5.1-5.5/6.1-6.2 |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  |
|----------|----------|-------------|----------|------------------|-----------------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|
| ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm        | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min |
| 0,152    | 0,072    | 35          | 0,017    | 929              | 0,144           | 0,064    | 30          | 0,014    | 677              | 0,240    | 0,140    | 65          | 0,041    | 4.192            | 0,220    | 0,128    | 70          | 0,032    | 3.611            | 0,200    | 0,120    | 60          | 0,026    | 2.476            |
| 0,228    | 0,108    | 50          | 0,022    | 1.180            | 0,216           | 0,096    | 40          | 0,019    | 802              | 0,360    | 0,210    | 100         | 0,054    | 5.732            | 0,330    | 0,192    | 120         | 0,045    | 5.732            | 0,300    | 0,180    | 105         | 0,035    | 3.852            |
| 0,304    | 0,144    | 65          | 0,028    | 1.438            | 0,288           | 0,128    | 55          | 0,024    | 1.034            | 0,480    | 0,280    | 210         | 0,070    | 11.737           | 0,440    | 0,256    | 210         | 0,059    | 9.781            | 0,400    | 0,240    | 180         | 0,043    | 6.191            |
| 0,380    | 0,180    | 80          | 0,033    | 1.699            | 0,360           | 0,160    | 70          | 0,028    | 1.264            | 0,600    | 0,350    | 390         | 0,087    | 21.731           | 0,550    | 0,320    | 390         | 0,073    | 18.109           | 0,500    | 0,300    | 335         | 0,052    | 11.061           |
| 0,570    | 0,270    | 95          | 0,046    | 1.868            | 0,540           | 0,240    | 80          | 0,039    | 1.337            | 0,900    | 0,525    | 600         | 0,126    | 32.102           | 0,825    | 0,480    | 600         | 0,105    | 26.752           | 0,750    | 0,450    | 510         | 0,072    | 15.592           |

| 4.3      |          |             |          |                  | 5.1-5.5/6.1-6.2 |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  | 9.1-9.2  |          |             |          |                  |
|----------|----------|-------------|----------|------------------|-----------------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|----------|----------|-------------|----------|------------------|
| ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm        | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min | ae<br>mm | ap<br>mm | Vc<br>m/min | fz<br>mm | Vf<br>mm/<br>min |
| 0,020    | 0,020    | 35          | 0,020    | 1.101            | 0,020           | 0,020    | 30          | 0,017    | 802              | 0,040    | 0,040    | 65          | 0,048    | 4.968            | 0,030    | 0,030    | 65          | 0,038    | 3.975            | 0,080    | 0,600    | 55          | 0,031    | 2.690            |
| 0,030    | 0,030    | 50          | 0,030    | 1.573            | 0,030           | 0,030    | 45          | 0,025    | 1.204            | 0,060    | 0,060    | 105         | 0,072    | 8.025            | 0,045    | 0,045    | 125         | 0,060    | 7.962            | 0,120    | 0,900    | 105         | 0,046    | 5.136            |
| 0,040    | 0,040    | 70          | 0,040    | 2.203            | 0,040           | 0,040    | 55          | 0,034    | 1.471            | 0,080    | 0,080    | 220         | 0,100    | 17.488           | 0,060    | 0,060    | 220         | 0,083    | 14.573           | 0,160    | 1,200    | 185         | 0,061    | 9.050            |
| 0,050    | 0,050    | 85          | 0,049    | 2.675            | 0,050           | 0,050    | 70          | 0,042    | 1.872            | 0,100    | 0,100    | 410         | 0,130    | 33.845           | 0,075    | 0,075    | 410         | 0,108    | 28.204           | 0,200    | 1,500    | 350         | 0,077    | 17.121           |
| 0,075    | 0,075    | 100         | 0,074    | 3.146            | 0,075           | 0,075    | 85          | 0,063    | 2.273            | 0,150    | 0,150    | 655         | 0,202    | 56.071           | 0,113    | 0,113    | 655         | 0,168    | 46.726           | 0,300    | 2,250    | 555         | 0,115    | 27.149           |

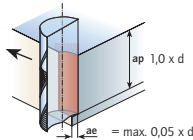
|      |         |         |         |
|------|---------|---------|---------|
| Art. | 30.6296 | 30.6331 | 30.6332 |
|      | 30.6341 | 30.6342 |         |

Empfohlene Schnittdaten für Karnasch Micro-Schaftfräser  
Recommended cutting data for Karnasch solid carbide micro end mills

1 Nuten  
Slot milling



2 Umfangfräsen  
Circumference milling



Chemisch beständige und wärmefeste Stähle, leg. Stähle bis 1000 N/mm<sup>2</sup>, Vergütungs- und Werkzeugstähle, GG > 200 HB.  
Chemical resistant and high temperature steel. Alloyed steel until 1000 N/mm<sup>2</sup>. Heat treatable and tool steel, GG > 200 HB.

| 1 Vc ≈ 130 m/min<br>UFX-1 NANO beschichtet/coated |       |     | 2 Vc ≈ 130 m/min<br>UFX-1 NANO beschichtet/coated |       |     |
|---------------------------------------------------|-------|-----|---------------------------------------------------|-------|-----|
| d1                                                | n     | Vf  | d1                                                | n     | Vf  |
| 2                                                 | 21000 | 180 | 2                                                 | 21000 | 570 |
| 4                                                 | 10400 | 220 | 4                                                 | 14000 | 400 |
| 6                                                 | 6900  | 260 | 6                                                 | 6900  | 320 |
| 8                                                 | 5200  | 230 | 8                                                 | 5200  | 300 |
| 10                                                | 4000  | 250 | 10                                                | 4000  | 330 |
| 12                                                | 3400  | 250 | 12                                                | 3400  | 340 |
| 16                                                | 2600  | 260 | 16                                                | 2600  | 360 |
| 20                                                | 2100  | 320 | 20                                                | 2100  | 340 |

Leg. Stähle bis 1300 N/mm<sup>2</sup>, Ventil-, Kaltarbeits- und Schnellarbeitsstähle, chemisch beständige Stähle.  
Alloyed steel until 1300 N/mm<sup>2</sup>, valve and high-speed steel, chemical resistance steel.

| 1 Vc ≈ 110 m/min<br>UFX-1 NANO beschichtet/coated |       |     | 2 Vc ≈ 110 m/min<br>UFX-1 NANO beschichtet/coated |       |     |
|---------------------------------------------------|-------|-----|---------------------------------------------------|-------|-----|
| d1                                                | n     | Vf  | d1                                                | n     | Vf  |
| 2                                                 | 18000 | 160 | 2                                                 | 18000 | 500 |
| 4                                                 | 8800  | 180 | 4                                                 | 8500  | 340 |
| 6                                                 | 6000  | 230 | 6                                                 | 5700  | 280 |
| 8                                                 | 4500  | 200 | 8                                                 | 4500  | 260 |
| 10                                                | 3600  | 210 | 10                                                | 3500  | 280 |
| 12                                                | 3000  | 230 | 12                                                | 3000  | 300 |
| 16                                                | 2100  | 240 | 16                                                | 2200  | 300 |
| 20                                                | 1800  | 270 | 20                                                | 1800  | 280 |

Schwer zerspanbare Materialien, hochwärmefeste Stähle, Ti- und Ni-Legierungen bis 1500 N/mm<sup>2</sup>.  
For hard-cut material, high-temperature steel Ti- and Ni-alloys until 1500 N/mm<sup>2</sup>.

| 1 Vc ≈ 90 m/min<br>UFX-1 NANO beschichtet/coated |       |     | 2 Vc ≈ 90 m/min<br>UFX-1 NANO beschichtet/coated |       |     |
|--------------------------------------------------|-------|-----|--------------------------------------------------|-------|-----|
| d1                                               | n     | Vf  | d1                                               | n     | Vf  |
| 2                                                | 15000 | 130 | 2                                                | 15000 | 410 |
| 4                                                | 7000  | 155 | 4                                                | 7000  | 280 |
| 6                                                | 4800  | 180 | 6                                                | 4800  | 210 |
| 8                                                | 3600  | 165 | 8                                                | 3600  | 210 |
| 10                                               | 2800  | 170 | 10                                               | 2800  | 220 |
| 12                                               | 2400  | 180 | 12                                               | 2400  | 250 |
| 16                                               | 1800  | 195 | 16                                               | 1800  | 260 |
| 20                                               | 1500  | 215 | 20                                               | 1500  | 220 |

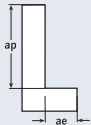
Leg. Stähle bis 1600 N/mm<sup>2</sup> Kaltarbeitsstähle mit 12% Cr sowie Hitzebeständige Stähle.  
Alloyed steel until 1600 N/mm<sup>2</sup> value steel, high-temperature steel with 12% Cr.

| 1 Vc ≈ 70 m/min<br>UFX-1 NANO beschichtet/coated |       |     | 2 Vc ≈ 70 m/min<br>UFX-1 NANO beschichtet/coated |       |     |
|--------------------------------------------------|-------|-----|--------------------------------------------------|-------|-----|
| d1                                               | n     | Vf  | d1                                               | n     | Vf  |
| 2                                                | 11000 | 100 | 2                                                | 11000 | 320 |
| 4                                                | 5700  | 125 | 4                                                | 5700  | 230 |
| 6                                                | 3800  | 150 | 6                                                | 3800  | 180 |
| 8                                                | 2800  | 130 | 8                                                | 2800  | 170 |
| 10                                               | 2200  | 140 | 10                                               | 2200  | 180 |
| 12                                               | 1800  | 140 | 12                                               | 1800  | 180 |
| 16                                               | 1400  | 150 | 14                                               | 1400  | 200 |
| 20                                               | 1100  | 170 | 16                                               | 1100  | 190 |

Einsatzempfehlungen für Fräser HSC-Fräsen / Insert recommendation for miller HSC-milling

| Werkstoff<br>N/mm <sup>2</sup><br>Material | unlegierter Stahl<br>bis 800<br>unalloyed steel<br>to 800 |        | legierter Stahl<br>bis 1000<br>alloyed steel<br>to 1000 |        | legierter Stahl<br>bis 1200<br>alloyed steel<br>to 1200 |        | legierter Stahl / VA<br>über 1200<br>alloyed steel /<br>stainless steel<br>over 1200 |        | gehärteter Stahl<br>45 - 55 HRC<br>hardened steel<br>45 - 55 HRC |        |
|--------------------------------------------|-----------------------------------------------------------|--------|---------------------------------------------------------|--------|---------------------------------------------------------|--------|--------------------------------------------------------------------------------------|--------|------------------------------------------------------------------|--------|
|                                            | mm                                                        | mm/min | mm                                                      | mm/min | mm                                                      | mm/min | mm                                                                                   | mm/min | mm                                                               | mm/min |
| d1                                         | min <sup>-1</sup>                                         | Vf     | min <sup>-1</sup>                                       | Vf     | min <sup>-1</sup>                                       | Vf     | min <sup>-1</sup>                                                                    | Vf     | min <sup>-1</sup>                                                | Vf     |
| 6                                          | 21000                                                     | 2450   | 18500                                                   | 2150   | 13000                                                   | 1500   | 7950                                                                                 | 795    | 4200                                                             | 420    |
| 8                                          | 15500                                                     | 2450   | 1350                                                    | 2100   | 9900                                                    | 1450   | 5950                                                                                 | 795    | 3150                                                             | 425    |
| 10                                         | 12500                                                     | 2500   | 11000                                                   | 2100   | 7950                                                    | 1450   | 4750                                                                                 | 800    | 2500                                                             | 420    |
| 12                                         | 10500                                                     | 2450   | 9250                                                    | 2100   | 6600                                                    | 1450   | 3950                                                                                 | 790    | 2100                                                             | 410    |
| 14                                         | 9050                                                      | 2350   | 7950                                                    | 2000   | 5650                                                    | 1350   | 3400                                                                                 | 740    | 1800                                                             | 390    |
| 16                                         | 7950                                                      | 2250   | 6150                                                    | 1950   | 4950                                                    | 1350   | 2950                                                                                 | 715    | 1550                                                             | 375    |
| 18                                         | 7050                                                      | 2250   | 6150                                                    | 1900   | 4400                                                    | 1300   | 2650                                                                                 | 705    | 1400                                                             | 375    |
| 20                                         | 6350                                                      | 2100   | 5500                                                    | 1850   | 3950                                                    | 1300   | 2350                                                                                 | 665    | 1250                                                             | 355    |

|                | ap    | ae     |
|----------------|-------|--------|
| D ≤ Ø 8        | 1,5 D | 0,01 D |
| Ø 8 < D ≤ Ø 16 | 1,5 D | 0,02 D |
| Ø 16 < D       | 1,5 D | 0,05 D |

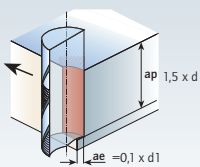


|         | ap  | ae     |
|---------|-----|--------|
| D ≤ Ø 8 | 1 D | 0,01 D |
| Ø 8 < D | 1 D | 0,01 D |

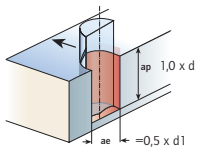


Empfohlene Schnittwerte für Vollhartmetallfräser  
Recommended cutting data for solid carbide end mills

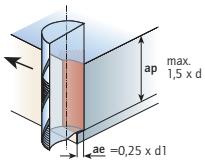
Art. 30.6353 Art. 30.6355



Schlichten/Finishing



Nutfräsen/Sloting



Schruppen/Roughing

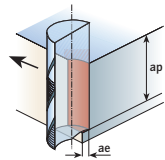
| Werkstoff<br>Workpiece material                                                                | Zugfestigkeit<br>Tensile strength<br>(N/mm <sup>2</sup> ) Härte (HB)            | Schnittgeschwindigkeit<br>Cutting speed<br>Vc in (m/min) | Vorschub pro Zahn<br>Feed per tooth<br>fz (mm) |         |      |      | Kühlung<br>Cooling            |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------|---------|------|------|-------------------------------|
|                                                                                                |                                                                                 |                                                          | Ø 6-8                                          | Ø 10-12 | Ø 16 | Ø 20 |                               |
| Baustähle (allg. Bau- Vergütungs-, Einsatz-, Automaten-, Nitrostahl)<br><i>unalloyed steel</i> | < 500 N/mm <sup>2</sup><br>500 - 700 N/mm <sup>2</sup><br>700 N/mm <sup>2</sup> | 140 - 160                                                | 0,05                                           | 0,07    | 0,07 | 0,08 | Emulsion Schneidöl            |
|                                                                                                |                                                                                 | 100 - 140                                                | 0,04                                           | 0,06    | 0,06 | 0,07 | Emulsion Schneidöl            |
|                                                                                                |                                                                                 | 60 - 90                                                  | 0,03                                           | 0,05    | 0,05 | 0,06 | Emulsion Schneidöl            |
| Werkzeugstähle<br><i>tool steel</i>                                                            | < 1400 N/mm <sup>2</sup><br>> 1400 N/mm <sup>2</sup>                            | 40 - 80                                                  | 0,02                                           | 0,03    | 0,04 | 0,05 | Emulsion Schneidöl            |
|                                                                                                |                                                                                 | 30 - 50                                                  | 0,02                                           | 0,03    | 0,04 | 0,05 | Emulsion Schneidöl            |
| Sonderstähle (hitzbets. hochwarm-<br>fest nichtrostend chem. best.)<br><i>stainless steel</i>  |                                                                                 | 25 - 75                                                  | 0,02                                           | 0,03    | 0,04 | 0,05 | Emulsion Schneidöl            |
| Gehärtete Stähle<br><i>hardened steel</i>                                                      | 55 - 60 HRC                                                                     | 20 - 30                                                  | 0,01                                           | 0,02    | 0,03 | 0,03 | Trocken - MMKS                |
| Stahlguß GG-GGG<br><i>steel cast iron</i>                                                      | < 500 N/mm <sup>2</sup><br>> 500 N/mm <sup>2</sup>                              | 80 - 140                                                 | 0,05                                           | 0,06    | 0,07 | 0,08 | Emulsion                      |
|                                                                                                |                                                                                 | 60 - 120                                                 | 0,03                                           | 0,04    | 0,05 | 0,06 | Emulsion                      |
| Gußeisen<br><i>cast iron</i>                                                                   | < 200 HB<br>> 200 HB                                                            | 60 - 90                                                  | 0,06                                           | 0,08    | 0,09 | 0,12 | Trocken - Emulsion            |
|                                                                                                |                                                                                 | 50 - 80                                                  | 0,04                                           | 0,06    | 0,08 | 0,11 | Trocken - Emulsion            |
| Kupfer<br><i>copper</i>                                                                        |                                                                                 | 100 - 250                                                | 0,04                                           | 0,06    | 0,08 | 0,1  | Trocken Emulsion<br>Schneidöl |
| Messing Rotguss<br><i>brass, leader bronze all</i>                                             |                                                                                 | 90 - 200                                                 | 0,04                                           | 0,06    | 0,08 | 0,1  | Trocken Emulsion<br>Schneidöl |
| Bronze<br><i>bronze</i>                                                                        |                                                                                 | 80 - 160                                                 | 0,04                                           | 0,06    | 0,08 | 0,1  | Trocken Emulsion<br>Schneidöl |
| Hochwarmfeste Leg.<br>(Cr-Ni- Basis, Cr Ni Co- Basis)<br><i>head resisting steel, Inconell</i> |                                                                                 | 30 - 50                                                  | 0,01                                           | 0,02    | 0,03 | 0,04 | Emulsion Petroleum            |
| Aluminium Leg.<br><i>aluminium alloy</i>                                                       |                                                                                 | 100 - 400                                                | 0,06                                           | 0,1     | 0,14 | 0,18 | Emulsion Petroleum            |

Bei Werkzeugen mit großer Ausragelänge sollte der Vorschub je nach geforderter Oberflächengüte reduziert werden.

Empfohlene Richtwerte für den Einsatz von Karnasch VHM-Fräsern „DUO“ für die HSC/HHC-Bearbeitung  
Recommended cutting data for Karnasch solid carbide end mills „DUO“ for HSC/HHC- cutting

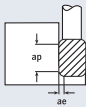
Art. 30.6425

Umfangfräsen / Circumference milling



| Werkstoff<br>Workpiece<br>material | Kohlenstoffstahl<br>Baustahl, GG,<br>-750 N/mm <sup>2</sup> |       | legierter Stahl, Werkzeugstahl<br>alloyed steel, tool steel<br>-30 HRC |       | legierter Stahl<br>alloyed steel<br>30 - 38 HRC |       | legierter Stahl VA<br>alloyed steel VA<br>38 - 45 HRC |     | gehärteter Stahl<br>hardened steel<br>45 - 55 HRC |     | gehärteter Stahl<br>hardened steel<br>55 - 60 HRC |     |
|------------------------------------|-------------------------------------------------------------|-------|------------------------------------------------------------------------|-------|-------------------------------------------------|-------|-------------------------------------------------------|-----|---------------------------------------------------|-----|---------------------------------------------------|-----|
| mm                                 | Vc 200 m/min                                                |       | Vc 200 m/min                                                           |       | Vc 200 m/min                                    |       | Vc 150 m/min                                          |     | Vc 150 m/min                                      |     | Vc 100 m/min                                      |     |
| d1                                 | min <sup>-1</sup>                                           | Vf    | min <sup>-1</sup>                                                      | Vf    | min <sup>-1</sup>                               | Vf    | min <sup>-1</sup>                                     | Vf  | min <sup>-1</sup>                                 | Vf  | min <sup>-1</sup>                                 | Vf  |
| 7                                  | 9.000                                                       | 2.100 | 9.000                                                                  | 1.700 | 9.000                                           | 1.060 | 6.800                                                 | 800 | 6.800                                             | 640 | 4.500                                             | 420 |
| 9                                  | 7.000                                                       | 2.120 | 7.000                                                                  | 1.700 | 7.000                                           | 1.060 | 5.200                                                 | 800 | 5.300                                             | 640 | 3.500                                             | 420 |
| 11                                 | 5.600                                                       | 2.120 | 5.600                                                                  | 1.700 | 5.600                                           | 1.060 | 4.200                                                 | 800 | 4.200                                             | 640 | 2.850                                             | 420 |
| 13                                 | 4.800                                                       | 2.120 | 4.800                                                                  | 1.700 | 4.800                                           | 1.060 | 3.600                                                 | 800 | 3.600                                             | 640 | 2.500                                             | 420 |

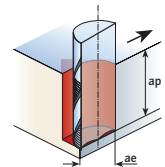
ap = 1,3 x D  
ae = 0,05 x D



ap = 1,3 x D  
ae = 0,03 x D

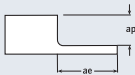
ap = 1,3 x D  
ae = 0,02 x D

Konturenfräsen / Contouring



| Werkstoff<br>Workpiece<br>material | Kohlenstoffstahl<br>Baustahl, GG,<br>-750 N/mm <sup>2</sup> |       | legierter Stahl, Werkzeugstahl<br>alloyed steel, tool steel<br>-30 HRC |       | legierter Stahl<br>alloyed steel<br>30 - 38 HRC |     | legierter Stahl VA<br>alloyed steel VA<br>38 - 45 HRC |     | gehärteter Stahl<br>hardened steel<br>45 - 55 HRC |     | gehärteter Stahl<br>hardened steel<br>55 - 60 HRC |     |
|------------------------------------|-------------------------------------------------------------|-------|------------------------------------------------------------------------|-------|-------------------------------------------------|-----|-------------------------------------------------------|-----|---------------------------------------------------|-----|---------------------------------------------------|-----|
| mm                                 | Vc 200 m/min                                                |       | Vc 200 m/min                                                           |       | Vc 200 m/min                                    |     | Vc 150 m/min                                          |     | Vc 150 m/min                                      |     | Vc 100 m/min                                      |     |
| dI                                 | min <sup>-1</sup>                                           | Vf    | min <sup>-1</sup>                                                      | Vf    | min <sup>-1</sup>                               | Vf  | min <sup>-1</sup>                                     | Vf  | min <sup>-1</sup>                                 | Vf  | min <sup>-1</sup>                                 | Vf  |
| 7                                  | 9.000                                                       | 1.300 | 9.000                                                                  | 1.000 | 6.800                                           | 800 | 6.800                                                 | 700 | 6.800                                             | 400 | 4.500                                             | 250 |
| 9                                  | 7.000                                                       | 1.300 | 7.000                                                                  | 1.000 | 5.200                                           | 800 | 5.200                                                 | 700 | 5.200                                             | 400 | 3.500                                             | 250 |
| 11                                 | 5.600                                                       | 1.300 | 5.600                                                                  | 1.000 | 4.200                                           | 800 | 4.200                                                 | 700 | 4.200                                             | 400 | 2.850                                             | 250 |
| 13                                 | 4.800                                                       | 1.300 | 4.800                                                                  | 1.000 | 3.600                                           | 800 | 3.600                                                 | 700 | 3.600                                             | 400 | 2.500                                             | 250 |

ap = 0,1 x D  
ae = 0,03 D - 0,5 x D



ap = 0,05 x D  
ae = 0,2 - 0,3 x D

ap = 0,02 x D  
ae = 0,2 - 0,3 x D

Die angegebenen Schnittdaten sind eine Empfehlung. Die tatsächlichen Schnittdaten sollten immer an die Bearbeitung und Maschine angepasst werden. Ist die Ihnen zur Verfügung stehende Drehzahl niedriger als die in der Tabelle angegebene, sollte der Vorschub im gleichen Verhältnis reduziert werden.  
These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. If the rpm available is lower than recommended please reduce the feed rate to the same ratio.

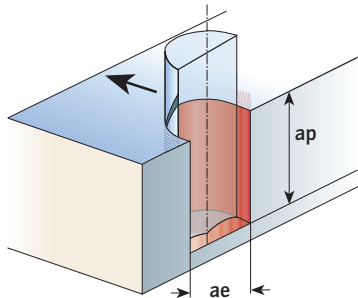
Nutfräsen / Slot milling

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material  | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 6<br>fz = mm<br>Z x 4 | Ø 8<br>fz = mm<br>Z x 4 | Ø 10<br>fz = mm<br>Z x 4 | Ø 12<br>fz = mm<br>Z x 4 | Ø 14<br>fz = mm<br>Z x 4 | Ø 16<br>fz = mm<br>Z x 5 | Ø 18 > 20<br>fz = mm<br>Z x 5 |
|-----------------------------------|------------------------|---------------------------------------------|----------------------------------------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------------|
|                                   |                        |                                             | ± 10%                                                    |                         |                         |                          |                          |                          |                          |                               |
| 1.1                               | 36 Mn 6                | < 450                                       | 240                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 1.2                               | ck 45                  | < 650                                       | 220                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 1.3                               | 24 Cr Mo 5             | < 850                                       | 210                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 1.4                               | 43 Cr Mo 4             | < 950                                       | 190                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 2.1                               | 21 Mn Cr 5             | < 600                                       | 180                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 2.2                               | 26 Cr Mo 4             | < 950                                       | 160                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 2.3                               | 41 Cr Al Mo 7          | < 1100                                      | 150                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 3.1.1                             | X 36 Cr Mo 17          | < 700-1000                                  | 150                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 4.1                               | X 12 Cr S 13           | < 700                                       | 75                                                       | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 4.2                               | X 38 Cr 13             | < 700                                       | 65                                                       | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 4.3                               | X 5 Cr Ni Mo 17.12.2   | < 700                                       | 65                                                       | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 4.3.1                             | X 2 Cr Ni Mo N 17.13.3 | < 850                                       | 55                                                       | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 6.1                               | Ti 1                   | < 850                                       | 60                                                       | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 6.1                               | Ti Al 6 V 4            | < 1200                                      | 50                                                       | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 7.1                               | GG 15                  | < 180 HB                                    | 140                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 7.2                               | GG 35                  | < 260 HB                                    | 130                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 7.3                               | GGG 50                 | < 200 HB                                    | 130                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 7.4                               | GGG 70                 | < 250 HB                                    | 130                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 7.5                               | GTS 40.05              | < 130 HB                                    | 120                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |
| 7.6                               | GTS 65.05              | < 230 HB                                    | 110                                                      | 0,03                    | 0,04                    | 0,06                     | 0,07                     | 0,08                     | 0,10                     | 0,12                          |

Umfangfräsen / Circumference milling

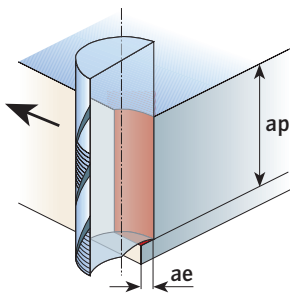
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material  | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 6<br>fz = mm<br>Z x 4 | Ø 8<br>fz = mm<br>Z x 4 | Ø 10<br>fz = mm<br>Z x 4 | Ø 12<br>fz = mm<br>Z x 4 | Ø 14<br>fz = mm<br>Z x 4 | Ø 16<br>fz = mm<br>Z x 5 | Ø 18 > 20<br>fz = mm<br>Z x 5 |
|-----------------------------------|------------------------|---------------------------------------------|----------------------------------------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------------|
|                                   |                        |                                             | ± 10%                                                    |                         |                         |                          |                          |                          |                          |                               |
| 1.1                               | 36 Mn 6                | < 450                                       | 240                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 1.2                               | ck 45                  | < 650                                       | 220                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 1.3                               | 24 Cr Mo 5             | < 850                                       | 210                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 1.4                               | 43 Cr Mo 4             | < 950                                       | 190                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 2.1                               | 21 Mn Cr 5             | < 600                                       | 180                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 2.2                               | 26 Cr Mo 4             | < 950                                       | 160                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 2.3                               | 41 Cr Al Mo 7          | < 1100                                      | 150                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 3.1.1                             | X 36 Cr Mo 17          | < 700-1000                                  | 150                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 4.1                               | X 12 Cr S 13           | < 700                                       | 75                                                       | 0,02                    | 0,03                    | 0,04                     | 0,05                     | 0,06                     | 0,07                     | 0,08                          |
| 4.2                               | X 38 Cr 13             | < 700                                       | 65                                                       | 0,02                    | 0,03                    | 0,04                     | 0,05                     | 0,06                     | 0,07                     | 0,08                          |
| 4.3                               | X 5 Cr Ni Mo 17.12.2   | < 700                                       | 65                                                       | 0,02                    | 0,03                    | 0,04                     | 0,05                     | 0,06                     | 0,07                     | 0,08                          |
| 4.3.1                             | X 2 Cr Ni Mo N 17.13.3 | < 850                                       | 55                                                       | 0,02                    | 0,03                    | 0,04                     | 0,05                     | 0,06                     | 0,07                     | 0,08                          |
| 6.1                               | Ti 1                   | < 850                                       | 50                                                       | 0,02                    | 0,03                    | 0,04                     | 0,05                     | 0,06                     | 0,07                     | 0,08                          |
| 6.2                               | Ti Al 6 V 4            | < 1200                                      | 45                                                       | 0,02                    | 0,03                    | 0,04                     | 0,05                     | 0,06                     | 0,07                     | 0,08                          |
| 7.1                               | GG 15                  | < 180 HB                                    | 140                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 7.2                               | GG 35                  | < 260 HB                                    | 130                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 7.3                               | GGG 50                 | < 200 HB                                    | 130                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 7.4                               | GGG 70                 | < 250 HB                                    | 130                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 7.5                               | GTS 40.05              | < 130 HB                                    | 120                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |
| 7.6                               | GTS 65.05              | < 230 HB                                    | 110                                                      | 0,03                    | 0,04                    | 0,05                     | 0,06                     | 0,07                     | 0,08                     | 0,10                          |

Nutenfräsen / Slot Milling



6 Ø = ae 1,0 x d1 - ap = 0,75 x d1  
8-20 Ø = ap = 1,5 x d1

Umfangfräsen / Circumference milling



6 Ø = ae 0,5 x d1 - ap = 1,5 x d1  
8-20 Ø = ae = 2,0 x d1

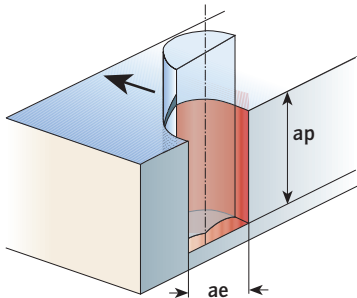
Nutfräsen / Slot milling

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material  | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 6<br>fz = mm | Ø 8<br>fz = mm | Ø 10<br>fz = mm | Ø 12<br>fz = mm | Ø 14<br>fz = mm | Ø 16<br>fz = mm | Ø 18<br>fz = mm | Ø 20<br>fz = mm |
|-----------------------------------|------------------------|---------------------------------------------|----------------------------------------------------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                                   |                        |                                             | ± 10%                                                    |                |                |                 |                 |                 |                 |                 |                 |
| 1.1                               | 36 Mn 6                | < 450                                       | 240                                                      | 0,025          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 1.2                               | ck 45                  | < 650                                       | 220                                                      | 0,027          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 1.3                               | 24 Cr Mo 5             | < 850                                       | 210                                                      | 0,027          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 1.4                               | 43 Cr Mo 4             | < 950                                       | 190                                                      | 0,027          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 2.1                               | 21 Mn Cr 5             | < 600                                       | 180                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 2.2                               | 26 Cr Mo 4             | < 950                                       | 160                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 2.3                               | 41 Cr Al Mo 7          | < 1100                                      | 150                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 3.1                               | X 36 Cr Mo 17          | < 700-1000                                  | 150                                                      | 0,025          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 3.2                               | X 12 Cr S 13           | < 700                                       | 75                                                       | 0,025          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 4.1                               | X 38 Cr 13             | < 700                                       | 65                                                       | 0,020          | 0,03           | 0,04            | 0,05            | 0,055           | 0,06            | 0,07            | 0,08            |
| 4.2                               | X 5 Cr Ni Mo 17.12.2   | < 700                                       | 65                                                       | 0,020          | 0,03           | 0,04            | 0,05            | 0,055           | 0,06            | 0,07            | 0,08            |
| 4.3                               | X 2 Cr Ni Mo N 17.13.3 | < 850                                       | 55                                                       | 0,025          | 0,03           | 0,04            | 0,05            | 0,055           | 0,06            | 0,07            | 0,08            |
| 4.3.1                             | Ti 1                   | < 850                                       | 60                                                       | 0,025          | 0,03           | 0,04            | 0,05            | 0,055           | 0,06            | 0,07            | 0,08            |
| 6.1                               | Ti Al 6 V 4            | < 1200                                      | 50                                                       | 0,02           | 0,03           | 0,04            | 0,05            | 0,055           | 0,06            | 0,07            | 0,08            |
| 6.2                               | GG 15                  | < 180 HB                                    | 140                                                      | 0,02           | 0,03           | 0,04            | 0,05            | 0,055           | 0,06            | 0,07            | 0,08            |
| 7.1                               | GG 15                  | < 260 HB                                    | 130                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 7.2                               | GGG 35                 | < 200 HB                                    | 130                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 7.3                               | GGG 50                 | < 250 HB                                    | 130                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 7.4                               |                        | < 130 HB                                    | 120                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |
| 7.5                               |                        | < 230 HB                                    | 110                                                      | 0,026          | 0,04           | 0,05            | 0,06            | 0,07            | 0,08            | 0,09            | 0,10            |

Umfangfräsen / Circumference milling

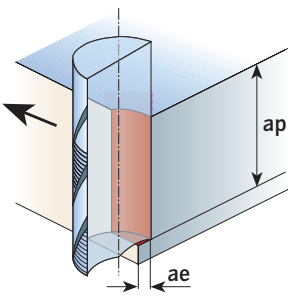
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 6<br>fz = mm | Ø 8<br>fz = mm | Ø 10<br>fz = mm | Ø 12<br>fz = mm | Ø 16<br>fz = mm | Ø 20<br>fz = mm |  |
|-----------------------------------|-----------------------|---------------------------------------------|----------------------------------------------------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|--|
|                                   |                       |                                             | ± 10%                                                    |                |                |                 |                 |                 |                 |  |
| 1.1                               | St 37.2               | < 450                                       | 260                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 1.2                               | C 45                  |                                             | 240                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 1.3                               | 16 Cr Mo 4            | < 650                                       | 240                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 1.4                               | CK 60                 | < 850                                       | 210                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 2.1                               | 45 Ni Cr 6            | < 950                                       | 200                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 2.2                               | 100 Cr Mo 5           | < 600                                       | 160                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 2.3                               | 39 Cr Mo V 139        | < 950                                       | 140                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 3.1                               | X 36 Cr Mo 17         | < 1100                                      | 180                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 3.2                               | S 18 -1-2-10          | < 700                                       | 150                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 4.1                               | X 12 Cr Mo S 17       | < 1400                                      | 75                                                       | 0,03           | 0,04           | 0,05            | 0,06            | 0,08            | 0,10            |  |
| 4.2                               | X 38 Cr 13            | < 700                                       | 70                                                       | 0,03           | 0,04           | 0,05            | 0,06            | 0,08            | 0,10            |  |
| 4.3                               | X 5 Cr Ni 18 10       | < 850                                       | 70                                                       | 0,03           | 0,04           | 0,05            | 0,06            | 0,08            | 0,10            |  |
| 4.3.1                             | X 2 Cr Ni Mo N 17133  | < 700                                       | 60                                                       | 0,03           | 0,04           | 0,05            | 0,06            | 0,08            | 0,10            |  |
| 6.1                               | Ti 1                  | < 850                                       | 70                                                       | 0,03           | 0,04           | 0,05            | 0,06            | 0,08            | 0,10            |  |
| 6.2                               | Ti Al 6 V 4           | < 850                                       | 60                                                       | 0,03           | 0,04           | 0,05            | 0,06            | 0,08            | 0,10            |  |
| 7.1                               | GG 15                 | < 1200                                      | 150                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 7.2                               | GG 25                 | < 180 HB                                    | 140                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 7.3                               | GGG 40                | < 180 HB                                    | 140                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 7.4                               | GGG 60                | < 180 HB                                    | 140                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |
| 7.5                               | GTW 55                | < 250 HB                                    | 140                                                      | 0,03           | 0,05           | 0,06            | 0,07            | 0,09            | 0,12            |  |

Nutenfräsen / Slot Milling



6 Ø = ap 1,0 x d1  
8 - 20 Ø = ap max. 1,5 x D

Umfangfräsen / Circumference milling



6 Ø = ae 0,5 x d1 - ap = 1,5 x d1  
8 - 20 Ø = ap max. 2,0 x d1

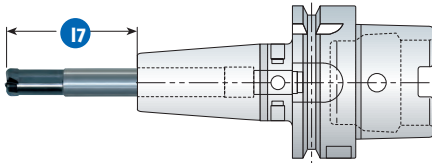
Art. 30.6433

Empfohlene Richtwerte für High-Performance Fräser  
Recommended cutting data for high performance mills

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                                                                    | Festigkeit<br>Strength | n/Vf                  | Ø2 rp<br>0,5 | Ø3 rp<br>0,75 | Ø4 rp<br>1,0 | Ø5 rp<br>1,2 | Ø6 rp<br>1,5 | Ø7 rp<br>1,5<br>N/mm² | Ø8 rp<br>2,0 | Ø9 rp<br>2,0 | Ø10 rp<br>2,0 | Ø11 rp<br>2,0 | Ø12 rp<br>3,0 | Ø13 rp<br>3,0 | Ø16 rp<br>4,0 | ap = 0,1 x rp<br>ae = 0,3 x d1                                                                                                    |
|-----------------------------------|------------------------------------------------------------------------------------------|------------------------|-----------------------|--------------|---------------|--------------|--------------|--------------|-----------------------|--------------|--------------|---------------|---------------|---------------|---------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1.1                               | Automatenstähle<br>unalloyed steel                                                       | < 450                  | n (min <sup>1</sup> ) | 32.000       | 21.000        | 16.000       | 12.000       | 11.000       | 9.000                 | 8.000        | 7.000        | 6.000         | 6.000         | 5.000         | 5.000         | 4.500         |                                                                                                                                   |
| 1.2                               |                                                                                          | < 650                  | Vf (mm/min)           | 10.000       | 12.000        | 12.000       | 13.000       | 14.000       | 12.000                | 13.000       | 12.000       | 13.000        | 12.000        | 13.000        | 13.000        | 12.000        |                                                                                                                                   |
| 1.3                               |                                                                                          | < 750                  |                       |              |               |              |              |              |                       |              |              |               |               |               |               |               |                                                                                                                                   |
| 2.1                               | Vergütungsstähle<br>alloyed steel                                                        | < 600                  | n (min <sup>1</sup> ) | 32.000       | 21.000        | 15.000       | 12.000       | 11.000       | 9.000                 | 8.000        | 7.000        | 6.000         | 6.000         | 5.000         | 5.000         | 5.000         |                                                                                                                                   |
| 2.2                               |                                                                                          | < 950                  | Vf (mm/min)           | 9.000        | 12.000        | 11.000       | 12.000       | 13.000       | 10.000                | 12.000       | 11.000       | 12.000        | 11.000        | 11.000        | 11.000        | 11.000        |                                                                                                                                   |
| 4.1                               | Rostfreie Stähle<br>ferritic, martensitisch<br>Stainless steels<br>ferritic, martensitic | < 1500                 | n (min <sup>1</sup> ) | 24.000       | 16.000        | 12.000       | 10.000       | 8.000        | 6.500                 | 6.000        | 5.000        | 4.500         | 4.000         | 4.000         | 3.500         | 3.000         | ≤rp2=ap 0,1 x rp<br>>rp2=ap 0,2 x rp<br>ae=0,3xd1<br>ae=0,3xd1<br>≤rp2=ap 0,05 x rp<br>≤rp2=ap 0,1 x rp<br>ae=0,3xd1<br>ae=0,3xd1 |
| 4.2                               |                                                                                          | < 1500                 | Vf (mm/min)           | 7.000        | 8.000         | 8.000        | 9.000        | 9.000        | 8.000                 | 9.000        | 8.000        | 9.000         | 8.000         | 8.000         | 7.000         | 6.000         |                                                                                                                                   |
| 8.1                               | Toolox 44                                                                                | 45-55 HRC              | n (min <sup>1</sup> ) | 22.000       | 16.000        | 12.000       | 9.000        | 7.500        | 6.500                 | 6.000        | 5.000        | 4.500         | 4.000         | 4.000         | 3.500         | 3.200         |                                                                                                                                   |
|                                   |                                                                                          |                        | Vf (mm/min)           | 6.000        | 7.000         | 6.000        | 8.000        | 8.000        | 7.000                 | 8.000        | 7.000        | 8.000         | 7.000         | 8.000         | 7.000         | 6.500         |                                                                                                                                   |
| 8.2                               | gehärtete Stähle<br>hardened material                                                    | 55-60 HRC              | n (min <sup>1</sup> ) | 16.000       | 10.000        | 8.000        | 6.000        | 5.000        | 4.500                 | 4.000        | 3.500        | 3.000         | 3.000         | 2.500         | 2.500         | 2.000         |                                                                                                                                   |
|                                   |                                                                                          |                        | Vf (mm/min)           | 2.500        | 3.000         | 3.000        | 3.000        | 3.500        | 3.000                 | 2.500        | 2.000        | 2.200         | 2.500         | 3.000         | 2.800         | 2.200         |                                                                                                                                   |

Bearbeitungshinweise:

- 1. Vorausgesetzt, es werden stabile Maschinenverhältnisse und einwandfreie Werkzeugaufnahmen verwendet (Schrumpffutter)
- 2. Die genannten Richtwerte basieren auf interpolationsfräsen auch in den Ecken. Ohne Interpolationsfräsen reduzieren Sie die Schnittgeschwindigkeit (Vc) um 50%-70% sowie die Schnitttiefe (ap) um 50%-80%.
- 3. Kühlen Sie mit MMKS (Minimalkühlschmierung) oder Luft.
- 4. Beim Eintauchen in Z-Achse mit einer Schräge von ≈ 2° ist der Vorschub auf 40-60% zu reduzieren.
- 5. Die Richtwerte beziehen sich auf eine Auskraglänge l3 von 3xD. Für tiefere Anwendungen sind Vc / ap / Vf den Gegebenheiten anzupassen.
- 6. Um optimale Schnittbedingungen zu erreichen sind die Einsatzbedingungen vor Ort zu berücksichtigen.



Machining details:

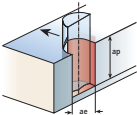
- 1. Conditions must be: rigid machine circumstances and excellent holders. (shrinking holder)
- 2. The mentioned standard values based on interpolation milling also in corners.
- 3. Coolant with MMKS [MQL (mist)] on air blow.
- 4. When dipping in Z-axis, you have to reduce the feed speed 40% > 60%.
- 5. The standard values refer to the length l3 od 3xD. For deeper applications please adjust Vc/ap/Vf for the conditions.
- 6. In order to achieve ideal cutting results you have to consider your local operating conditions.

| Länge ausserhalb Spannfutter<br>overhang length l7 | Vc - % | ap - % | Vf - % |
|----------------------------------------------------|--------|--------|--------|
| l7 ≤ 4 x d1                                        | 100    | 100    | 100    |
| l7 ≤ 5 x d1                                        | 70     | 70     | 80     |
| l7 ≤ 6 x d1                                        | 50     | 50     | 70     |

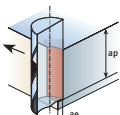
Art. 30.6349

Empfohlene Schnittdaten für Karnasch 1xD Schrappfräser HPC  
Recommended cutting data for Karnasch 1xD solid carbide roughing end mills

| Werkstoffgruppe<br>Material group | 1.1 - 1.2 |       | 2.1 - 2.2 - 2.3 |       | 3.1 - 3.2 |       | 4.1 - 4.2 - 4.3 |       | 6.1 - 6.2 |       | 7.1 - 7.2 - 7.3 - 7.4 |       |
|-----------------------------------|-----------|-------|-----------------|-------|-----------|-------|-----------------|-------|-----------|-------|-----------------------|-------|
| d1                                | Vc mm/min | fz/mm | Vc mm/min       | fz/mm | Vc mm/min | fz/mm | Vc mm/min       | fz/mm | Vc mm/min | fz/mm | Vc mm/min             | fz/mm |
| 6,0                               | 180       | 0,028 | 180             | 0,028 | 140       | 0,028 | 60              | 0,020 | 40        | 0,020 | 120                   | 0,028 |
| 8,0                               | 180       | 0,040 | 180             | 0,040 | 140       | 0,040 | 60              | 0,030 | 40        | 0,030 | 120                   | 0,040 |
| 10,0                              | 180       | 0,050 | 180             | 0,050 | 140       | 0,050 | 60              | 0,040 | 40        | 0,040 | 120                   | 0,050 |
| 12,0                              | 180       | 0,060 | 180             | 0,060 | 140       | 0,060 | 60              | 0,050 | 40        | 0,050 | 120                   | 0,060 |
| 14,0                              | 180       | 0,060 | 180             | 0,060 | 140       | 0,060 | 60              | 0,050 | 40        | 0,050 | 120                   | 0,060 |
| 16,0                              | 180       | 0,080 | 180             | 0,080 | 140       | 0,080 | 60              | 0,060 | 40        | 0,060 | 120                   | 0,070 |
| 18,0                              | 180       | 0,080 | 180             | 0,080 | 140       | 0,080 | 60              | 0,060 | 40        | 0,060 | 120                   | 0,080 |
| 20,0                              | 180       | 0,100 | 180             | 0,100 | 140       | 0,100 | 60              | 0,080 | 40        | 0,080 | 120                   | 0,100 |



< 6Ø = ap 0,75 x D  
> 8Ø = ap 1,00 x D



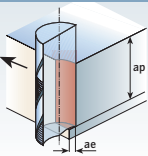
> 6Ø = ap 1,00 x D > 1,3 x D



Empfohlene Schnittwerte für Vollhartmetallfräser  
Recommended cutting data for solid carbide end mills

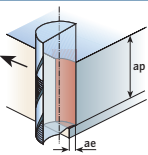
Art. 30.6446 Art. 30.6447

Umfangfräsen  
Circumference milling



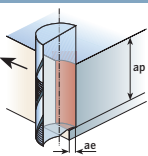
Schruppen über 0,07 x d  
ae < 0,07 x d

Umfangfräsen  
Circumference milling



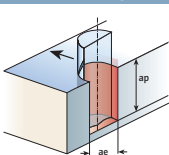
Schlichten bis 0,03 x d  
ae > 0,03

Umfangfräsen  
Circumference milling



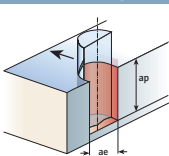
max. Spirallänge ap  
bei 0,7 fz

Nutenfräsen  
Slot milling



Schruppen max. 0,07 x d  
ap bei 0,7 x fz

Nutenfräsen  
Slot milling



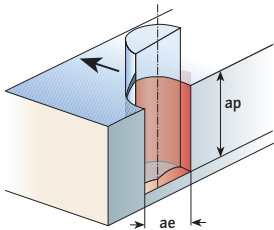
Schlichten bis 0,03 x d  
ap bei 1,2 fz

| Werkstoff<br>Workpiece material                                                                                               | Schnittgeschwindigkeit<br>Cutting speed<br>Vc in m/min. |                      | Vorschubgeschwindigkeit / Feeder speed Vf                                 |       |       |         |       |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------|---------------------------------------------------------------------------|-------|-------|---------|-------|
|                                                                                                                               | Schruppen/Roughing                                      | Schlichten/Finishing | Ø 6                                                                       | Ø 8   | Ø 10  | Ø 12-16 | Ø 20  |
|                                                                                                                               |                                                         |                      | Fräserdurchmesser / Dimension<br>Vorschub pro Zahn / Feed per teeth fz mm |       |       |         |       |
| unlegiert < 500 N/mm <sup>2</sup><br>unalloyed steel < 500 N/mm <sup>2</sup>                                                  | 190                                                     | 230                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| legiert < 500 N/mm <sup>2</sup><br>alloyed steel < 500 N/mm <sup>2</sup>                                                      | 160                                                     | 200                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| unleg. < 1000 N/mm <sup>2</sup><br>unalloyed steel < 1000 N/mm <sup>2</sup>                                                   | 170                                                     | 180                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| leg. < 1000 N/mm <sup>2</sup><br>alloyed steel < 1000 N/mm <sup>2</sup>                                                       | 120                                                     | 140                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| unleg. < 1300 N/mm <sup>2</sup><br>unalloyed steel < 1300 N/mm <sup>2</sup>                                                   | 140                                                     | 165                  | 0,035                                                                     | 0,055 | 0,072 | 0,090   | 0,108 |
| leg. < 1300 N/mm <sup>2</sup><br>alloyed steel < 1300 N/mm <sup>2</sup>                                                       | 100                                                     | 125                  | 0,035                                                                     | 0,055 | 0,072 | 0,090   | 0,108 |
| unleg. < 1600 N/mm <sup>2</sup><br>unalloyed steel < 1600 N/mm <sup>2</sup>                                                   | 120                                                     | 125                  | 0,032                                                                     | 0,048 | 0,065 | 0,080   | 0,095 |
| leg. < 1600 N/mm <sup>2</sup><br>alloyed steel < 1600 N/mm <sup>2</sup>                                                       | 80                                                      | 100                  | 0,032                                                                     | 0,048 | 0,065 | 0,080   | 0,095 |
| Guss < 150 HB<br>cast iron < 150 HB                                                                                           | 170                                                     | 200                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| Guss 150-200 HB<br>cast iron 150-200 HB                                                                                       | 145                                                     | 175                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| Guss 200-250 HB<br>cast iron 200-250 HB                                                                                       | 115                                                     | 140                  | 0,032                                                                     | 0,048 | 0,064 | 0,08    | 0,096 |
| Guss 250-300 HB<br>cast iron 250-300 HB                                                                                       | 105                                                     | 125                  | 0,032                                                                     | 0,048 | 0,064 | 0,08    | 0,096 |
| gehärteter Stahl < 52 HRC<br>hardened steel < 52 HRC                                                                          | -                                                       | 84                   | 0,015                                                                     | 0,02  | 0,025 | 0,03    | 0,05  |
| rostfreier Stahl<br>stainless steel                                                                                           | 94                                                      | 113                  | 0,025                                                                     | 0,025 | 0,05  | 0,06    | 0,08  |
| hochwarmfeste Fe-Leg.<br>+ Ni-Leg. ausgehärtet<br>+ Titan ausgehärtet<br>titanium, titanium alloy<br>< 1100 N/mm <sup>2</sup> | 84                                                      | 101                  | 0,025                                                                     | 0,025 | 0,05  | 0,06    | 0,08  |
| hochwarmfeste Co-Leg.<br>heat resisting steel                                                                                 | 73                                                      | 88                   | 0,025                                                                     | 0,025 | 0,05  | 0,06    | 0,08  |
| + Ni-Leg. nicht ausgeh.<br>+ Titan unleg.<br>Nickel<br>titanium unalloyed                                                     | 63                                                      | 75                   | 0,025                                                                     | 0,025 | 0,05  | 0,06    | 0,08  |
| Alu unleg., Knetleg. nicht<br>ausgeh. + Magnes.- Knetleg.<br>aluminium unalloyed                                              | 440                                                     | 528                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |
| Alu Knetleg. ausgeh.,<br>Gußleg. bis 6% Si +<br>Magnesium Gußlegierung<br>aluminium < 6% Si                                   | 367                                                     | 440                  | 0,04                                                                      | 0,06  | 0,08  | 0,12    | 0,16  |
| Aluminium Gußleg.<br>< 12% Si<br>aluminium < 12% Si                                                                           | 294                                                     | 352                  | 0,04                                                                      | 0,06  | 0,08  | 0,12    | 0,16  |
| Aluminium Gußleg.<br>über 12% Si<br>aluminium > 12% Si                                                                        | 220                                                     | 264                  | 0,04                                                                      | 0,06  | 0,08  | 0,1     | 0,12  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material              | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 2-3<br>fz = mm<br>Z x 4 | Ø 4-6<br>fz = mm<br>Z x 6 | Ø 8<br>fz = mm<br>Z x 6 | Ø 10<br>fz = mm<br>Z x 6 | Ø 12<br>fz = mm<br>Z x 6 | Ø 14<br>fz = mm<br>Z x 6 | Ø 16<br>fz = mm<br>Z x 8 | Ø 18<br>fz = mm<br>Z x 8 | Ø 20<br>fz = mm<br>Z x 10 |
|-----------------------------------|------------------------------------|---------------------------------------------|----------------------------------------------------------|---------------------------|---------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
|                                   |                                    |                                             | ± 10%                                                    |                           |                           |                         |                          |                          |                          |                          |                          |                           |
| 3.1<br>3.2                        | X 45 Ni Cr Mo 4<br>S 65 25         | 1100-1400                                   | 180                                                      | 0,012                     | 0,020                     | 0,025                   | 0,028                    | 0,032                    | 0,035                    | 0,040                    | 0,042                    | 0,045                     |
| 8.1                               | Toolox 44<br>hardened steel        | 45-55 HRC                                   | 170                                                      | 0,012                     | 0,020                     | 0,025                   | 0,028                    | 0,032                    | 0,035                    | 0,040                    | 0,042                    | 0,045                     |
| 8.2                               | gehärteter Stahl<br>hardened steel | 45-60 HRC                                   | 140                                                      | 0,010                     | 0,018                     | 0,022                   | 0,024                    | 0,030                    | 0,032                    | 0,035                    | 0,040                    | 0,042                     |
| 8.3                               | gehärteter Stahl<br>hardened steel | 60-70 HRC                                   | 100                                                      | 0,008                     | 0,015                     | 0,020                   | 0,023                    | 0,025                    | 0,030                    | 0,032                    | 0,035                    | 0,038                     |
| 12.0                              | Hardox 400                         | 350 N/mm <sup>2</sup>                       | 170                                                      | 0,012                     | 0,020                     | 0,025                   | 0,028                    | 0,030                    | 0,035                    | 0,040                    | 0,044                    | 0,045                     |
| 12.1                              | Hardox 500                         | 800 N/mm <sup>2</sup>                       | 140                                                      | 0,016                     | 0,018                     | 0,020                   | 0,025                    | 0,028                    | 0,032                    | 0,030                    | 0,040                    | 0,042                     |

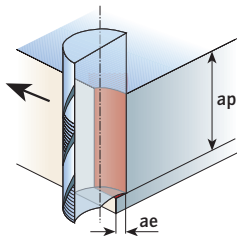
| Werkstoffgruppe<br>Material group | N/mm <sup>2</sup> / HRC     | Vorschub<br>Korrekturfaktor<br>Feed correction factor |
|-----------------------------------|-----------------------------|-------------------------------------------------------|
| 3.1/3.2                           | 1100-1400 N/mm <sup>2</sup> | 1.2                                                   |
| 8.1                               | 45-55 HRC                   | 1.1                                                   |
| 8.2                               | 55-60 HRC                   | 1.0                                                   |
| 8.3                               | 60-70 HRC                   | 0.9                                                   |
| 12.0                              | 1350 N/mm <sup>2</sup>      | 1.1                                                   |
| 12.1                              | 1800 N/mm <sup>2</sup>      | 1.0                                                   |

Nutenfräsen / Slot milling



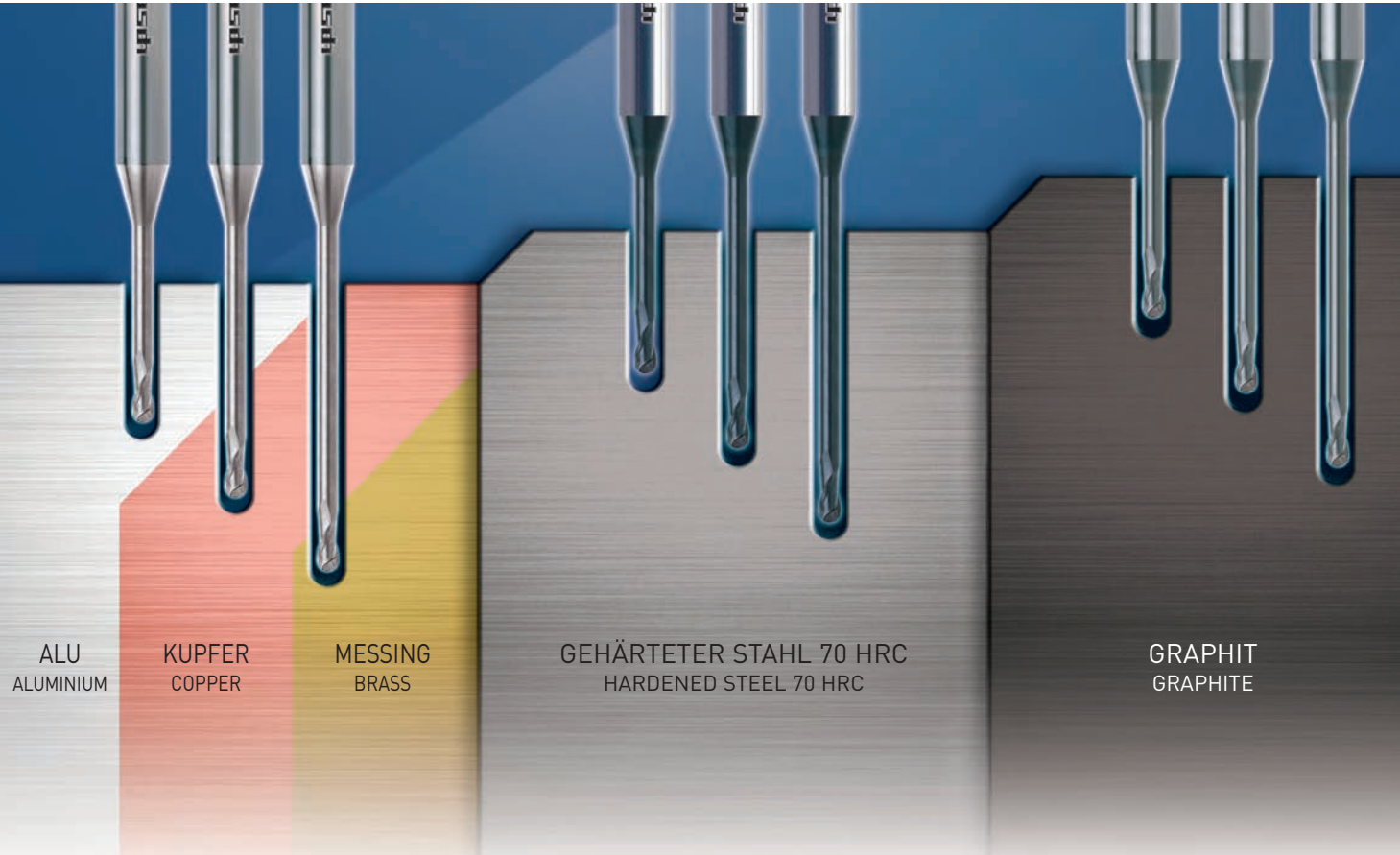
fz gültig für ae max. 1.0 x d1  
und ap 0,25 x d1

Umfangfräsen / Circumference milling



fz gültig für ae max. 0.07 x d1  
und ap 1,0 - 1,5 x d1

HSC — HHC — HPC



Edition für den Formenbau weltweit einmalig und ab Lager  
lieferbar. Über 2000 Variationen Vollhartmetallfräser von  
0,05 Ø bis 6,0 Ø mm < 30 x D.

Edition for the mouldmaker useable worldwide and all  
tools in stock. More than 2000 possible variations from  
0,05 Ø to 6,0 Ø mm < 30 x D.

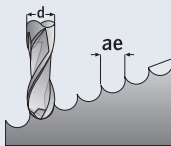
Empfohlene Richtwerte für den Einsatz von Karnasch Rockwell-Cutter HHC/HSC  
Recommended cutting data for Karnasch Rockwell cutter for hardened steel HHC/HSC

| Art. | 30.5955 | 30.6474 | 30.6476 |
|------|---------|---------|---------|
|      | 30.5958 | 30.6475 | 30.6477 |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                        | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 0,1 – 1,0<br>fz = mm/Z<br>Z x 2 | Ø 1,2 – 2,0<br>fz = mm/Z<br>Z x 2 | Ø 2,5 – 4,0<br>fz = mm/Z<br>Z x 2 | Ø 5,0 – 6,0<br>fz = mm/Z<br>Z x 2 | Ø 8,0<br>fz = mm/Z<br>Z x 2 | Ø 10,0<br>fz = mm/Z<br>Z x 2 | Ø 12<br>fz = mm/Z<br>Z x 2 |
|-----------------------------------|----------------------------------------------|---------------------------------------------|----------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------|------------------------------|----------------------------|
|                                   |                                              |                                             | ± 10%                                                    |                                   |                                   |                                   |                                   |                             |                              |                            |
| 3.1<br>3.2                        | X 36 Cr Mo 17<br>X 50 Ni Cr WV 1313          | 1100-1400                                   | 210                                                      | 0,008                             | 0,012                             | 0,08                              | 0,04                              | 0,08                        | 0,09                         | 0,10                       |
| 8.1                               | Toolox 44/gehärteter<br>Stahl/hardened steel | 45-55 HRC                                   | 180                                                      | 0,004                             | 0,006                             | 0,03                              | 0,06                              | 0,07                        | 0,08                         | 0,09                       |
| 8.2                               | gehärtete Stähle<br>hardened steel           | 45-60 HRC                                   | 160                                                      | 0,004                             | 0,005                             | 0,02                              | 0,05                              | 0,06                        | 0,07                         | 0,08                       |
| 8.3                               | gehärtete Stähle<br>hardened steel           | 60-70 HRC                                   | 120                                                      | 0,003                             | 0,005                             | 0,018                             | 0,045                             | 0,055                       | 0,065                        | 0,075                      |

| Werkstoffgruppe<br>Material group | N/mm <sup>2</sup> / HRC     | Vorschub<br>Korrekturfaktor<br>Feed correction factor |
|-----------------------------------|-----------------------------|-------------------------------------------------------|
| 3.1/3.2                           | 1100-1400 N/mm <sup>2</sup> | 1.2                                                   |
| 8.1                               | 45-55 HRC                   | 1.1                                                   |
| 8.2                               | 55-60 HRC                   | 1.0                                                   |
| 8.3                               | 60-70 HRC                   | 0.9                                                   |

Korrekturfaktor für/Correction factor for  
30.6475 = 0,7



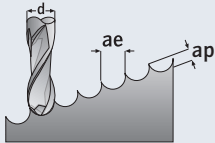
Kopierfräsen  
Copying milling  
fz für ae = 0,05 x d1  
ap = 0,05 x d1

Empfohlene Richtwerte für den Einsatz von Karnasch Radiusfräsern HSC

| Art. | 30.6478 | Art. | 30.6479 |
|------|---------|------|---------|
|------|---------|------|---------|

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                      | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | ae und ap =                                              | 0,2                               | 0,06                              | 0,12                              | 0,18                        | 0,25                        | 0,30                         | 0,35                         |
|-----------------------------------|--------------------------------------------|---------------------------------------------|----------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------|-----------------------------|------------------------------|------------------------------|
|                                   |                                            |                                             | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | Ø 1,0 - 1,5<br>fz = mm/Z<br>Z x 2 | Ø 2,0 - 3,0<br>fz = mm/Z<br>Z x 2 | Ø 4,0 - 5,0<br>fz = mm/Z<br>Z x 2 | Ø 6,0<br>fz = mm/Z<br>Z x 2 | Ø 8,0<br>fz = mm/Z<br>Z x 2 | Ø 10,0<br>fz = mm/Z<br>Z x 2 | Ø 12,0<br>fz = mm/Z<br>Z x 2 |
| 1.1<br>1.2<br>1.3                 | 36 Mn 6                                    | < 450                                       | 350                                                      | 0,009                             | 0,012                             | 0,040                             | 0,055                       | 0,070                       | 0,080                        | 0,010                        |
|                                   | ck 45                                      | < 650                                       | 350                                                      |                                   |                                   |                                   |                             |                             |                              |                              |
|                                   | 24 Cr Mo 5                                 | < 850                                       | 350                                                      |                                   |                                   |                                   |                             |                             |                              |                              |
| 2.1<br>2.2                        | 21 Mu Cr 5<br>26 Cr Mo 4                   | < 600<br>< 950                              | 300<br>260                                               | 0,008                             | 0,012                             | 0,040                             | 0,055                       | 0,070                       | 0,080                        | 0,010                        |
| 2.5<br>2.6                        | 34 Cr Al 6<br>31 Cr Mo V9                  | < 1000<br>> 1000                            | 300<br>260                                               | 0,008                             | 0,012                             | 0,040                             | 0,055                       | 0,070                       | 0,080                        | 0,010                        |
| 3.1<br>3.2                        | X 36 Cr Mo 17<br>S 18 -1-2-10              | < 700<br>< 1400                             | 360<br>200                                               | 0,008                             | 0,012                             | 0,040                             | 0,055                       | 0,070                       | 0,080                        | 0,010                        |
| 4.1<br>4.2<br>4.3                 | X 12 Cr S 13<br>X 38 Cr 13<br>X 5 Cr Ni Mo | < 700<br>< 700<br>17 12 2 < 700             | 280<br>280<br>280                                        | 0,008                             | 0,012                             | 0,040                             | 0,055                       | 0,070                       | 0,080                        | 0,010                        |
| 7.1<br>7.2<br>7.3                 | GG 15<br>GG 35<br>GGG 50                   | < 180 HB<br>< 260 HB                        | 500<br>500<br>370                                        | 0,008                             | 0,012                             | 0,040                             | 0,055                       | 0,070                       | 0,080                        | 0,010                        |
| 8.10                              | Toolox 44                                  | 45-55 HRC                                   | 140                                                      | 0,008                             | 0,012                             | 0,040                             | 0,055                       | 0,060                       | 0,070                        | 0,080                        |

Korrekturfaktor für/ Correction factor for  
30.6479 = 0,7



Art. 30.6486

Richtwerte für den Einsatz von Karnasch VHM- HSC- HRC Radiusfräsern 3D - Z=4 – High-Performance  
Recommended cutting data for Karnasch solid carbide ball nose 3D - 4 flutes

| Werkstoffgruppe<br>Material group | Festigkeit<br>Strength<br>N/mm <sup>2</sup> |    | Ø 2   | Ø 3   | Ø 4   | Ø 5   | Ø 6   | Ø 8   | Ø 10  | Ø 12  |                   |
|-----------------------------------|---------------------------------------------|----|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|
| 1.1-1.2-1.3-1.4-1.5               | <1100<br>N/mm <sup>2</sup>                  | ap | < 0,2 | < 0,3 | < 0,4 | < 0,5 | < 0,6 | < 0,8 | < 0,9 | < 1,0 | ap max.<br>1,0 mm |
|                                   |                                             | ae | < 0,2 | < 0,3 | < 0,5 | < 0,8 | < 1,0 | < 1,6 | < 2,0 | < 2,4 |                   |
|                                   |                                             | n  | 33500 | 22500 | 17000 | 14000 | 11000 | 8400  | 6700  | 5500  |                   |
|                                   |                                             | vf | 6000  | 6000  | 5800  | 5500  | 6000  | 5800  | 5700  | 5200  |                   |
| 2.1-2.2-2.3-2.4-2.5-2.6           | <30 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,6  | <0,6  | <0,8  | <0,9  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,5  | <0,8  | <1,0  | <1,6  | <2,0  | <2,4  |                   |
|                                   |                                             | n  | 33300 | 22500 | 17000 | 14000 | 11000 | 8400  | 6000  | 5000  |                   |
|                                   |                                             | vf | 6000  | 6000  | 5800  | 5500  | 6000  | 5800  | 5000  | 4500  |                   |
| 3.1-3.2                           | <35 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,6  | <0,6  | <0,8  | <0,9  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,5  | <0,8  | <1,0  | <1,6  | <2,0  | <2,4  |                   |
|                                   |                                             | n  | 33000 | 22500 | 17000 | 14000 | 8400  | 6300  | 5000  | 4200  |                   |
|                                   |                                             | vf | 6000  | 6000  | 5700  | 5500  | 4500  | 4500  | 4200  | 4000  |                   |
| 4.1-4.2-4.3                       | <45 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,6  | <0,6  | <0,8  | <0,9  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,5  | <0,8  | <1,0  | <1,6  | <2,0  | <2,4  |                   |
|                                   |                                             | n  | 24000 | 16000 | 12000 | 10000 | 8000  | 6000  | 4700  | 4000  |                   |
|                                   |                                             | vf | 3800  | 3700  | 3500  | 3300  | 3900  | 3800  | 3600  | 3200  |                   |
| 8.1                               | <55 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,6  | <0,6  | <0,8  | <0,9  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,5  | <0,8  | <1,0  | <1,6  | <2,0  | <2,4  |                   |
|                                   |                                             | n  | 20000 | 14000 | 10000 | 8500  | 6000  | 4600  | 3800  | 3100  |                   |
|                                   |                                             | vf | 3300  | 3100  | 2900  | 2800  | 2700  | 2600  | 2500  | 2300  |                   |
| 8.2                               | <60 HRC                                     | ap | <0,1  | <0,15 | <0,2  | <0,25 | <0,3  | <0,5  | <0,5  | <0,5  | ap max.<br>0,5 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  |                   |
|                                   |                                             | n  | 16000 | 10500 | 8000  | 6500  | 5000  | 4000  | 3200  | 2700  |                   |
|                                   |                                             | vf | 2500  | 2200  | 2000  | 2000  | 2000  | 2000  | 1900  | 1800  |                   |
| 8.3                               | <65 HRC                                     | ap | <0,2  | <0,15 | <0,2  | <0,25 | <0,25 | <0,6  | <0,5  | <0,5  | ap max.<br>0,5 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  |                   |
|                                   |                                             | n  | 14000 | 10000 | 7000  | 6000  | 4200  | 3200  | 2500  | 2000  |                   |
|                                   |                                             | vf | 2200  | 2000  | 1800  | 1700  | 1500  | 1500  | 1500  | 1200  |                   |
| 8.3                               | <70 HRC                                     | ap | <0,1  | <0,15 | <0,2  | <0,25 | <0,25 | <0,3  | <0,5  | <0,5  | ap max.<br>0,5 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  |                   |
|                                   |                                             | n  | 9000  | 6000  | 4500  | 3700  | 2500  | 2000  | 1500  | 1200  |                   |
|                                   |                                             | vf | 1400  | 1200  | 1100  | 1100  | 900   | 900   | 900   | 700   |                   |

Art. 30.6486

Richtwerte für den Einsatz von Karnasch VHM- HSC- HRC Radiusfräsern 3D - Z=4 – High-Performance  
Recommended cutting data for Karnasch solid carbide ball nose 3D - 4 flutes

| Werkstoffgruppe<br>Material group | Festigkeit<br>Strength<br>N/mm <sup>2</sup> |    | Ø 2   | Ø 3   | Ø 4   | Ø 5   | Ø 6   | Ø 8   | Ø 10  | Ø 12  |                   |
|-----------------------------------|---------------------------------------------|----|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|
| 1.1-1.2-1.3-1.4-1.5               | <1100<br>N/mm <sup>2</sup>                  | ap | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | 0,4   | 0,5   | 0,6   | 0,8   | 1,0   | <1,2  | <1,6  | <2,0  |                   |
|                                   |                                             | n  | 50000 | 33000 | 25000 | 20000 | 17000 | 12000 | 10000 | 8000  |                   |
|                                   |                                             | vf | 9000  | 8800  | 8500  | 8200  | 9000  | 9000  | 8500  | 8000  |                   |
| 2.1-2.2-2.3-2.4-2.5-2.6           | <30 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | 0,4   | 0,5   | 0,6   | 0,8   | 1,0   | <1,2  | <1,6  | <2,0  |                   |
|                                   |                                             | n  | 50000 | 33000 | 25000 | 20000 | 17000 | 12500 | 10000 | 8000  |                   |
|                                   |                                             | vf | 9000  | 8800  | 8500  | 8200  | 9000  | 8000  | 8000  | 7000  |                   |
| 3.1-3.2                           | <35 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  | <1,6  | <2,0  |                   |
|                                   |                                             | n  | 42000 | 28000 | 21000 | 18000 | 16000 | 12000 | 10000 | 8000  |                   |
|                                   |                                             | vf | 8000  | 7000  | 6000  | 6000  | 6000  | 6000  | 6000  | 6000  |                   |
| 4.1-4.2-4.3                       | <45 HRC                                     | ap | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,0  | ap max.<br>1,0 mm |
|                                   |                                             | ae | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  | <1,6  | <2,0  |                   |
|                                   |                                             | n  | 40000 | 26000 | 20000 | 17000 | 16000 | 12000 | 10000 | 8000  |                   |
|                                   |                                             | vf | 7000  | 6500  | 6000  | 5500  | 7000  | 7000  | 6500  | 6000  |                   |
| 8.1                               | <55 HRC                                     | ap | <0,15 | <0,24 | <0,30 | <0,4  | <0,45 | <0,6  | <0,8  | <0,8  | ap max.<br>0,8 mm |
|                                   |                                             | ae | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  | <1,6  | <2,0  |                   |
|                                   |                                             | n  | 35000 | 23000 | 17000 | 14500 | 13000 | 10000 | 8000  | 6500  |                   |
|                                   |                                             | vf | 5500  | 5000  | 4500  | 4500  | 5000  | 5000  | 5000  | 5000  |                   |
| 8.2                               | <60 HRC                                     | ap | <0,1  | <0,15 | <0,20 | <0,25 | <0,3  | <0,4  | <0,5  | <0,5  | ap max.<br>0,5 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  |                   |
|                                   |                                             | n  | 25000 | 17000 | 12000 | 10500 | 10000 | 7500  | 6000  | 5000  |                   |
|                                   |                                             | vf | 4000  | 3500  | 3300  | 3000  | 4000  | 4000  | 3500  | 3000  |                   |
| 8.3                               | <65 HRC                                     | ap | 0,1   | 0,15  | 0,20  | 0,25  | 0,3   | <0,4  | <0,5  | <0,5  | ap max.<br>0,5 mm |
|                                   |                                             | ae | 0,2   | 0,3   | 0,4   | 0,5   | 0,6   | <0,8  | <1,0  | <1,2  |                   |
|                                   |                                             | n  | 24000 | 16000 | 12000 | 10000 | 9000  | 7000  | 5500  | 4500  |                   |
|                                   |                                             | vf | 3500  | 3400  | 3100  | 2900  | 2900  | 2900  | 2800  | 2500  |                   |
| 8.3                               | <70 HRC                                     | ap | <0,06 | <0,09 | <0,12 | <0,15 | <0,18 | <0,24 | <0,30 | <0,30 | ap max.<br>0,3 mm |
|                                   |                                             | ae | <0,2  | <0,3  | <0,4  | <0,5  | <0,6  | <0,8  | <1,0  | <1,2  |                   |
|                                   |                                             | n  | 17000 | 11000 | 8000  | 6000  | 6000  | 4800  | 3800  | 3200  |                   |
|                                   |                                             | vf | 2600  | 2400  | 2100  | 2000  | 2000  | 2000  | 2000  | 1800  |                   |

Bearbeitungshinweise:

1. Vorausgesetzt, es werden stabile Maschinenverhältnisse und einwandfreie Werkzeugaufnahmen verwendet.
2. Bei größeren Auskraglängen müssen die Schnittdaten entsprechend reduziert werden.
3. Die angegebenen Schnittdaten sind auf eine Auskraglänge von max. 4xD und eine Werkstückschräge von max. 15° angelegt.
4. Ist der Eckenradius der Werkstückkontur kleiner als 1,5 x Werkzeugradius, oder die Kontur zu steil, müssen die Schnittdaten um ≈ 50% reduziert werden.



HSC-Schlichten/*HSC-Finishing*

Richtwerte für den Einsatz von Karnasch VHM- HSC- HRC Radiusfräsern 3D - Z=4 – High-Performance  
Recommended cutting data for Karnasch solid carbide ball nose 3D - 4 flutes

Art. **30.6486**

| Werkstoffgruppe<br>Material group | Festigkeit<br>Strength<br>N/mm² |    | Ø 2   | Ø 3   | Ø 4   | Ø 5   | Ø 6   | Ø 8  | Ø 10 | Ø 12 |
|-----------------------------------|---------------------------------|----|-------|-------|-------|-------|-------|------|------|------|
| 1.1-1.2-1.3-1.4-1.5               | <1100<br>N/mm²                  | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 38000 | 25500 | 19000 | 16000 | 12000 | 9000 | 7000 | 6000 |
|                                   |                                 | vf | 7500  | 7000  | 6500  | 6000  | 7500  | 6500 | 6000 | 5500 |
| 2.1-2.2-2.3-2.4<br>2.5-2.6        | <30 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 38000 | 25500 | 19000 | 16000 | 12000 | 9000 | 7000 | 6000 |
|                                   |                                 | vf | 7500  | 7000  | 6500  | 6000  | 7000  | 6000 | 5000 | 5000 |
| 3.1-3.2                           | <35 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 28000 | 28000 | 24000 | 12000 | 9000  | 7000 | 5500 | 4500 |
|                                   |                                 | vf | 7000  | 6700  | 6000  | 5800  | 5500  | 5000 | 4500 | 4000 |
| 4.1-4.2-4.3                       | <45 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 26000 | 17000 | 13000 | 11000 | 8500  | 6500 | 5000 | 4000 |
|                                   |                                 | vf | 4500  | 4500  | 4000  | 3800  | 5000  | 4500 | 4000 | 3500 |
| 8.1                               | <55 HRC                         | a  | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 22000 | 15000 | 11000 | 9000  | 7000  | 5200 | 4000 | 3500 |
|                                   |                                 | vf | 3200  | 3100  | 3000  | 3000  | 3500  | 3200 | 2600 | 2400 |
| 8.2                               | <60 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 17000 | 11500 | 8500  | 7200  | 6500  | 5000 | 4000 | 3200 |
|                                   |                                 | vf | 2700  | 2500  | 2200  | 2000  | 3000  | 2800 | 2500 | 2200 |
| 8.3                               | <65 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 14000 | 9000  | 7000  | 5500  | 5800  | 4200 | 3500 | 2800 |
|                                   |                                 | vf | 2300  | 2200  | 2000  | 1900  | 2500  | 2200 | 2000 | 1500 |
|                                   | 8.3<br><70 HRC                  | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16 | 0,20 | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40 | 0,50 | 0,60 |
|                                   |                                 | n  | 8500  | 5500  | 4400  | 3500  | 3700  | 2800 | 2200 | 1800 |
|                                   |                                 | vf | 1400  | 1300  | 1200  | 1100  | 1500  | 1300 | 1200 | 1000 |

HSC-Schlichten/*HSC-Finishing*

Richtwerte für den Einsatz von Karnasch VHM- HSC- HRC Radiusfräsern 3D - Z=4 – High-Performance  
Recommended cutting data for Karnasch solid carbide ball nose 3D - 4 flutes

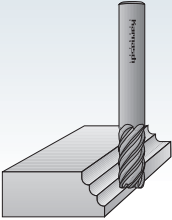
Art. **30.6486**

| Werkstoffgruppe<br>Material group | Festigkeit<br>Strength<br>N/mm² |    | Ø 2   | Ø 3   | Ø 4   | Ø 5   | Ø 6   | Ø 8   | Ø 10  | Ø 12 |
|-----------------------------------|---------------------------------|----|-------|-------|-------|-------|-------|-------|-------|------|
| 1.1-1.2-1.3-1.4-1.5               | <1100<br>N/mm²                  | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 55000 | 35000 | 27000 | 22000 | 18000 | 13500 | 11000 | 9000 |
|                                   |                                 | vf | 10000 | 9500  | 9000  | 8000  | 11000 | 10000 | 9000  | 8500 |
| 2.1-2.2-2.3-2.4<br>2.5-2.6        | <30 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 55000 | 35000 | 27000 | 22000 | 18000 | 13500 | 11000 | 9000 |
|                                   |                                 | vf | 9500  | 9000  | 8500  | 7500  | 10000 | 9500  | 8500  | 8000 |
| 3.1-3.2                           | <35 HRC                         | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 45000 | 30000 | 23000 | 20000 | 17000 | 12500 | 10000 | 8500 |
|                                   |                                 | vf | 9000  | 8500  | 8000  | 7500  | 10000 | 9500  | 8500  | 8000 |
| 4.1-4.2-4.3                       | <45<br>HRC                      | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 44000 | 29000 | 22000 | 18000 | 16500 | 12500 | 9500  | 8000 |
|                                   |                                 | vf | 8200  | 7500  | 6500  | 6200  | 9800  | 8500  | 7500  | 7000 |
| 8.1                               | <55<br>HRC                      | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 36000 | 24500 | 18000 | 15000 | 14000 | 10000 | 8000  | 7000 |
|                                   |                                 | vf | 6200  | 5200  | 4800  | 5000  | 7000  | 6000  | 5500  | 5000 |
| 8.2                               | <60<br>HRC                      | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 27000 | 18000 | 13000 | 11000 | 11000 | 8000  | 6500  | 5500 |
|                                   |                                 | vf | 4200  | 3800  | 3500  | 3200  | 5000  | 4500  | 4000  | 3500 |
| 8.3                               | <65<br>HRC                      | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 25000 | 17000 | 13000 | 10000 | 10000 | 7500  | 6000  | 5000 |
|                                   |                                 | vf | 4000  | 3500  | 3200  | 3000  | 4500  | 4000  | 3200  | 2800 |
| 8.3                               | <170<br>HRC                     | ap | 0,04  | 0,06  | 0,08  | 0,10  | 0,12  | 0,16  | 0,20  | 0,24 |
|                                   |                                 | ae | 0,10  | 0,15  | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60 |
|                                   |                                 | n  | 17500 | 11500 | 8500  | 7000  | 7000  | 5100  | 4100  | 3500 |
|                                   |                                 | vf | 2700  | 2500  | 2200  | 2000  | 2500  | 2400  | 2200  | 1800 |

|      |         |         |
|------|---------|---------|
| Art. | 30.6434 | 30.6437 |
|      | 30.6435 | 30.6439 |
|      | 30.6436 | 30.6485 |

Empfohlene Schnittdaten für VHM-Radiusfräser HSC/HHC- beschichtet  
Recommended cutting data for solid carbide end mills, coated -3D- HSC/HHC

Z 4-6



30.643430.6435

30.643630.6437

30.6439

ae < 0,05 x d1  
ap < 0,02 x d1

| 1 Werkzeugstähle < 1200 N/mm <sup>2</sup><br>Vc ≈ 300 - 400 m/min |     |       |       |       |         | 2 Vergütungsstähle < 1600 N/mm <sup>2</sup><br>Vc ≈ 280 - 370 m/min |       |       |       |         | 3 gehärtete Stähle < 54 HRC<br>Vc ≈ 220 - 260 m/min |       |       |       |         |
|-------------------------------------------------------------------|-----|-------|-------|-------|---------|---------------------------------------------------------------------|-------|-------|-------|---------|-----------------------------------------------------|-------|-------|-------|---------|
| d1                                                                | Vc  | fz    | n     | Vf/Z2 | Vf/Z4-6 | Vc                                                                  | fz    | n     | Vf/Z2 | Vf/Z4-6 | Vc                                                  | fz    | n     | Vf/Z2 | Vf/Z4-6 |
| 1-3                                                               | 300 | 0,04  | 32000 | 2600  | 5200    | 280                                                                 | 0,04  | 30000 | 2400  | 4800    | 220                                                 | 0,04  | 25000 | 2000  | 4000    |
|                                                                   | 400 | 0,04  | 43000 | 3400  | 6800    | 370                                                                 | 0,04  | 40000 | 3200  | 6400    | 260                                                 | 0,04  | 28000 | 2200  | 4400    |
| 4                                                                 | 300 | 0,045 | 24000 | 2200  | 4400    | 280                                                                 | 0,045 | 23000 | 2000  | 4000    | 220                                                 | 0,045 | 18000 | 1700  | 3400    |
|                                                                   | 400 | 0,045 | 32000 | 2900  | 5800    | 370                                                                 | 0,045 | 31000 | 2700  | 5400    | 260                                                 | 0,045 | 21000 | 1900  | 3800    |
| 5                                                                 | 300 | 0,05  | 19000 | 2000  | 4000    | 280                                                                 | 0,05  | 18000 | 1800  | 3600    | 220                                                 | 0,05  | 15000 | 1500  | 3000    |
|                                                                   | 400 | 0,05  | 26000 | 2500  | 5000    | 370                                                                 | 0,05  | 24000 | 2400  | 4800    | 260                                                 | 0,05  | 17000 | 1700  | 3400    |
| 6                                                                 | 300 | 0,055 | 16000 | 1700  | 3400    | 280                                                                 | 0,055 | 15000 | 1600  | 3200    | 220                                                 | 0,055 | 12000 | 1300  | 2600    |
|                                                                   | 400 | 0,055 | 22000 | 2400  | 4800    | 370                                                                 | 0,055 | 20000 | 2200  | 4400    | 260                                                 | 0,055 | 14000 | 1500  | 3000    |
| 8                                                                 | 300 | 0,065 | 12000 | 1600  | 3200    | 280                                                                 | 0,065 | 11000 | 1500  | 3000    | 220                                                 | 0,065 | 9000  | 1200  | 2400    |
|                                                                   | 400 | 0,065 | 16000 | 2000  | 4000    | 370                                                                 | 0,065 | 15000 | 2000  | 4000    | 260                                                 | 0,065 | 11000 | 1400  | 2800    |
| 10                                                                | 300 | 0,07  | 9000  | 1500  | 3000    | 280                                                                 | 0,07  | 9000  | 1300  | 2600    | 220                                                 | 0,07  | 7000  | 1000  | 2000    |
|                                                                   | 400 | 0,07  | 13000 | 2000  | 4000    | 370                                                                 | 0,07  | 12000 | 1700  | 3400    | 260                                                 | 0,07  | 9000  | 1200  | 2400    |
| 12                                                                | 300 | 0,08  | 8000  | 1300  | 2600    | 280                                                                 | 0,08  | 7000  | 1200  | 2400    | 220                                                 | 0,08  | 6000  | 1000  | 2000    |
|                                                                   | 400 | 0,08  | 11000 | 1700  | 3400    | 370                                                                 | 0,08  | 10000 | 1600  | 3200    | 260                                                 | 0,08  | 7000  | 1100  | 2200    |
| 16                                                                | 300 | 0,09  | 6000  | 1100  | 2200    | 280                                                                 | 0,09  | 5500  | 1000  | 2000    | 220                                                 | 0,09  | 4500  | 800   | 1600    |
|                                                                   | 400 | 0,09  | 8000  | 1400  | 2800    | 370                                                                 | 0,09  | 7600  | 1350  | 2700    | 260                                                 | 0,09  | 5200  | 900   | 1800    |

Z 2



30.6485

ae = 0,05 x d1  
ap = 0,02 x d1

| 4 gehärtete Stähle < 68 HRC<br>Vc ≈ 100 - 150 m/min |     |       |       |       |         | 5 Cr - Ni- Legierungen < 900 N/mm <sup>2</sup><br>Vc ≈ 440 - 600 m/min |       |       |       |         | 6 Titanlegierungen < 850 N/mm <sup>2</sup><br>Vc ≈ 400 - 500 m/min |       |       |       |         |
|-----------------------------------------------------|-----|-------|-------|-------|---------|------------------------------------------------------------------------|-------|-------|-------|---------|--------------------------------------------------------------------|-------|-------|-------|---------|
| d1                                                  | Vc  | fz    | n     | Vf/Z2 | Vf/Z4-6 | Vc                                                                     | fz    | n     | Vf/Z2 | Vf/Z4-6 | Vc                                                                 | fz    | n     | Vf/Z2 | Vf/Z4-6 |
| 1-3                                                 | 100 | 0,04  | 11000 | 900   | 1800    | 440                                                                    | 0,04  | 48000 | 4000  | 8000    | 400                                                                | 0,04  | 43000 | 3400  | 6800    |
|                                                     | 150 | 0,04  | 16000 | 1300  | 2600    | 600                                                                    | 0,04  | 64000 | 5100  | 10200   | 500                                                                | 0,04  | 53000 | 4300  | 8600    |
| 4                                                   | 100 | 0,045 | 8000  | 700   | 1400    | 440                                                                    | 0,045 | 36000 | 3200  | 6400    | 400                                                                | 0,045 | 32000 | 2900  | 5800    |
|                                                     | 150 | 0,045 | 12000 | 1100  | 2200    | 600                                                                    | 0,045 | 48000 | 4300  | 8600    | 500                                                                | 0,045 | 40000 | 3600  | 7200    |
| 5                                                   | 100 | 0,05  | 6000  | 600   | 1200    | 440                                                                    | 0,05  | 29000 | 2800  | 5600    | 400                                                                | 0,05  | 26000 | 2600  | 5200    |
|                                                     | 150 | 0,05  | 9000  | 1000  | 2000    | 600                                                                    | 0,05  | 38000 | 3800  | 7600    | 500                                                                | 0,05  | 32000 | 3200  | 6400    |
| 6                                                   | 100 | 0,055 | 5000  | 500   | 1000    | 440                                                                    | 0,055 | 24000 | 2600  | 5200    | 400                                                                | 0,055 | 21000 | 2300  | 4600    |
|                                                     | 150 | 0,055 | 8000  | 900   | 1800    | 600                                                                    | 0,055 | 32000 | 3500  | 7000    | 500                                                                | 0,055 | 27000 | 2900  | 5800    |
| 8                                                   | 100 | 0,065 | 4000  | 500   | 1000    | 440                                                                    | 0,065 | 18000 | 2300  | 4600    | 400                                                                | 0,065 | 16000 | 2100  | 4200    |
|                                                     | 150 | 0,065 | 6000  | 800   | 1600    | 600                                                                    | 0,065 | 24000 | 3100  | 6200    | 500                                                                | 0,065 | 20000 | 2600  | 5200    |
| 10                                                  | 100 | 0,07  | 3000  | 400   | 800     | 440                                                                    | 0,07  | 15000 | 2000  | 4000    | 400                                                                | 0,07  | 13000 | 1800  | 3600    |
|                                                     | 150 | 0,07  | 5000  | 700   | 1400    | 600                                                                    | 0,07  | 19000 | 2700  | 5400    | 500                                                                | 0,07  | 16000 | 2200  | 4400    |
| 12                                                  | 100 | 0,08  | 3000  | 400   | 800     | 440                                                                    | 0,08  | 12000 | 1900  | 3800    | 400                                                                | 0,08  | 11000 | 1700  | 3400    |
|                                                     | 150 | 0,08  | 4000  | 600   | 1200    | 600                                                                    | 0,08  | 16000 | 2600  | 5200    | 500                                                                | 0,08  | 13000 | 2100  | 4100    |
| 16                                                  | 100 | 0,09  | 2000  | 350   | 700     | 440                                                                    | 0,09  | 9000  | 1600  | 3200    | 400                                                                | 0,09  | 8000  | 1500  | 3000    |
|                                                     | 150 | 0,09  | 3000  | 520   | 1040    | 600                                                                    | 0,09  | 12000 | 2100  | 4100    | 300                                                                | 0,09  | 10000 | 1800  | 3600    |

| 7 GG Grauguß < 240 HB- Gußlegierungen<br>( < 900 N/mm <sup>2</sup> ) • Vc ≈ 700 - 900 m/min |     |       |       |       |         | 8 Graphit<br>Vc ≈ 800 - 1200 m/min |       |        |       |         | 9 Alu-Legierungen < 600 N/mm <sup>2</sup><br>Vc ≈ 1000 - 3000 m/min |       |        |       |         |
|---------------------------------------------------------------------------------------------|-----|-------|-------|-------|---------|------------------------------------|-------|--------|-------|---------|---------------------------------------------------------------------|-------|--------|-------|---------|
| d1                                                                                          | Vc  | fz    | n     | Vf/Z2 | Vf/Z4-6 | Vc                                 | fz    | n      | Vf/Z2 | Vf/Z4-6 | Vc                                                                  | fz    | n      | Vf/Z2 | Vf/Z4-6 |
| 1-3                                                                                         | 700 | 0,04  | 80000 | 6400  | 12800   | 800                                | 0,05  | 85000  | 9000  | 18000   | 1000                                                                | 0,05  | 106000 | 11000 | 22000   |
|                                                                                             | 900 | 0,04  | 96000 | 7700  | 15400   | 1200                               | 0,05  | 128000 | 13000 | 26000   | 3000                                                                | 0,05  | 320000 | 32000 | 64000   |
| 4                                                                                           | 700 | 0,045 | 60000 | 5400  | 10800   | 800                                | 0,055 | 64000  | 7000  | 14000   | 1000                                                                | 0,055 | 80000  | 9000  | 18000   |
|                                                                                             | 900 | 0,045 | 72000 | 6500  | 13000   | 1200                               | 0,055 | 96000  | 11000 | 22000   | 3000                                                                | 0,055 | 240000 | 26000 | 52000   |
| 5                                                                                           | 700 | 0,05  | 48000 | 4800  | 9600    | 800                                | 0,06  | 51000  | 6100  | 12200   | 1000                                                                | 0,06  | 64000  | 7700  | 15400   |
|                                                                                             | 900 | 0,05  | 57000 | 5700  | 11400   | 1200                               | 0,06  | 75000  | 9200  | 18400   | 3000                                                                | 0,06  | 190000 | 23000 | 46000   |
| 6                                                                                           | 700 | 0,055 | 40000 | 4400  | 8800    | 800                                | 0,065 | 43000  | 5500  | 11000   | 1000                                                                | 0,065 | 53000  | 7000  | 14000   |
|                                                                                             | 900 | 0,055 | 48000 | 5300  | 10600   | 1200                               | 0,065 | 64000  | 8300  | 16600   | 3000                                                                | 0,065 | 160000 | 21000 | 42000   |
| 8                                                                                           | 700 | 0,065 | 30000 | 3900  | 7800    | 800                                | 0,075 | 32000  | 4800  | 9600    | 1000                                                                | 0,075 | 40000  | 6000  | 12000   |
|                                                                                             | 900 | 0,065 | 36000 | 4700  | 9400    | 1200                               | 0,075 | 48000  | 7200  | 14400   | 3000                                                                | 0,075 | 120000 | 18000 | 36000   |
| 10                                                                                          | 700 | 0,07  | 24000 | 3300  | 6600    | 800                                | 0,08  | 26000  | 4100  | 8200    | 1000                                                                | 0,08  | 32000  | 5000  | 10000   |
|                                                                                             | 900 | 0,07  | 29000 | 4000  | 8000    | 1200                               | 0,08  | 39000  | 6200  | 12400   | 3000                                                                | 0,08  | 96000  | 15000 | 30000   |
| 12                                                                                          | 700 | 0,08  | 20000 | 3200  | 6400    | 800                                | 0,09  | 22000  | 3800  | 7600    | 1000                                                                | 0,09  | 27000  | 4800  | 9600    |
|                                                                                             | 900 | 0,08  | 24000 | 3800  | 7600    | 1200                               | 0,09  | 32000  | 5700  | 11400   | 3000                                                                | 0,09  | 80000  | 14000 | 28000   |
| 16                                                                                          | 700 | 0,09  | 15000 | 2700  | 5400    | 800                                | 0,100 | 16000  | 3200  | 6400    | 1000                                                                | 0,100 | 20000  | 4000  | 8000    |
|                                                                                             | 900 | 0,09  | 18000 | 3200  | 6400    | 1200                               | 0,100 | 24000  | 4800  | 9600    | 3000                                                                | 0,100 | 60000  | 12000 | 24000   |

Bei Werkzeugen mit großer Auskraglänge sollte der Vorschub je nach geforderter Oberflächengüte reduziert werden.  
Tools with a larger projection length the feed should be reduced according to the required surface quality.

Tabelle zur Ermittlung der Senktiefe für Kegelsenker auf CNC- Bearbeitungsmaschinen  
Tables for determination of the counter bore depth for calculating cone counter borer on CNC processing machines

Art. 30.6497

| d1<br>* d3<br>Aussen-<br>Senkungs-Drm. | drm. 31,0<br>4,2 (-0,2) | drm. 25,0<br>3,8 (-0,2) | drm. 20,5<br>3,5 (-0,2) | drm. 16,5<br>3,2 (-0,2) | drm. 15,0<br>3,2 (-0,2) | drm. 12,4<br>2,8 (-0,2) | drm. 10,4<br>2,5 (-0,2) | drm. 8,3<br>2,0 (-0,2) | drm. 6,3<br>1,5 (-0,2) |
|----------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------------------------|------------------------|
|                                        | Z-Wert                  | Z-Wert                  | Z-Wert                  | Z-Wert                  | Z-Wert                  | Z-Wert                  | Z-Wert                  | Z-Wert                 | Z-Wert                 |
| 4 mm                                   | 0                       | -0,15                   | -0,3                    | -0,45                   | -0,45                   | -0,65                   | -0,8                    | -1,05                  | -1,3                   |
| 6 mm                                   | -0,95                   | -1,15                   | -1,3                    | -1,45                   | -1,45                   | -1,65                   | -1,8                    | -2,05                  | -2,3                   |
| 8 mm                                   | -1,95                   | -2,15                   | -2,3                    | -2,45                   | -2,45                   | -2,65                   | -2,8                    | -3,05                  |                        |
| 10 mm                                  | -2,95                   | -3,15                   | -3,3                    | -3,45                   | -3,45                   | -3,65                   | -3,8                    |                        |                        |
| 12 mm                                  | -3,95                   | -4,15                   | -4,3                    | -4,45                   | -4,45                   | -4,65                   |                         |                        |                        |
| 14 mm                                  | -4,95                   | -5,15                   | -5,3                    | -5,45                   | -5,45                   |                         |                         |                        |                        |
| 16 mm                                  | -5,95                   | -6,15                   | -6,3                    | -6,35                   |                         |                         |                         |                        |                        |
| 20 mm                                  | -7,95                   | -8,15                   | -8,3                    |                         |                         |                         |                         |                        |                        |
| 24 mm                                  | -9,95                   | -10,15                  |                         |                         |                         |                         |                         |                        |                        |
| 30 mm                                  | -12,95                  |                         |                         |                         |                         |                         |                         |                        |                        |

Alle Z-Maße mitte Toleranz/All Z dimensions middle tolerance

Senktiefe ermitteln am Einstellgerät oder  
Fertigsenk-radius minus Radius d 3 = Senktiefe  
(nicht nachgeschliffene Senker)  
\* d3 Angaben mit Fertigungstoleranz.

Counter bore depth calculated on the adjustment device or  
finished counter bore radius minus radius d 3 = counter bored depth  
(not retro-ground counter borer)  
\* d 3 information including finishing tolerance.

Schnittdaten für HM-Senker/Entgrater bezogen auf mittleren  
Senkdurchmesser · Cutting data for carbide countersinkers

| Art. | 30.6200 | 30.6494 | 30.6495 | 30.6493 |
|------|---------|---------|---------|---------|
|      | 30.6490 | 30.6491 | 30.6492 | 30.6497 |

| Werkstoff<br>Workpiece material                                             | Werkstoffgruppe<br>Material group | Schnittgeschwindigkeit Vc (m/min)<br>cutting speed Vc (m/min) | Vorschub f (mm/U) bei Senker-Ø<br>feed f (mm/U) for countersinker Ø |             |             |
|-----------------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------|-------------|-------------|
|                                                                             |                                   |                                                               | <6                                                                  | 8-12,4      | 16,5-31     |
| Stahl bis 500 N/mm²<br>steel up to 500 N/mm²                                | 1.1 - 1.2                         | 45 - 75                                                       | 0,03 - 0,08                                                         | 0,08 - 0,10 | 0,10 - 0,20 |
| Stahl bis 800 N/mm²<br>steel up to 800 N/mm²                                | 1.3 - 1.4                         | 45 - 75                                                       | 0,03 - 0,08                                                         | 0,08 - 0,10 | 0,10 - 0,20 |
| Stahl über 800 N/mm²<br>steel over 800 N/mm²                                | 1.5                               | 30 - 45                                                       | 0,02 - 0,05                                                         | 0,04 - 0,08 | 0,08 - 0,10 |
| rostfreier Stahl<br>stainless steel                                         | 2.1-2.2-2.3-2.4                   | 22 - 40                                                       | 0,02 - 0,05                                                         | 0,04 - 0,08 | 0,08 - 0,10 |
| hochhitzebeständiger Stahl<br>heat resisting steel                          | 1.6                               | 12 - 24                                                       | 0,02 - 0,04                                                         | 0,03 - 0,06 | 0,06 - 0,08 |
| Grau-, Temper-, Hartguß<br>cast iron, malleable cast iron                   | 7.1-7.2-7.3                       | 22 - 45                                                       | 0,04 - 0,08                                                         | 0,08 - 0,12 | 0,12 - 0,16 |
| HHC < 65 HRC<br>HHC < 65 HRC                                                | 8.1-8.2                           | 25 - 45                                                       | 0,03 - 0,07                                                         | 0,05 - 0,1  | 0,1 - 0,15  |
| Alu., Alu.legierung über 80 HB<br>aluminium, alu. alloy over 80 HB          | 9.1-9.2                           | 75 - 150                                                      | 0,04 - 0,10                                                         | 0,10 - 0,20 | 0,16 - 0,25 |
| Messing, Bronze, Kupfer, Rotguß<br>brass, bronze, copper, leaded bronze all | 10.1-10.2-10.3                    | 38 - 75                                                       | 0,04 - 0,08                                                         | 0,08 - 0,12 | 0,12 - 0,16 |
| Kunststoffe<br>plastics                                                     | 11.1-11.2-11.3-11.4               | 38 - 75                                                       | 0,03 - 0,08                                                         | 0,08 - 0,12 | 0,12 - 0,20 |

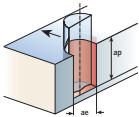
30.6495 30.6494  
Vc: 145-175 m/min.

Vc: 120-140 m/min.

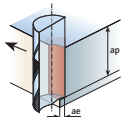
Empfohlene Schnittdaten für Karnasch · HPC · INOX Fräser  
Recommended cutting data for Karnasch · high performance stainless steel end mills

Art. 30.7415

| Werkstoffgruppe<br>Material group | < 700 N/mm²<br>4.1 |                    | < 700 N/mm²<br>4.2 |       | < 1100 N/mm²       |       |
|-----------------------------------|--------------------|--------------------|--------------------|-------|--------------------|-------|
|                                   | d1                 | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | fz/mm | Vc mm/min<br>fz/mm | fz/mm |
| 3,0                               | 130                | 0,020              | 120                | 0,020 | 100                | 0,020 |
| 4,0                               | 130                | 0,020              | 120                | 0,020 | 100                | 0,020 |
| 5,0                               | 130                | 0,020              | 120                | 0,020 | 100                | 0,020 |
| 6,0                               | 130                | 0,030              | 120                | 0,030 | 100                | 0,030 |
| 8,0                               | 130                | 0,040              | 120                | 0,040 | 100                | 0,040 |
| 10,0                              | 130                | 0,050              | 120                | 0,050 | 100                | 0,050 |
| 12,0                              | 130                | 0,060              | 120                | 0,060 | 100                | 0,060 |
| 16,0                              | 130                | 0,080              | 120                | 0,080 | 100                | 0,080 |
| 20,0                              | 130                | 0,100              | 120                | 0,100 | 100                | 0,100 |



ap = 1xD    ae = 1xD



ap = 2xD    ae = 0,02xD

| Werkstoff-<br>gruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                   |                                                                           | Ø2<br>r = 0,2<br>Z3                                       | Ø3<br>r = 0,3<br>Z3                                        | Ø4<br>r = 0,5<br>Z3                                    | Ø5<br>r = 0,5<br>Z3                                      | Ø6<br>r = 0,5<br>Z4                                    | Ø8<br>r = 0,5/1/2<br>Z4                                | Ø10<br>r = 0,5/1/2<br>Z4                                | Ø12<br>r = 0,5/1/2/3<br>Z4                              | Ø16<br>r = 0,5/1/2/3<br>Z4                              | Ø20<br>r = 0,5/1/2/3<br>Z4                               |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|
| 2.1                                    | 1.4104                                                                                                                                                                                                                                                               | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,5<br>vc 80<br>n 12800<br>fz 0,007<br>vf 269  | ae 3<br>ap 0,75<br>vc 85<br>n 9000<br>fz 0,018<br>vf 486   | ae 4<br>ap 1<br>vc 88<br>n 7000<br>fz 0,026<br>vf 546  | ae 5<br>ap 2,5<br>vc 86<br>n 5500<br>fz 0,015<br>vf 247  | ae 6<br>ap 3<br>vc 89<br>n 4700<br>fz 0,015<br>vf 282  | ae 8<br>ap 4<br>vc 90<br>n 3600<br>fz 0,025<br>vf 360  | ae 10<br>ap 5<br>vc 94<br>n 3000<br>fz 0,032<br>vf 384  | ae 12<br>ap 6<br>vc 94<br>n 2500<br>fz 0,040<br>vf 400  | ae 16<br>ap 8<br>vc 100<br>n 2000<br>fz 0,051<br>vf 408 | ae 20<br>ap 10<br>vc 101<br>n 1600<br>fz 0,061<br>vf 390 |
|                                        | 1.4305                                                                                                                                                                                                                                                               | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,5<br>vc 97<br>n 15400<br>fz 0,007<br>vf 323  | ae 3<br>ap 0,75<br>vc 102<br>n 10800<br>fz 0,018<br>vf 583 | ae 4<br>ap 1<br>vc 106<br>n 8400<br>fz 0,026<br>vf 655 | ae 5<br>ap 2,5<br>vc 102<br>n 6500<br>fz 0,015<br>vf 293 | ae 6<br>ap 3<br>vc 107<br>n 5650<br>fz 0,015<br>vf 340 | ae 8<br>ap 4<br>vc 108<br>n 4300<br>fz 0,025<br>vf 430 | ae 10<br>ap 5<br>vc 110<br>n 3500<br>fz 0,032<br>vf 448 | ae 12<br>ap 6<br>vc 113<br>n 3000<br>fz 0,040<br>vf 480 | ae 16<br>ap 8<br>vc 121<br>n 2400<br>fz 0,051<br>vf 490 | ae 20<br>ap 10<br>vc 119<br>n 1900<br>fz 0,061<br>vf 463 |
| 2.2                                    | 1.4110-1.4112-1.4192<br>1.4319-1.4404-1.4406<br>1.4408-1.4429-1.4435<br>1.4436-1.4438-1.4439<br>1.4441-1.4452-1.4528<br>1.4541-1.4542-1.4545<br>1.4546-1.4550-1.4552<br>1.4568-1.4718-1.4724<br>1.4731-1.4742-1.4760<br>1.4762-1.4828-1.4871<br>1.4873-1.4912-1.4961 | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,5<br>vc 65<br>n 10300<br>fz 0,006<br>vf 185  | ae 3<br>ap 0,75<br>vc 68<br>n 7200<br>fz 0,017<br>vf 367   | ae 4<br>ap 1<br>vc 70<br>n 5600<br>fz 0,025<br>vf 420  | ae 5<br>ap 2,5<br>vc 69<br>n 4400<br>fz 0,014<br>vf 185  | ae 6<br>ap 3<br>vc 72<br>n 3800<br>fz 0,015<br>vf 228  | ae 8<br>ap 4<br>vc 73<br>n 2900<br>fz 0,025<br>vf 291  | ae 10<br>ap 5<br>vc 75<br>n 2400<br>fz 0,032<br>vf 307  | ae 12<br>ap 6<br>vc 75<br>n 2000<br>fz 0,040<br>vf 320  | ae 16<br>ap 8<br>vc 80<br>n 1600<br>fz 0,051<br>vf 326  | ae 20<br>ap 10<br>vc 82<br>n 1300<br>fz 0,061<br>vf 317  |
|                                        | 1.4301-1.4306<br>1.4308-1.4310<br>1.4311-1.4312                                                                                                                                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,25<br>vc 83<br>n 13200<br>fz 0,014<br>vf 554 | ae 3<br>ap 0,75<br>vc 81<br>n 8600<br>fz 0,017<br>vf 439   | ae 4<br>ap 1<br>vc 85<br>n 6800<br>fz 0,025<br>vf 510  | ae 5<br>ap 2,5<br>vc 83<br>n 5300<br>fz 0,014<br>vf 223  | ae 6<br>ap 3<br>vc 85<br>n 4500<br>fz 0,015<br>vf 252  | ae 8<br>ap 4<br>vc 88<br>n 3500<br>fz 0,025<br>vf 350  | ae 10<br>ap 5<br>vc 88<br>n 2800<br>fz 0,032<br>vf 358  | ae 12<br>ap 6<br>vc 90<br>n 2400<br>fz 0,040<br>vf 384  | ae 16<br>ap 8<br>vc 96<br>n 1900<br>fz 0,051<br>vf 388  | ae 20<br>ap 10<br>vc 94<br>n 1500<br>fz 0,061<br>vf 366  |
|                                        | 1.4303                                                                                                                                                                                                                                                               | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,5<br>vc 71<br>n 11300<br>fz 0,006<br>vf 203  | ae 3<br>ap 0,75<br>vc 75<br>n 7900<br>fz 0,017<br>vf 403   | ae 4<br>ap 1<br>vc 78<br>n 6200<br>fz 0,025<br>vf 465  | ae 5<br>ap 2,5<br>vc 78<br>n 4800<br>fz 0,014<br>vf 202  | ae 6<br>ap 3<br>vc 79<br>n 4200<br>fz 0,015<br>vf 252  | ae 8<br>ap 4<br>vc 80<br>n 3200<br>fz 0,025<br>vf 320  | ae 10<br>ap 5<br>vc 82<br>n 2600<br>fz 0,032<br>vf 332  | ae 12<br>ap 6<br>vc 83<br>n 2200<br>fz 0,040<br>vf 352  | ae 16<br>ap 8<br>vc 86<br>n 1700<br>fz 0,051<br>vf 347  | ae 20<br>ap 10<br>vc 88<br>n 1400<br>fz 0,061<br>vf 342  |
|                                        | 1.4571-1.4580<br>1.4581-1.4583                                                                                                                                                                                                                                       | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,5<br>vc 58<br>n 9300<br>fz 0,006<br>vf 167   | ae 3<br>ap 0,75<br>vc 61<br>n 6500<br>fz 0,017<br>vf 332   | ae 4<br>ap 1<br>vc 64<br>n 5100<br>fz 0,025<br>vf 383  | ae 5<br>ap 2,5<br>vc 63<br>n 4000<br>fz 0,014<br>vf 168  | ae 6<br>ap 3<br>vc 65<br>n 3400<br>fz 0,015<br>vf 205  | ae 8<br>ap 4<br>vc 65<br>n 2600<br>fz 0,025<br>vf 260  | ae 10<br>ap 5<br>vc 66<br>n 2100<br>fz 0,032<br>vf 269  | ae 12<br>ap 6<br>vc 68<br>n 1800<br>fz 0,040<br>vf 288  | ae 16<br>ap 8<br>vc 70<br>n 1400<br>fz 0,051<br>vf 286  | ae 20<br>ap 10<br>vc 75<br>n 1200<br>fz 0,061<br>vf 293  |
|                                        | 1.4833-1.4841<br>1.4842-1.4845<br>1.4864-1.4941                                                                                                                                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,5<br>vc 52<br>n 8200<br>fz 0,006<br>vf 148   | ae 3<br>ap 0,75<br>vc 55<br>n 5800<br>fz 0,017<br>vf 296   | ae 4<br>ap 1<br>vc 57<br>n 4500<br>fz 0,025<br>vf 338  | ae 5<br>ap 2,5<br>vc 55<br>n 3500<br>fz 0,014<br>vf 147  | ae 6<br>ap 3<br>vc 57<br>n 3000<br>fz 0,015<br>vf 182  | ae 8<br>ap 4<br>vc 58<br>n 2300<br>fz 0,025<br>vf 230  | ae 10<br>ap 5<br>vc 60<br>n 1900<br>fz 0,032<br>vf 243  | ae 12<br>ap 6<br>vc 60<br>n 1600<br>fz 0,040<br>vf 256  | ae 16<br>ap 8<br>vc 65<br>n 1300<br>fz 0,051<br>vf 265  | ae 20<br>ap 10<br>vc 63<br>n 1000<br>fz 0,061<br>vf 244  |
|                                        | 1.4000.1.4001<br>1.4002-1.4005<br>1.4006-1.4008<br>1.4016-1.4021<br>1.4028-1.4031<br>1.4034-1.4125<br>1.4313-1.4460<br>1.4462-1.4510<br>1.4511-1.4512<br>1.4521                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,25<br>vc 57<br>n 9000<br>fz 0,014<br>vf 378  | ae 3<br>ap 0,75<br>vc 56<br>n 5900<br>fz 0,016<br>vf 283   | ae 4<br>ap 1<br>vc 58<br>n 4600<br>fz 0,022<br>vf 304  | ae 5<br>ap 2,5<br>vc 57<br>n 3600<br>fz 0,013<br>vf 140  | ae 6<br>ap 3<br>vc 58<br>n 3100<br>fz 0,015<br>vf 186  | ae 8<br>ap 4<br>vc 60<br>n 2400<br>fz 0,025<br>vf 240  | ae 10<br>ap 5<br>vc 60<br>n 1900<br>fz 0,032<br>vf 243  | ae 12<br>ap 6<br>vc 60<br>n 1600<br>fz 0,040<br>vf 256  | ae 16<br>ap 8<br>vc 65<br>n 1300<br>fz 0,051<br>vf 265  | ae 20<br>ap 10<br>vc 69<br>n 1100<br>fz 0,061<br>vf 268  |
| 2.4                                    | 1.4466-1.4539<br>1.4547-1.4865<br>1.4876-1.4939<br>1.4944-1.4971<br>1.4466-1.4539<br>1.4547-1.4558<br>1.4854-1.4865<br>1.4922-1.4944<br>1.4971-1.4977                                                                                                                | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,25<br>vc 42<br>n 6600<br>fz 0,013<br>vf 257  | ae 3<br>ap 0,75<br>vc 41<br>n 4300<br>fz 0,013<br>vf 168   | ae 4<br>ap 1<br>vc 43<br>n 3400<br>fz 0,019<br>vf 194  | ae 5<br>ap 2,5<br>vc 41<br>n 2600<br>fz 0,011<br>vf 86   | ae 6<br>ap 3<br>vc 43<br>n 2300<br>fz 0,015<br>vf 138  | ae 8<br>ap 4<br>vc 43<br>n 1700<br>fz 0,024<br>vf 163  | ae 10<br>ap 5<br>vc 44<br>n 1400<br>fz 0,032<br>vf 179  | ae 12<br>ap 6<br>vc 45<br>n 1200<br>fz 0,040<br>vf 192  | ae 16<br>ap 8<br>vc 50<br>n 1000<br>fz 0,051<br>vf 204  | ae 20<br>ap 10<br>vc 50<br>n 800<br>fz 0,061<br>vf 195   |
|                                        | 1.4558-1.4563<br>1.4854-1.4958<br>1.4977-1.4980<br>1.4563-1.4876<br>1.4958-1.4980                                                                                                                                                                                    | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 2<br>ap 0,25<br>vc 37<br>n 5900<br>fz 0,013<br>vf 230  | ae 3<br>ap 0,75<br>vc 37<br>n 3900<br>fz 0,013<br>vf 152   | ae 4<br>ap 1<br>vc 38<br>n 3000<br>fz 0,019<br>vf 171  | ae 5<br>ap 2,5<br>vc 38<br>n 2400<br>fz 0,011<br>vf 79   | ae 6<br>ap 3<br>vc 39<br>n 2050<br>fz 0,015<br>vf 123  | ae 8<br>ap 4<br>vc 40<br>n 1600<br>fz 0,024<br>vf 153  | ae 10<br>ap 5<br>vc 41<br>n 1300<br>fz 0,032<br>vf 166  | ae 12<br>ap 6<br>vc 42<br>n 1100<br>fz 0,040<br>vf 176  | ae 16<br>ap 8<br>vc 45<br>n 900<br>fz 0,051<br>vf 183   | ae 20<br>ap 10<br>vc 44<br>n 700<br>fz 0,061<br>vf 171   |



Empfohlene Richtwerte für VHM-Schaftfräser "Goldwin" mit Eckenradius  
Recommended cutting data for solid carbide end mill "Goldwin" with corner radius

Nutfräsen  
Slot milling

Art. 30.7425

| Werkstoff-<br>gruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                                    |                     | Ø2<br>r = 0,2<br>Z3 | Ø3<br>r = 0,3<br>Z3 | Ø4<br>r = 0,5<br>Z3 | Ø5<br>r = 0,5<br>Z3 | Ø6<br>r = 0,5<br>Z4 | Ø8<br>r = 0,5/1/2<br>Z4 | Ø10<br>r = 0,5/1/2<br>Z4 | Ø12<br>r = 0,5/1/2/3<br>Z4 | Ø16<br>r = 0,5/1/2/3<br>Z4 | Ø20<br>r = 0,5/1/2/3<br>Z4 |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------------|--------------------------|----------------------------|----------------------------|----------------------------|
| 4.1                                    | 3.7024-3.7025<br>3.7034-3.7035<br>3.7055-3.7064                                                                                                                                                                                                                                       | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 150              | vc 157              | vc 165              | vc 160              | vc 166              | vc 168                  | vc 173                   | vc 173                     | vc 181                     | vc 183                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 23900             | n 16700             | n 13100             | n 10200             | n 8800              | n 6700                  | n 5500                   | n 4600                     | n 3600                     | n 2900                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,013            | fz 0,021            | fz 0,031            | fz 0,023            | fz 0,022            | fz 0,042                | fz 0,054                 | fz 0,064                   | fz 0,083                   | fz 0,102                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 932              | vf 1052             | vf 1218             | vf 704              | vf 774              | vf 1126                 | vf 1188                  | vf 1177                    | vf 1195                    | vf 1184                    |
| 4.2                                    | 3.7105-3.7115<br>3.7124-3.7184                                                                                                                                                                                                                                                        | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 54               | vc 57               | vc 59               | vc 58               | vc 60               | vc 60                   | vc 63                    | vc 64                      | vc 65                      | vc 69                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 8600              | n 6000              | n 4700              | n 3700              | n 3200              | n 2400                  | n 2000                   | n 1700                     | n 1300                     | n 1100                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,012            | fz 0,021            | fz 0,026            | fz 0,018            | fz 0,015            | fz 0,025                | fz 0,032                 | fz 0,040                   | fz 0,051                   | fz 0,061                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 310              | vf 378              | vf 367              | vf 200              | vf 192              | vf 240                  | vf 256                   | vf 272                     | vf 265                     | vf 268                     |
| 4.3                                    | 3.7154-3.7164<br>3.7124                                                                                                                                                                                                                                                               | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 43               | vc 45               | vc 48               | vc 47               | vc 48               | vc 50                   | vc 50                    | vc 49                      | vc 55                      | vc 56                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 6900              | n 4800              | n 3800              | n 3000              | n 2550              | n 2000                  | n 1600                   | n 1300                     | n 1100                     | n 900                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,009            | fz 0,021            | fz 0,026            | fz 0,018            | fz 0,015            | fz 0,025                | fz 0,032                 | fz 0,040                   | fz 0,051                   | fz 0,061                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 186              | vf 302              | vf 296              | vf 162              | vf 153              | vf 200                  | vf 205                   | vf 208                     | vf 224                     | vf 220                     |
| 5.1                                    | 1.3911-1.3926<br>1.3927                                                                                                                                                                                                                                                               | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 241              | vc 252              | vc 264              | vc 255              | vc 264              | vc 269                  | vc 273                   | vc 275                     | vc 291                     | vc 295                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 38300             | n 26800             | n 21000             | n 16200             | n 14000             | n 10700                 | n 8700                   | n 7300                     | n 5800                     | n 4700                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,013            | fz 0,021            | fz 0,031            | fz 0,023            | fz 0,022            | fz 0,042                | fz 0,054                 | fz 0,064                   | fz 0,083                   | fz 0,102                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 1494             | vf 1688             | vf 1953             | vf 1118             | vf 1232             | vf 1798                 | vf 1879                  | vf 1869                    | vf 1926                    | vf 1917                    |
| 5.2                                    | 1.3912-1.3981                                                                                                                                                                                                                                                                         | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 45               | vc 47               | vc 49               | vc 47               | vc 49               | vc 50                   | vc 50                    | vc 53                      | vc 55                      | vc 57                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 7100              | n 5000              | n 3900              | n 3000              | n 2600              | n 2000                  | n 1600                   | n 1400                     | n 1100                     | n 900                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,011            | fz 0,021            | fz 0,026            | fz 0,018            | fz 0,015            | fz 0,025                | fz 0,032                 | fz 0,040                   | fz 0,051                   | fz 0,061                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 234              | vf 315              | vf 304              | vf 1118             | vf 156              | vf 200                  | vf 205                   | vf 224                     | vf 224                     | vf 220                     |
| 5.3                                    | 1.3913-1.3915-1.3916<br>1.3917-1.3918-1.3920<br>1.3921-1.3922-1.3923<br>1.3924-1.3928-2.4360<br>2.4375-2.4602-2.4630<br>2.4631-2.4634-2.4636<br>2.4642-2.4650-2.4654<br>2.4662-2.4665-2.4668<br>2.4669-2.4672-2.4674<br>2.4676-2.4816-2.4851<br>2.4856-2.4858-2.4916<br>2.4973-2.4983 | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 26               | vc 27               | vc 29               | vc 28               | vc 29               | vc 30                   | vc 31                    | vc 30                      | vc 35                      | vc 32                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 4200              | n 2900              | n 2300              | n 1800              | n 1550              | n 1200                  | n 1000                   | n 800                      | n 700                      | n 500                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,009            | fz 0,021            | fz 0,026            | fz 0,018            | fz 0,015            | fz 0,025                | fz 0,032                 | fz 0,040                   | fz 0,051                   | fz 0,061                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 113              | vf 183              | vf 180              | vf 97               | vf 93               | vf 120                  | vf 128                   | vf 128                     | vf 143                     | vf 122                     |
|                                        | 2.4633                                                                                                                                                                                                                                                                                | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 18               | vc 20               | vc 20               | vc 21               | vc 21               | vc 20                   | vc 22                    | vc 22                      | vc 25                      | vc 25                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 2900              | n 2100              | n 1600              | n 1300              | n 1100              | n 800                   | n 700                    | n 600                      | n 500                      | n 400                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,009            | fz 0,021            | fz 0,026            | fz 0,018            | fz 0,015            | fz 0,025                | fz 0,032                 | fz 0,040                   | fz 0,051                   | fz 0,061                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 78               | vf 132              | vf 125              | vf 70               | vf 66               | vf 80                   | vf 90                    | vf 96                      | vf 102                     | vf 98                      |
|                                        | 2.4670-2.4672<br>2.4674                                                                                                                                                                                                                                                               | ae mm               | ae 2                | ae 3                | ae 4                | ae 5                | ae 6                | ae 8                    | ae 10                    | ae 12                      | ae 16                      | ae 20                      |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 0,5              | ap 0,75             | ap 1                | ap 2,5              | ap 3                | ap 4                    | ap 5                     | ap 6                       | ap 8                       | ap 10                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 23               | vc 25               | vc 26               | vc 25               | vc 26               | vc 28                   | vc 28                    | vc 27                      | vc 30                      | vc 31                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 3700              | n 2600              | n 2100              | n 1600              | n 1400              | n 1100                  | n 900                    | n 700                      | n 600                      | n 500                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,009            | fz 0,021            | fz 0,026            | fz 0,018            | fz 0,015            | fz 0,025                | fz 0,032                 | fz 0,040                   | fz 0,051                   | fz 0,061                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 100              | vf 164              | vf 164              | vf 86               | vf 84               | vf 110                  | vf 115                   | vf 112                     | vf 122                     | vf 122                     |

| Werkstoff-<br>gruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                   |                     | Ø2<br>r = 0,2<br>Z3 | Ø3<br>r = 0,3<br>Z3 | Ø4<br>r = 0,5<br>Z3 | Ø5<br>r = 0,5<br>Z3 | Ø6<br>r = 0,5<br>Z4 | Ø8<br>r = 0,5/1/2<br>Z4 | Ø10<br>r = 0,5/1/2<br>Z4 | Ø12<br>r = 0,5/1/2/3<br>Z4 | Ø16<br>r = 0,5/1/2/3<br>Z4 | Ø20<br>r = 0,5/1/2/3<br>Z4 |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------------|--------------------------|----------------------------|----------------------------|----------------------------|
| 2.1                                    | 1.4104                                                                                                                                                                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 127              | vc 135              | vc 138              | vc 145              | vc 132              | vc 126                  | vc 123                   | vc 136                     | vc 141                     | vc 170                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 20200             | n 14300             | n 11000             | n 9200              | n 7000              | n 5000                  | n 3900                   | n 3600                     | n 2800                     | n 2700                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,011            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 667              | vf 1502             | vf 1386             | vf 966              | vf 840              | vf 1000                 | vf 983                   | vf 1123                    | vf 1120                    | vf 1285                    |
|                                        | 1.4305                                                                                                                                                                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 152              | vc 161              | vc 167              | vc 173              | vc 179              | vc 181                  | vc 185                   | vc 188                     | vc 197                     | vc 201                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 24100             | n 17100             | n 13300             | n 11000             | n 9500              | n 7200                  | n 5900                   | n 5000                     | n 3900                     | n 3200                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,012            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 868              | vf 1796             | vf 1676             | vf 1155             | vf 1140             | vf 1440                 | vf 1487                  | vf 1560                    | vf 1560                    | vf 1526                    |
|                                        | 1.4110-1.4112-1.4192<br>1.4319-1.4404-1.4406<br>1.4408-1.4429-1.4435<br>1.4436-1.4438-1.4439<br>1.4441-1.4452-1.4528<br>1.4541-1.4542-1.4545<br>1.4546-1.4550-1.4552<br>1.4568-1.4718-1.4724<br>1.4731-1.4742-1.4760<br>1.4762-1.4828-1.4871<br>1.4873-1.4912-1.4961 | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 102              | vc 108              | vc 112              | vc 116              | vc 121              | vc 123                  | vc 126                   | vc 124                     | vc 131                     | vc 132                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 16200             | n 11500             | n 8900              | n 7400              | n 6400              | n 4900                  | n 4000                   | n 3300                     | n 2600                     | n 2100                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,011            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 535              | vf 1208             | vf 1121             | vf 777              | vf 768              | vf 980                  | vf 1008                  | vf 1030                    | vf 1040                    | vf 1000                    |
|                                        | 1.4301-1.4306<br>1.4308-1.4310<br>1.4311-1.4312                                                                                                                                                                                                                      | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 120              | vc 130              | vc 133              | vc 138              | vc 143              | vc 146                  | vc 151                   | vc 151                     | vc 161                     | vc 163                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 19000             | n 13800             | n 10600             | n 8800              | n 7600              | n 5800                  | n 4800                   | n 4000                     | n 3200                     | n 2600                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,011            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 627              | vf 1449             | vf 1336             | vf 924              | vf 912              | vf 1160                 | vf 1210                  | vf 1248                    | vf 1280                    | vf 1238                    |
|                                        | 1.4303                                                                                                                                                                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 112              | vc 119              | vc 122              | vc 127              | vc 132              | vc 133                  | vc 138                   | vc 140                     | vc 146                     | vc 145                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 17800             | n 12600             | n 9700              | n 8100              | n 7000              | n 5300                  | n 4400                   | n 3700                     | n 2900                     | n 2300                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,011            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 587              | vf 1323             | vf 1222             | vf 851              | vf 840              | vf 1060                 | vf 1109                  | vf 1154                    | vf 1160                    | vf 1095                    |
|                                        | 1.4571-1.4580<br>1.4581-1.4583                                                                                                                                                                                                                                       | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 92               | vc 97               | vc 101              | vc 104              | vc 108              | vc 111                  | vc 113                   | vc 113                     | vc 121                     | vc 119                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 14600             | n 10300             | n 8000              | n 6600              | n 5700              | n 4400                  | n 3600                   | n 3000                     | n 2400                     | n 1900                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,011            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 482              | vf 1082             | vf 1008             | vf 693              | vf 684              | vf 880                  | vf 907                   | vf 936                     | vf 960                     | vf 904                     |
|                                        | 1.4833-1.4841<br>1.4842-1.4845<br>1.4864-1.4941                                                                                                                                                                                                                      | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 82               | vc 87               | vc 89               | vc 93               | vc 96               | vc 98                   | vc 101                   | vc 102                     | vc 106                     | vc 107                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 13000             | n 9200              | n 7100              | n 5900              | n 5100              | n 3900                  | n 3200                   | n 2700                     | n 2100                     | n 1700                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,011            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 429              | vf 966              | vf 895              | vf 620              | vf 612              | vf 780                  | vf 806                   | vf 842                     | vf 840                     | vf 809                     |
|                                        | 1.4000-1.4001-1.4002<br>1.4005-1.4006-1.4008<br>1.4016-1.4021-1.4028<br>1.4031-1.4034-1.4125<br>1.4313-1.4460-1.4462<br>1.4510-1.4511-1.4512<br>1.4521                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 83               | vc 88               | vc 91               | vc 94               | vc 98               | vc 101                  | vc 101                   | vc 102                     | vc 111                     | vc 108                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 13200             | n 9300              | n 7200              | n 6000              | n 5200              | n 4000                  | n 3200                   | n 2700                     | n 2200                     | n 1700                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,010            | fz 0,033            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 396              | vf 921              | vf 907              | vf 630              | vf 624              | vf 800                  | vf 806                   | vf 842                     | vf 880                     | vf 809                     |
|                                        | 1.4466-1.4539-1.4547<br>1.4865-1.4876-1.4939<br>1.4944-1.4971-1.4466<br>1.4539-1.4547-1.4558<br>1.4854-1.4865-1.4922<br>1.4944-1.4971-1.4977                                                                                                                         | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 83               | vc 88               | vc 91               | vc 94               | vc 98               | vc 101                  | vc 101                   | vc 102                     | vc 111                     | vc 107                     |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 13200             | n 9300              | n 7200              | n 6000              | n 5200              | n 4000                  | n 3200                   | n 2700                     | n 2200                     | n 1700                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,010            | fz 0,033            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 396              | vf 921              | vf 907              | vf 630              | vf 624              | vf 800                  | vf 806                   | vf 842                     | vf 880                     | vf 809                     |
|                                        | 1.4558-1.4563<br>1.4854-1.4958<br>1.4977-1.4980<br>1.4563-1.4876<br>1.4958-1.4980                                                                                                                                                                                    | ae mm               | ae 0,1              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 63               | vc 58               | vc 60               | vc 63               | vc 64               | vc 65                   | vc 69                    | vc 68                      | vc 71                      | vc 75                      |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 10100             | n 6200              | n 4800              | n 4000              | n 3400              | n 2600                  | n 2200                   | n 1800                     | n 1400                     | n 1200                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,017            | fz 0,024            | fz 0,030            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 515              | vf 446              | vf 432              | vf 420              | vf 408              | vf 520                  | vf 554                   | vf 562                     | vf 560                     | vf 571                     |
|                                        | 1.4865                                                                                                                                                                                                                                                               | ae mm               | ae 0,1              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                      | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                      | Vc m/min.           | vc 70               | vc 65               | vc 67               | vc 69               | vc 72               | vc 73                   | vc 75                    | vc 75                      | vc 80                      | vc 82                      |
|                                        |                                                                                                                                                                                                                                                                      | n min <sup>-1</sup> | n 11200             | n 6900              | n 5300              | n 4400              | n 3800              | n 2900                  | n 2400                   | n 2000                     | n 1600                     | n 1300                     |
|                                        |                                                                                                                                                                                                                                                                      | fz mm               | fz 0,020            | fz 0,028            | fz 0,034            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                      | Vf mm/min.          | vf 672              | vf 580              | vf 541              | vf 462              | vf 456              | vf 580                  | vf 605                   | vf 624                     | vf 640                     | vf 619                     |

Empfohlene Richtwerte für VHM-Schaftfräser "Goldwin" mit Eckenradius  
Recommendet cutting data for solid carbide and mill "Goldwin" with corner radius

Umfangfräsen  
Side milling

Art. 30.7425

| Werkstoff-<br>gruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                                    |                     | Ø2<br>r = 0,2<br>Z3 | Ø3<br>r = 0,3<br>Z3 | Ø4<br>r = 0,5<br>Z3 | Ø5<br>r = 0,5<br>Z3 | Ø6<br>r = 0,5<br>Z4 | Ø8<br>r = 0,5/1/2<br>Z4 | Ø10<br>r = 0,5/1/2<br>Z4 | Ø12<br>r = 0,5/1/2/3<br>Z4 | Ø16<br>r = 0,5/1/2/3<br>Z4 | Ø20<br>r = 0,5/1/2/3<br>Z4 |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------------|--------------------------|----------------------------|----------------------------|----------------------------|
| 4.1                                    | 3.7024-3.7025<br>3.7034-3.7035<br>3.7055-3.7064                                                                                                                                                                                                                                       | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 277              | vc 294              | vc 303              | vc 316              | vc 326              | vc 332                  | vc 339                   | vc 339                     | vc 362                     | vc 364                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 44100             | n 31200             | n 24100             | n 20100             | n 17300             | n 13200                 | n 10800                  | n 9000                     | n 7200                     | n 5800                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,021            | fz 0,035            | fz 0,050            | fz 0,044            | fz 0,043            | fz 0,083                | fz 0,100                 | fz 0,110                   | fz 0,126                   | fz 0,141                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 2778             | vf 3276             | vf 3615             | vf 2653             | vf 2976             | vf 4382                 | vf 4320                  | vf 3960                    | vf 3629                    | vf 3271                    |
| 4.2                                    | 3.7105-3.7115<br>3.7124-3.7184                                                                                                                                                                                                                                                        | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 117              | vc 124              | vc 128              | vc 133              | vc 138              | vc 141                  | vc 145                   | vc 143                     | vc 151                     | vc 157                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 18600             | n 13200             | n 10200             | n 8500              | n 7300              | n 5600                  | n 4600                   | n 3800                     | n 3000                     | n 2500                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,019            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 1060             | vf 1386             | vf 1285             | vf 892              | vf 876              | vf 1120                 | vf 1159                  | vf 1186                    | vf 1200                    | vf 1190                    |
| 4.3                                    | 3.7154-3.7164<br>3.7124                                                                                                                                                                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 94               | vc 100              | vc 103              | vc 107              | vc 111              | vc 113                  | vc 116                   | vc 117                     | vc 121                     | vc 126                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 14900             | n 10600             | n 8200              | n 6800              | n 5900              | n 4500                  | n 3700                   | n 3100                     | n 2400                     | n 2000                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,016            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 715              | vf 1113             | vf 1033             | vf 714              | vf 708              | vf 900                  | vf 932                   | vf 967                     | vf 960                     | vf 952                     |
| 5.1                                    | 1.3911-1.3926<br>1.3927                                                                                                                                                                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 379              | vc 402              | vc 415              | vc 432              | vc 447              | vc 452                  | vc 462                   | vc 464                     | vc 493                     | vc 496                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 60300             | n 42700             | n 33000             | n 27500             | n 23700             | n 18000                 | n 14700                  | n 12300                    | n 9800                     | n 7900                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,021            | fz 0,035            | fz 0,050            | fz 0,044            | fz 0,043            | fz 0,083                | fz 0,100                 | fz 0,110                   | fz 0,126                   | fz 0,141                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 3799             | vf 4484             | vf 4950             | vf 3630             | vf 4076             | vf 5976                 | vf 5880                  | vf 5412                    | vf 4939                    | vf 4455                    |
| 5.2                                    | 1.3912-1.3981                                                                                                                                                                                                                                                                         | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 83               | vc 88               | vc 90               | vc 94               | vc 98               | vc 101                  | vc 101                   | vc 102                     | vc 111                     | vc 107                     |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 13200             | n 9300              | n 7200              | n 6000              | n 5200              | n 4000                  | n 3200                   | n 2700                     | n 2200                     | n 1700                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,019            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,100                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 752              | vf 977              | vf 907              | vf 630              | vf 624              | vf 800                  | vf 806                   | vf 842                     | vf 880                     | vf 809                     |
| 5.3                                    | 1.3913-1.3915-1.3916<br>1.3917-1.3918-1.3920<br>1.3921-1.3922-1.3923<br>1.3924-1.3928-2.4630<br>2.4375-2.4602-2.4630<br>2.4631-2.4634-2.4636<br>2.4642-2.4650-2.4654<br>2.4662-2.4665-2.4668<br>2.4669-2.4672-2.4674<br>2.4676-2.4816-2.4851<br>2.4856-2.4858-2.4916<br>2.4973-2.4983 | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 48               | vc 51               | vc 53               | vc 55               | vc 57               | vc 58                   | vc 60                    | vc 60                      | vc 65                      | vc 63                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 7700              | n 5400              | n 4200              | n 3500              | n 3000              | n 2300                  | n 1900                   | n 1600                     | n 1300                     | n 1000                     |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,016            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 370              | vf 567              | vf 529              | vf 369              | vf 360              | vf 460                  | vf 479                   | vf 499                     | vf 520                     | vf 476                     |
|                                        | 2.4633                                                                                                                                                                                                                                                                                | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 34               | vc 36               | vc 38               | vc 39               | vc 40               | vc 40                   | vc 41                    | vc 42                      | vc 45                      | vc 44                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 5400              | n 3800              | n 3000              | n 2500              | n 2100              | n 1600                  | n 1300                   | n 1100                     | n 900                      | n 700                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,016            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 259              | vf 399              | vf 378              | vf 263              | vf 252              | vf 320                  | vf 328                   | vf 343                     | vf 360                     | vf 333                     |
|                                        | 2.4670-2.4672<br>2.4674                                                                                                                                                                                                                                                               | ae mm               | ae 0,2              | ae 0,3              | ae 0,4              | ae 0,5              | ae 0,6              | ae 0,8                  | ae 1,0                   | ae 1,2                     | ae 1,6                     | ae 2,0                     |
|                                        |                                                                                                                                                                                                                                                                                       | ap mm               | ap 3                | ap 4                | ap 6                | ap 7,5              | ap 9                | ap 12                   | ap 15                    | ap 18                      | ap 24                      | ap 30                      |
|                                        |                                                                                                                                                                                                                                                                                       | Vc m/min.           | vc 43               | vc 46               | vc 48               | vc 50               | vc 51               | vc 53                   | vc 53                    | vc 53                      | vc 60                      | vc 57                      |
|                                        |                                                                                                                                                                                                                                                                                       | n min <sup>-1</sup> | n 6900              | n 4900              | n 3800              | n 3200              | n 2700              | n 2100                  | n 1700                   | n 1400                     | n 1200                     | n 900                      |
|                                        |                                                                                                                                                                                                                                                                                       | fz mm               | fz 0,016            | fz 0,035            | fz 0,042            | fz 0,035            | fz 0,030            | fz 0,050                | fz 0,063                 | fz 0,078                   | fz 0,100                   | fz 0,119                   |
|                                        |                                                                                                                                                                                                                                                                                       | Vf mm/min.          | vf 331              | vf 515              | vf 479              | vf 336              | vf 324              | vf 420                  | vf 428                   | vf 437                     | vf 480                     | vf 428                     |

Art. 30.6271

Empfohlene Schnittdaten für DIAMANT-beschichtete VHM-Fräser zur Bearbeitung von HARTMETALL  
Recommended cutting data for DIAMOND-coated solid carbide end mills for machining CEMENTED CARBIDE

| Werkstoff: Hartmetall<br>Material: cemented carbide |      |     | 5-Achsfräsen<br>Z-Level Milling |           |       |       | Flächenfräsen<br>Flat Milling |           |       |       | Umfangfräsen<br>Side Milling |           |       |       | Nutfräsen<br>Slotting |           |       |       |
|-----------------------------------------------------|------|-----|---------------------------------|-----------|-------|-------|-------------------------------|-----------|-------|-------|------------------------------|-----------|-------|-------|-----------------------|-----------|-------|-------|
| d1                                                  | r    | l1  | min <sup>-1</sup>               | Vf mm/min | ae mm | ap mm | min <sup>-1</sup>             | Vf mm/min | ae mm | ap mm | min <sup>-1</sup>            | Vf mm/min | ae mm | ap mm | min <sup>-1</sup>     | Vf mm/min | ae mm | ap mm |
| 0,3                                                 | 0,03 | 0,6 | 25000-35000                     | 220       | 0,010 | 0,200 | 25000-35000                   | 220       | 0,010 | 0,200 | 25000-35000                  | 110       | 0,050 | 0,001 | 25000-35000           | 110       | 0,010 |       |
| 0,3                                                 | 0,05 | 0,6 | 25000-35000                     | 220       | 0,010 | 0,200 | 25000-35000                   | 220       | 0,010 | 0,200 | 25000-35000                  | 110       | 0,050 | 0,001 | 25000-35000           | 110       | 0,010 |       |
| 0,5                                                 | 0,03 | 0,5 | 25000-35000                     | 185       | 0,010 | 0,400 | 25000-35000                   | 185       | 0,010 | 0,400 | 25000-35000                  | 375       | 0,250 | 0,005 | 25000-35000           | 375       | 0,010 |       |
| 0,5                                                 | 0,03 | 1,0 | 25000-35000                     | 185       | 0,010 | 0,400 | 25000-35000                   | 185       | 0,010 | 0,400 | 25000-35000                  | 180       | 0,125 | 0,005 | 25000-35000           | 375       | 0,010 |       |
| 0,5                                                 | 0,05 | 0,5 | 25000-35000                     | 375       | 0,010 | 0,400 | 25000-35000                   | 375       | 0,010 | 0,400 | 25000-35000                  | 375       | 0,250 | 0,005 | 25000-35000           | 375       | 0,010 |       |
| 0,5                                                 | 0,05 | 1,0 | 25000-35000                     | 375       | 0,010 | 0,400 | 25000-35000                   | 375       | 0,010 | 0,400 | 25000-35000                  | 180       | 0,125 | 0,005 | 25000-35000           | 375       | 0,010 |       |
| 0,8                                                 | 0,03 | 0,8 | 25000-35000                     | 185       | 0,010 | 0,600 | 25000-35000                   | 185       | 0,010 | 0,600 | 25000-35000                  | 600       | 0,400 | 0,008 | 25000-35000           | 375       | 0,010 |       |
| 0,8                                                 | 0,03 | 1,6 | 25000-35000                     | 185       | 0,010 | 0,600 | 25000-35000                   | 185       | 0,010 | 0,600 | 25000-35000                  | 300       | 0,200 | 0,008 | 25000-35000           | 375       | 0,010 |       |
| 0,8                                                 | 0,05 | 0,8 | 25000-35000                     | 375       | 0,010 | 0,600 | 25000-35000                   | 375       | 0,010 | 0,600 | 25000-35000                  | 600       | 0,400 | 0,008 | 25000-35000           | 375       | 0,010 |       |
| 0,8                                                 | 0,05 | 1,6 | 25000-35000                     | 375       | 0,010 | 0,600 | 25000-35000                   | 375       | 0,010 | 0,600 | 25000-35000                  | 300       | 0,200 | 0,008 | 25000-35000           | 375       | 0,010 |       |
| 0,8                                                 | 0,10 | 0,8 | 25000-35000                     | 375       | 0,010 | 0,600 | 25000-35000                   | 375       | 0,010 | 0,600 | 25000-35000                  | 600       | 0,400 | 0,008 | 25000-35000           | 375       | 0,010 |       |
| 0,8                                                 | 0,10 | 1,6 | 25000-35000                     | 375       | 0,010 | 0,600 | 25000-35000                   | 375       | 0,010 | 0,600 | 25000-35000                  | 300       | 0,200 | 0,008 | 25000-35000           | 375       | 0,010 |       |
| 1,0                                                 | 0,03 | 1,0 | 25000-35000                     | 185       | 0,010 | 0,800 | 25000-35000                   | 185       | 0,010 | 0,800 | 25000-35000                  | 750       | 0,500 | 0,010 | 25000-35000           | 375       | 0,010 |       |
| 1,0                                                 | 0,03 | 2,0 | 25000-35000                     | 185       | 0,010 | 0,800 | 25000-35000                   | 185       | 0,010 | 0,800 | 25000-35000                  | 375       | 0,250 | 0,010 | 25000-35000           | 375       | 0,010 |       |
| 1,0                                                 | 0,05 | 1,0 | 25000-35000                     | 375       | 0,010 | 0,800 | 25000-35000                   | 375       | 0,010 | 0,800 | 25000-35000                  | 750       | 0,500 | 0,010 | 25000-35000           | 375       | 0,010 |       |
| 1,0                                                 | 0,05 | 2,0 | 25000-35000                     | 375       | 0,010 | 0,800 | 25000-35000                   | 375       | 0,010 | 0,800 | 25000-35000                  | 375       | 0,250 | 0,010 | 25000-35000           | 375       | 0,010 |       |
| 1,0                                                 | 0,10 | 1,0 | 25000-35000                     | 375       | 0,010 | 0,800 | 25000-35000                   | 375       | 0,010 | 0,800 | 25000-35000                  | 750       | 0,500 | 0,010 | 25000-35000           | 375       | 0,010 |       |
| 1,0                                                 | 0,10 | 2,0 | 25000-35000                     | 375       | 0,010 | 0,800 | 25000-35000                   | 375       | 0,010 | 0,800 | 25000-35000                  | 375       | 0,250 | 0,010 | 25000-35000           | 375       | 0,010 |       |
| 1,5                                                 | 0,03 | 1,5 | 20000-30000                     | 185       | 0,010 | 1,300 | 20000-30000                   | 185       | 0,010 | 1,300 | 20000-30000                  | 750       | 0,750 | 0,010 | 20000-30000           | 375       | 0,015 |       |
| 1,5                                                 | 0,03 | 3,0 | 20000-30000                     | 185       | 0,010 | 1,300 | 20000-30000                   | 185       | 0,010 | 1,300 | 20000-30000                  | 375       | 0,375 | 0,010 | 20000-30000           | 375       | 0,015 |       |
| 1,5                                                 | 0,05 | 1,5 | 20000-30000                     | 375       | 0,015 | 1,300 | 20000-30000                   | 375       | 0,015 | 1,300 | 20000-30000                  | 750       | 0,750 | 0,010 | 20000-30000           | 375       | 0,015 |       |
| 1,5                                                 | 0,05 | 3,0 | 20000-30000                     | 375       | 0,015 | 1,300 | 20000-30000                   | 375       | 0,015 | 1,300 | 20000-30000                  | 375       | 0,375 | 0,010 | 20000-30000           | 375       | 0,015 |       |
| 1,5                                                 | 0,10 | 1,5 | 20000-30000                     | 375       | 0,015 | 1,300 | 20000-30000                   | 375       | 0,015 | 1,300 | 20000-30000                  | 750       | 0,750 | 0,010 | 20000-30000           | 375       | 0,015 |       |
| 1,5                                                 | 0,10 | 3,0 | 20000-30000                     | 375       | 0,015 | 1,300 | 20000-30000                   | 375       | 0,015 | 1,300 | 20000-30000                  | 375       | 0,375 | 0,010 | 20000-30000           | 375       | 0,015 |       |
| 2,0                                                 | 0,03 | 2,0 | 15000-25000                     | 185       | 0,010 | 1,800 | 15000-25000                   | 185       | 0,010 | 1,800 | 15000-25000                  | 750       | 1,000 | 0,010 | 15000-25000           | 375       | 0,020 |       |
| 2,0                                                 | 0,03 | 4,0 | 15000-25000                     | 185       | 0,010 | 1,800 | 15000-25000                   | 185       | 0,010 | 1,800 | 15000-25000                  | 375       | 0,500 | 0,010 | 15000-25000           | 375       | 0,020 |       |
| 2,0                                                 | 0,05 | 2,0 | 15000-25000                     | 375       | 0,020 | 1,800 | 15000-25000                   | 375       | 0,020 | 1,800 | 15000-25000                  | 750       | 1,000 | 0,010 | 15000-25000           | 375       | 0,020 |       |
| 2,0                                                 | 0,05 | 4,0 | 15000-25000                     | 375       | 0,020 | 1,800 | 15000-25000                   | 375       | 0,020 | 1,800 | 15000-25000                  | 375       | 0,500 | 0,010 | 15000-25000           | 375       | 0,020 |       |
| 2,0                                                 | 0,10 | 2,0 | 15000-25000                     | 375       | 0,020 | 1,800 | 15000-25000                   | 375       | 0,020 | 1,800 | 15000-25000                  | 750       | 1,000 | 0,010 | 15000-25000           | 375       | 0,020 |       |
| 2,0                                                 | 0,10 | 4,0 | 15000-25000                     | 375       | 0,020 | 1,800 | 15000-25000                   | 375       | 0,020 | 1,800 | 15000-25000                  | 375       | 0,500 | 0,010 | 15000-25000           | 375       | 0,020 |       |

Art. 30.6274

Empfohlene Schnittdaten für DIAMANT-beschichtete Vollhartmetallfräser zur Bearbeitung von HARTMETALL  
Recommended cutting data for DIAMOND-coated solid carbide end mills for machining CEMENTED CARBIDE

| Werkstoffgruppe<br>Material group |     |      |                   |           |       |       |
|-----------------------------------|-----|------|-------------------|-----------|-------|-------|
| Hartmetall<br>Cemented Carbide    | d1  | l3   | min <sup>-1</sup> | Vf mm/min | ap mm | ae mm |
|                                   | 0,2 | -    | 25.000-35.000     | 100       | 0,010 | 0,010 |
|                                   | 0,2 | 0,3  | 25.000-35.000     | 100       | 0,010 | 0,010 |
|                                   | 0,2 | 0,5  | 25.000-35.000     | 30        | 0,005 | 0,008 |
|                                   | 0,2 | 0,8  | 25.000-35.000     | 30        | 0,005 | 0,006 |
|                                   | 0,2 | 1,0  | 25.000-35.000     | 25        | 0,005 | 0,005 |
|                                   | 0,3 | -    | 25.000-35.000     | 125       | 0,015 | 0,030 |
|                                   | 0,4 | -    | 25.000-35.000     | 150       | 0,020 | 0,080 |
|                                   | 0,4 | 0,5  | 25.000-35.000     | 150       | 0,020 | 0,080 |
|                                   | 0,4 | 1,0  | 25.000-35.000     | 100       | 0,015 | 0,070 |
|                                   | 0,4 | 1,5  | 25.000-35.000     | 60        | 0,010 | 0,060 |
|                                   | 0,4 | 2,0  | 25.000-35.000     | 30        | 0,008 | 0,050 |
|                                   | 0,5 | -    | 25.000-35.000     | 175       | 0,025 | 0,110 |
|                                   | 0,6 | -    | 25.000-35.000     | 200       | 0,030 | 0,140 |
|                                   | 0,6 | 1,0  | 25.000-35.000     | 200       | 0,030 | 0,140 |
|                                   | 0,6 | 1,5  | 25.000-35.000     | 200       | 0,030 | 0,140 |
|                                   | 0,6 | 2,0  | 25.000-35.000     | 150       | 0,022 | 0,110 |
|                                   | 0,6 | 3,0  | 25.000-35.000     | 75        | 0,010 | 0,080 |
|                                   | 0,7 | -    | 25.000-35.000     | 225       | 0,035 | 0,170 |
|                                   | 0,8 | -    | 25.000-35.000     | 250       | 0,040 | 0,190 |
|                                   | 0,8 | 2,0  | 25.000-35.000     | 250       | 0,040 | 0,190 |
|                                   | 0,8 | 3,0  | 25.000-35.000     | 230       | 0,037 | 0,170 |
|                                   | 0,8 | 4,0  | 25.000-35.000     | 210       | 0,035 | 0,160 |
|                                   | 0,9 | -    | 25.000-35.000     | 275       | 0,045 | 0,220 |
|                                   | 1,0 | -    | 25.000-35.000     | 300       | 0,050 | 0,250 |
|                                   | 1,0 | 2,0  | 25.000-35.000     | 300       | 0,050 | 0,250 |
|                                   | 1,0 | 2,5  | 25.000-35.000     | 300       | 0,050 | 0,250 |
| Hartmetall<br>Cemented Carbide    | d1  | l3   | min <sup>-1</sup> | Vf mm/min | ap mm | ae mm |
|                                   | 1,0 | 3,0  | 25.000-35.000     | 300       | 0,050 | 0,250 |
|                                   | 1,0 | 4,0  | 25.000-35.000     | 300       | 0,050 | 0,250 |
|                                   | 1,0 | 5,0  | 25.000-35.000     | 300       | 0,050 | 0,250 |
|                                   | 2,0 | -    | 25.000-35.000     | 300       | 0,100 | 0,300 |
|                                   | 2,0 | 3,0  | 25.000-35.000     | 300       | 0,100 | 0,300 |
|                                   | 2,0 | 4,0  | 25.000-35.000     | 300       | 0,100 | 0,300 |
|                                   | 2,0 | 6,0  | 25.000-35.000     | 300       | 0,100 | 0,300 |
|                                   | 2,0 | 8,0  | 25.000-35.000     | 300       | 0,100 | 0,300 |
|                                   | 2,0 | 10,0 | 25.000-35.000     | 300       | 0,100 | 0,300 |
|                                   | 3,0 | -    | 22.500-32.500     | 275       | 0,125 | 0,330 |
|                                   | 3,0 | 6,0  | 25.000-35.000     | 275       | 0,125 | 0,330 |
|                                   | 3,0 | 8,0  | 25.000-35.000     | 275       | 0,125 | 0,330 |
|                                   | 3,0 | 10,0 | 25.000-35.000     | 275       | 0,125 | 0,330 |
|                                   | 3,0 | 12,0 | 25.000-35.000     | 220       | 0,125 | 0,330 |
|                                   | 3,0 | 14,0 | 25.000-35.000     | 220       | 0,125 | 0,330 |
|                                   | 4,0 | -    | 20.000-28.000     | 240       | 0,175 | 0,370 |
|                                   | 4,0 | 8,0  | 20.000-28.000     | 240       | 0,150 | 0,350 |
|                                   | 4,0 | 10,0 | 20.000-28.000     | 240       | 0,150 | 0,350 |
|                                   | 4,0 | 15,0 | 20.000-28.000     | 240       | 0,150 | 0,350 |
|                                   | 5,0 | -    | 18.000-26.000     | 220       | 0,175 | 0,370 |
|                                   | 5,0 | 10,0 | 18.000-26.000     | 220       | 0,175 | 0,370 |
|                                   | 5,0 | 15,0 | 18.000-26.000     | 220       | 0,175 | 0,370 |
|                                   | 6,0 | -    | 15.000-25.000     | 200       | 0,200 | 0,400 |
|                                   | 6,0 | 10,0 | 15.000-25.000     | 200       | 0,200 | 0,400 |
|                                   | 6,0 | 15,0 | 15.000-25.000     | 200       | 0,200 | 0,400 |



Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung  
Recommended cutting data for diamond coated solid carbide end mills HSC

| Art. | 30.6545 | 30.6553 | 30.6544 | 30.6556 |
|------|---------|---------|---------|---------|
|      | 30.6546 | 30.6552 | 30.6554 | 30.6551 |

| Werkstoffgruppe<br>Material group | d1   | Schruppen/roughing ap=0,5xD, ae=1,0xD |           |       |       |        | Schruppen/roughing ap=0,5xD, ae=0,5xD |           |       |       |       | Schlichten/finishing ap=0,2xD, ae=0,2xD |           |       |       |       |
|-----------------------------------|------|---------------------------------------|-----------|-------|-------|--------|---------------------------------------|-----------|-------|-------|-------|-----------------------------------------|-----------|-------|-------|-------|
|                                   |      | min <sup>-1</sup>                     | Vf mm/min | fz mm | ap mm | ae mm  | min <sup>-1</sup>                     | Vf mm/min | fz mm | ap mm | ae mm | min <sup>-1</sup>                       | Vf mm/min | fz mm | ap mm | ae mm |
| 14                                | 0,1  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,2  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,3  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,4  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,5  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,6  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,8  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 1,0  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 1,2  | -                                     | -         | -     | -     | -      | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 1,5  | 8.000                                 | 230       | 0,014 | 0,750 | 1,500  | 8.000                                 | 290       | 0,018 | 0,750 | 0,750 | 8.000                                   | 320       | 0,020 | 0,300 | 0,3   |
|                                   | 2,0  | 8.000                                 | 260       | 0,016 | 1,000 | 2,000  | 8.000                                 | 320       | 0,020 | 1,000 | 1,000 | 8.000                                   | 400       | 0,025 | 0,400 | 0,4   |
|                                   | 3,0  | 8.000                                 | 380       | 0,024 | 1,500 | 3,000  | 8.000                                 | 400       | 0,025 | 1,500 | 1,500 | 8.000                                   | 560       | 0,035 | 0,600 | 0,6   |
|                                   | 4,0  | 8.000                                 | 520       | 0,033 | 2,000 | 4,000  | 8.000                                 | 640       | 0,040 | 2,000 | 2,000 | 8.000                                   | 800       | 0,050 | 0,800 | 0,8   |
|                                   | 5,0  | 8.000                                 | 640       | 0,040 | 2,500 | 5,000  | 8.000                                 | 800       | 0,050 | 2,500 | 2,500 | 8.000                                   | 960       | 0,060 | 1,000 | 1,0   |
|                                   | 6,0  | 8.000                                 | 780       | 0,049 | 3,000 | 6,000  | 8.000                                 | 1.050     | 0,066 | 3,000 | 3,000 | 8.000                                   | 1.150     | 0,072 | 1,200 | 1,2   |
|                                   | 8,0  | 8.000                                 | 1.050     | 0,066 | 4,000 | 8,000  | 8.000                                 | 1.300     | 0,081 | 4,000 | 4,000 | 8.000                                   | 1.350     | 0,084 | 1,600 | 1,6   |
|                                   | 10,0 | 8.000                                 | 1.300     | 0,081 | 5,000 | 10,000 | 8.000                                 | 1.600     | 0,100 | 5,000 | 5,000 | 8.000                                   | 1.750     | 0,109 | 2,000 | 2,0   |
|                                   | 12,0 | 8.000                                 | 1.600     | 0,100 | 6,000 | 12,000 | 8.000                                 | 1.900     | 0,119 | 6,000 | 6,000 | 8.000                                   | 2.100     | 0,131 | 2,400 | 2,4   |

| Werkstoffgruppe<br>Material group | d1   | Schruppen/roughing ap=0,5xD, ae=1,0xD |           |       |       |       | Schruppen/roughing ap=0,5xD, ae=0,5xD |           |       |       |       | Schlichten/finishing ap=0,2xD, ae=0,2xD |           |       |       |       |
|-----------------------------------|------|---------------------------------------|-----------|-------|-------|-------|---------------------------------------|-----------|-------|-------|-------|-----------------------------------------|-----------|-------|-------|-------|
|                                   |      | min <sup>-1</sup>                     | Vf mm/min | fz mm | ap mm | ae mm | min <sup>-1</sup>                     | Vf mm/min | fz mm | ap mm | ae mm | min <sup>-1</sup>                       | Vf mm/min | fz mm | ap mm | ae mm |
| 14                                | 0,1  | -                                     | -         | -     | -     | -     | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,2  | -                                     | -         | -     | -     | -     | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,3  | -                                     | -         | -     | -     | -     | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,4  | -                                     | -         | -     | -     | -     | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,5  | -                                     | -         | -     | -     | -     | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,6  | -                                     | -         | -     | -     | -     | -                                     | -         | -     | -     | -     | -                                       | -         | -     | -     | -     |
|                                   | 0,8  | 15.000                                | 240       | 0,008 | 0,4   | 0,8   | 15.000                                | 300       | 0,010 | 0,4   | 0,4   | 15.000                                  | 360       | 0,012 | 0,16  | 0,16  |
|                                   | 1,0  | 15.000                                | 300       | 0,010 | 0,5   | 1,0   | 15.000                                | 360       | 0,012 | 0,5   | 0,5   | 15.000                                  | 450       | 0,015 | 0,2   | 0,2   |
|                                   | 1,2  | 15.000                                | 300       | 0,010 | 0,6   | 1,2   | 15.000                                | 360       | 0,012 | 0,6   | 0,6   | 15.000                                  | 450       | 0,015 | 0,24  | 0,24  |
|                                   | 1,5  | 15.000                                | 420       | 0,014 | 0,75  | 1,5   | 15.000                                | 540       | 0,018 | 0,75  | 0,75  | 15.000                                  | 600       | 0,020 | 0,3   | 0,3   |
|                                   | 2,0  | 15.000                                | 480       | 0,016 | 1,0   | 2,0   | 15.000                                | 600       | 0,020 | 1,0   | 1,0   | 15.000                                  | 750       | 0,025 | 0,4   | 0,4   |
|                                   | 3,0  | 15.000                                | 720       | 0,024 | 1,5   | 3,0   | 15.000                                | 760       | 0,025 | 1,5   | 1,5   | 15.000                                  | 1.050     | 0,035 | 0,6   | 0,6   |
|                                   | 4,0  | 15.000                                | 950       | 0,032 | 2,0   | 4,0   | 15.000                                | 1.100     | 0,037 | 2,0   | 2,0   | 15.000                                  | 1.500     | 0,050 | 0,8   | 0,8   |
|                                   | 5,0  | 15.000                                | 1.200     | 0,040 | 2,5   | 5,0   | 15.000                                | 1.500     | 0,050 | 2,5   | 2,5   | 15.000                                  | 1.800     | 0,060 | 1,0   | 1,0   |
|                                   | 6,0  | 15.000                                | 1.500     | 0,050 | 3,0   | 6,0   | 15.000                                | 1.900     | 0,063 | 3,0   | 3,0   | 15.000                                  | 2.100     | 0,070 | 1,2   | 1,2   |
|                                   | 8,0  | 15.000                                | 1.900     | 0,063 | 4,0   | 8,0   | 15.000                                | 2.400     | 0,080 | 4,0   | 4,0   | 15.000                                  | 2.600     | 0,087 | 1,6   | 1,6   |
|                                   | 10,0 | 15.000                                | 2.400     | 0,080 | 5,0   | 10,0  | 15.000                                | 3.000     | 0,100 | 5,0   | 5,0   | 15.000                                  | 3.300     | 0,110 | 2,0   | 2,0   |
|                                   | 12,0 | 15.000                                | 3.000     | 0,100 | 6,0   | 12,0  | 15.000                                | 3.600     | 0,120 | 6,0   | 6,0   | 15.000                                  | 4.000     | 0,133 | 2,4   | 2,4   |

Diese Schnittdaten stehen in Abhängigkeit der Auskraglänge. Korrigieren Sie gegebenenfalls Vc + fz sowie ae und ap um ein optimales Ergebnis zu erzielen!  
This cutting data depends upon the projecting length. If neccessary correct Vc + fz as well as ae and ap for archieving an optimal result!

|      |         |         |         |         |                                                                                                                                                             |
|------|---------|---------|---------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Art. | 30.6545 | 30.6553 | 30.6544 | 30.6556 | Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung<br>Recommended cutting data for diamond coated solid carbide end mills HSC |
|      | 30.6546 | 30.6552 | 30.6554 | 30.6551 |                                                                                                                                                             |

| Werkstoffgruppe<br>Material group | 24000<br>U/min | Schruppen/roughing ap=0,5xD, ae=1,0xD |                   |           |       |       | Schruppen/roughing ap=0,5xD, ae=0,5xD |                   |           |       |       | Schlichten/finishing ap=0,2xD, ae=0,2xD |                   |           |       |       |       |
|-----------------------------------|----------------|---------------------------------------|-------------------|-----------|-------|-------|---------------------------------------|-------------------|-----------|-------|-------|-----------------------------------------|-------------------|-----------|-------|-------|-------|
|                                   |                | d1                                    | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                 | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                   | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm |
| 14                                | 0,1            | -                                     | -                 | -         | -     | -     | -                                     | -                 | -         | -     | -     | -                                       | -                 | -         | -     | -     | -     |
|                                   | 0,2            | -                                     | -                 | -         | -     | -     | -                                     | -                 | -         | -     | -     | -                                       | -                 | -         | -     | -     | -     |
|                                   | 0,3            | -                                     | -                 | -         | -     | -     | -                                     | -                 | -         | -     | -     | -                                       | -                 | -         | -     | -     | -     |
|                                   | 0,4            | -                                     | -                 | -         | -     | -     | -                                     | -                 | -         | -     | -     | -                                       | -                 | -         | -     | -     | -     |
|                                   | 0,5            | 24.000                                | 240               | 0,005     | 0,25  | 0,5   | 24.000                                | 340               | 0,007     | 0,25  | 0,25  | 24.000                                  | 380               | 0,008     | 0,1   | 0,1   |       |
|                                   | 0,6            | 24.000                                | 290               | 0,006     | 0,3   | 0,6   | 24.000                                | 390               | 0,008     | 0,3   | 0,3   | 24.000                                  | 480               | 0,010     | 0,12  | 0,12  |       |
|                                   | 0,8            | 24.000                                | 390               | 0,008     | 0,4   | 0,8   | 24.000                                | 490               | 0,010     | 0,4   | 0,4   | 24.000                                  | 580               | 0,012     | 0,16  | 0,16  |       |
|                                   | 1,0            | 24.000                                | 480               | 0,010     | 0,5   | 1,0   | 24.000                                | 580               | 0,012     | 0,5   | 0,5   | 24.000                                  | 720               | 0,015     | 0,2   | 0,2   |       |
|                                   | 1,2            | 24.000                                | 480               | 0,010     | 0,6   | 1,2   | 24.000                                | 580               | 0,012     | 0,6   | 0,6   | 24.000                                  | 720               | 0,015     | 0,24  | 0,24  |       |
|                                   | 1,5            | 24.000                                | 680               | 0,014     | 0,75  | 1,5   | 24.000                                | 880               | 0,018     | 0,75  | 0,75  | 24.000                                  | 960               | 0,020     | 0,3   | 0,3   |       |
|                                   | 2,0            | 24.000                                | 760               | 0,016     | 1,0   | 2,0   | 24.000                                | 960               | 0,020     | 1,0   | 1,0   | 24.000                                  | 1.200             | 0,025     | 0,4   | 0,4   |       |
|                                   | 3,0            | 24.000                                | 1.100             | 0,023     | 1,5   | 3,0   | 24.000                                | 1.200             | 0,025     | 1,5   | 1,5   | 24.000                                  | 1.700             | 0,035     | 0,6   | 0,6   |       |
|                                   | 4,0            | 24.000                                | 1.500             | 0,031     | 2,0   | 4,0   | 24.000                                | 1.900             | 0,040     | 2,0   | 2,0   | 24.000                                  | 2.400             | 0,050     | 0,8   | 0,8   |       |
|                                   | 5,0            | 24.000                                | 1.900             | 0,040     | 2,5   | 5,0   | 24.000                                | 2.400             | 0,050     | 2,5   | 2,5   | 24.000                                  | 2.900             | 0,060     | 1,0   | 1,0   |       |
|                                   | 6,0            | 24.000                                | 2.300             | 0,048     | 3,0   | 6,0   | 24.000                                | 3.100             | 0,065     | 3,0   | 3,0   | 24.000                                  | 3.400             | 0,071     | 1,2   | 1,2   |       |
|                                   | 8,0            | 24.000                                | 3.100             | 0,065     | 4,0   | 8,0   | 24.000                                | 3.800             | 0,079     | 4,0   | 4,0   | 24.000                                  | 4.100             | 0,085     | 1,6   | 1,6   |       |
|                                   | 10,0           | 24.000                                | 3.800             | 0,079     | 5,0   | 10,0  | 24.000                                | 4.800             | 0,100     | 5,0   | 5,0   | 24.000                                  | 5.300             | 0,110     | 2,0   | 2,0   |       |
|                                   | 12,0           | 24.000                                | 4.800             | 0,100     | 6,0   | 12,0  | 24.000                                | 5.800             | 0,121     | 6,0   | 6,0   | 24.000                                  | 6.300             | 0,131     | 2,4   | 2,4   |       |

| Werkstoffgruppe<br>Material group | 30000<br>U/min | Schruppen/roughing ap=0,5xD, ae=1,0xD |                   |           |       |       | Schruppen/roughing ap=0,5xD, ae=0,5xD |                   |           |       |       | Schlichten/finishing ap=0,2xD, ae=0,2xD |                   |           |       |       |
|-----------------------------------|----------------|---------------------------------------|-------------------|-----------|-------|-------|---------------------------------------|-------------------|-----------|-------|-------|-----------------------------------------|-------------------|-----------|-------|-------|
|                                   |                | d1                                    | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                 | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                   | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm |
| 14                                | 0,1            | 30.000                                | 110               | 0,002     | 0,05  | 0,1   | 30.000                                | 170               | 0,003     | 0,05  | 0,05  | 30.000                                  | 220               | 0,004     | 0,02  | 0,02  |
|                                   | 0,2            | 30.000                                | 120               | 0,002     | 0,1   | 0,2   | 30.000                                | 180               | 0,003     | 0,1   | 0,1   | 30.000                                  | 240               | 0,004     | 0,04  | 0,04  |
|                                   | 0,3            | 30.000                                | 120               | 0,002     | 0,15  | 0,3   | 30.000                                | 180               | 0,003     | 0,15  | 0,15  | 30.000                                  | 240               | 0,004     | 0,06  | 0,06  |
|                                   | 0,4            | 30.000                                | 240               | 0,004     | 0,2   | 0,4   | 30.000                                | 300               | 0,005     | 0,2   | 0,2   | 30.000                                  | 360               | 0,006     | 0,08  | 0,08  |
|                                   | 0,5            | 30.000                                | 300               | 0,005     | 0,25  | 0,5   | 30.000                                | 420               | 0,007     | 0,25  | 0,25  | 30.000                                  | 480               | 0,008     | 0,1   | 0,1   |
|                                   | 0,6            | 30.000                                | 360               | 0,006     | 0,3   | 0,6   | 30.000                                | 480               | 0,008     | 0,3   | 0,3   | 30.000                                  | 600               | 0,010     | 0,12  | 0,12  |
|                                   | 0,8            | 30.000                                | 480               | 0,008     | 0,4   | 0,8   | 30.000                                | 600               | 0,010     | 0,4   | 0,4   | 30.000                                  | 730               | 0,012     | 0,16  | 0,16  |
|                                   | 1,0            | 30.000                                | 600               | 0,010     | 0,5   | 1,0   | 30.000                                | 720               | 0,012     | 0,5   | 0,5   | 30.000                                  | 900               | 0,015     | 0,2   | 0,2   |
|                                   | 1,2            | 30.000                                | 600               | 0,010     | 0,6   | 1,2   | 30.000                                | 720               | 0,012     | 0,6   | 0,6   | 30.000                                  | 900               | 0,015     | 0,24  | 0,24  |
|                                   | 1,5            | 30.000                                | 850               | 0,014     | 0,75  | 1,5   | 30.000                                | 1.050             | 0,018     | 0,75  | 0,75  | 30.000                                  | 1.200             | 0,020     | 0,3   | 0,3   |
|                                   | 2,0            | 30.000                                | 950               | 0,016     | 1,0   | 2,0   | 30.000                                | 1.200             | 0,020     | 1,0   | 1,0   | 30.000                                  | 1.500             | 0,025     | 0,4   | 0,4   |
|                                   | 3,0            | 30.000                                | 1.450             | 0,024     | 1,5   | 3,0   | 30.000                                | 1.550             | 0,026     | 1,5   | 1,5   | 30.000                                  | 2.100             | 0,035     | 0,6   | 0,6   |
|                                   | 4,0            | 30.000                                | 1.900             | 0,032     | 2,0   | 4,0   | 30.000                                | 2.400             | 0,040     | 2,0   | 2,0   | 30.000                                  | 3.000             | 0,050     | 0,8   | 0,8   |
|                                   | 5,0            | 30.000                                | 2.400             | 0,040     | 2,5   | 5,0   | 30.000                                | 3.000             | 0,050     | 2,5   | 2,5   | 30.000                                  | 3.600             | 0,060     | 1,0   | 1,0   |
|                                   | 6,0            | 30.000                                | 2.900             | 0,048     | 3,0   | 6,0   | 30.000                                | 3.900             | 0,065     | 3,0   | 3,0   | 30.000                                  | 4.200             | 0,070     | 1,2   | 1,2   |
|                                   | 8,0            | 30.000                                | 3.900             | 0,065     | 4,0   | 8,0   | 30.000                                | 4.800             | 0,080     | 4,0   | 4,0   | 30.000                                  | 5.100             | 0,085     | 1,6   | 1,6   |
|                                   | 10,0           | 30.000                                | 4.800             | 0,080     | 5,0   | 10,0  | 30.000                                | 6.000             | 0,100     | 5,0   | 5,0   | 30.000                                  | 6.600             | 0,110     | 2,0   | 2,0   |
|                                   | 12,0           | 30.000                                | 6.000             | 0,100     | 6,0   | 12,0  | 30.000                                | 7.200             | 0,120     | 6,0   | 6,0   | 30.000                                  | 7.800             | 0,130     | 2,4   | 2,4   |

Diese Schnittdaten stehen in Abhängigkeit der Auskraglänge. Korrigieren Sie gegebenenfalls Vc + fz sowie ae und ap um ein optimales Ergebnis zu erzielen!  
This cutting data depends upon the projecting length. If necessary correct Vc + fz as well as ae and ap for archieving an optimal result!

Art. 30.6561-5TEC

| Zirkonium • Graphite • Schrubbearbeitung/Roughing |     |                |                |                           |            |            |              |                 | Schruppen<br>roughing<br>▼ | HSK<br>32 | HSK<br>40 | SK<br>40 |
|---------------------------------------------------|-----|----------------|----------------|---------------------------|------------|------------|--------------|-----------------|----------------------------|-----------|-----------|----------|
| d Ø                                               | r   | l <sub>n</sub> | Vc<br>(m/min.) | n<br>(min <sup>-1</sup> ) | ap<br>(mm) | ae<br>(mm) | fz<br>(mm/t) | Vf<br>(mm/min.) |                            |           |           |          |
| 1,0                                               | 0,5 | 15             | 120-160        | 40.000-50.000             | 0,15       | 0,40       | 0,020        | 2,000           |                            |           |           |          |
|                                                   |     | 20             | 100-130        | 34.000-42.000             | 0,10       | 0,20       | 0,015        | 1,270           |                            |           |           |          |
| 2,0                                               | 1,0 | 15             | 250-310        | 40.000-50.000             | 0,30       | 0,80       | 0,040        | 4,000           |                            |           |           |          |
|                                                   |     | 20             | 200-250        | 34.000-42.000             | 0,20       | 0,60       | 0,030        | 4,000           |                            |           |           |          |
| 3,0                                               | 1,5 | 15             | 370-470        | 40.000-50.000             | 0,45       | 1,20       | 0,060        | 6,000           |                            |           |           |          |
|                                                   |     | 20             | 320-400        | 34.000-42.500             | 0,30       | 0,60       | 0,045        | 3,820           |                            |           |           |          |

| Zirkonium • Graphite • Schlichtbearbeitung/Finishing |     |                |                |                           |            |             |              |                 | Schlichten<br>finishing<br>▼▼▼ | HSK<br>32 | HSK<br>40 | SK<br>40 |
|------------------------------------------------------|-----|----------------|----------------|---------------------------|------------|-------------|--------------|-----------------|--------------------------------|-----------|-----------|----------|
| d Ø                                                  | r   | l <sub>n</sub> | Vc<br>(m/min.) | n<br>(min <sup>-1</sup> ) | ap<br>(mm) | ae<br>(mm)  | fz<br>(mm/t) | Vf<br>(mm/min.) |                                |           |           |          |
| 1,0                                                  | 0,5 | 15             | 120-160        | 40.000-50.000             | 0,050      | 0,050-0,150 | 0,015        | 1,500           |                                |           |           |          |
|                                                      |     | 20             | 100-130        | 34.000-42.000             | 0,030      | 0,030-0,090 | 0,010        | 850             |                                |           |           |          |
| 2,0                                                  | 1,0 | 15             | 250-310        | 40.000-50.000             | 0,100      | 0,100-0,300 | 0,030        | 3,000           |                                |           |           |          |
|                                                      |     | 20             | 250-310        | 40.000-50.000             | 0,100      | 0,100-0,200 | 0,020        | 3,000           |                                |           |           |          |
| 3,0                                                  | 1,5 | 15             | 370-470        | 40.000-50.000             | 0,150      | 0,150-0,450 | 0,045        | 4,500           |                                |           |           |          |
|                                                      |     | 20             | 320-400        | 34.000-42.500             | 0,090      | 0,090-0,270 | 0,030        | 2,500           |                                |           |           |          |

|                                                                                                                                                             |      |         |         |         |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|---------|---------|---------|
| Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung<br>Recommended cutting data for diamond coated solid carbide end mills HSC | Art. | 30.6545 | 30.6553 | 30.6544 | 30.6556 |
|                                                                                                                                                             |      | 30.6546 | 30.6552 | 30.6554 | 30.6551 |

| Werkstoffgruppe<br>Material group | 36000<br>U/min | Schruppen/roughing ap=0,5xD, ae=1,0xD |                   |           |       |       | Schruppen/roughing ap=0,5xD, ae=0,5xD |                   |           |       |       | Schlichten/finishing ap=0,2xD, ae=0,2xD |                   |           |       |       |
|-----------------------------------|----------------|---------------------------------------|-------------------|-----------|-------|-------|---------------------------------------|-------------------|-----------|-------|-------|-----------------------------------------|-------------------|-----------|-------|-------|
|                                   |                | d1                                    | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                 | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                   | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm |
| 14                                | 0,1            | 36.000                                | 130               | 0,002     | 0,05  | 0,1   | 36.000                                | 190               | 0,003     | 0,05  | 0,05  | 36.000                                  | 260               | 0,004     | 0,02  | 0,02  |
|                                   | 0,2            | 36.000                                | 140               | 0,002     | 0,1   | 0,2   | 36.000                                | 210               | 0,003     | 0,1   | 0,1   | 36.000                                  | 280               | 0,004     | 0,04  | 0,04  |
|                                   | 0,3            | 36.000                                | 140               | 0,002     | 0,15  | 0,3   | 36.000                                | 210               | 0,003     | 0,15  | 0,15  | 36.000                                  | 280               | 0,004     | 0,06  | 0,06  |
|                                   | 0,4            | 36.000                                | 290               | 0,004     | 0,2   | 0,4   | 36.000                                | 360               | 0,005     | 0,2   | 0,2   | 36.000                                  | 440               | 0,006     | 0,08  | 0,08  |
|                                   | 0,5            | 36.000                                | 360               | 0,005     | 0,25  | 0,5   | 36.000                                | 500               | 0,007     | 0,25  | 0,25  | 36.000                                  | 580               | 0,008     | 0,1   | 0,1   |
|                                   | 0,6            | 36.000                                | 440               | 0,006     | 0,3   | 0,6   | 36.000                                | 580               | 0,008     | 0,3   | 0,3   | 36.000                                  | 720               | 0,010     | 0,12  | 0,12  |
|                                   | 0,8            | 36.000                                | 580               | 0,008     | 0,4   | 0,8   | 36.000                                | 720               | 0,010     | 0,4   | 0,4   | 36.000                                  | 880               | 0,012     | 0,16  | 0,16  |
|                                   | 1,0            | 36.000                                | 720               | 0,010     | 0,5   | 1,0   | 36.000                                | 880               | 0,012     | 0,5   | 0,5   | 36.000                                  | 1.100             | 0,015     | 0,2   | 0,2   |
|                                   | 1,2            | 36.000                                | 720               | 0,010     | 0,6   | 1,2   | 36.000                                | 880               | 0,012     | 0,6   | 0,6   | 36.000                                  | 1.100             | 0,015     | 0,24  | 0,24  |
|                                   | 1,5            | 36.000                                | 1.000             | 0,014     | 0,75  | 1,5   | 36.000                                | 1.300             | 0,018     | 0,75  | 0,75  | 36.000                                  | 1.450             | 0,020     | 0,3   | 0,3   |
|                                   | 2,0            | 36.000                                | 1.200             | 0,017     | 1,0   | 2,0   | 36.000                                | 1.450             | 0,020     | 1,0   | 1,0   | 36.000                                  | 1.800             | 0,025     | 0,4   | 0,4   |
|                                   | 3,0            | 36.000                                | 1.700             | 0,024     | 1,5   | 3,0   | 36.000                                | 1.800             | 0,025     | 1,5   | 1,5   | 36.000                                  | 2.600             | 0,036     | 0,6   | 0,6   |
|                                   | 4,0            | 36.000                                | 2.300             | 0,032     | 2,0   | 4,0   | 36.000                                | 2.900             | 0,040     | 2,0   | 2,0   | 36.000                                  | 3.600             | 0,050     | 0,8   | 0,8   |
|                                   | 5,0            | 36.000                                | 2.900             | 0,040     | 2,5   | 5,0   | 36.000                                | 3.600             | 0,050     | 2,5   | 2,5   | 36.000                                  | 4.400             | 0,061     | 1,0   | 1,0   |
|                                   | 6,0            | 36.000                                | 3.500             | 0,049     | 3,0   | 6,0   | 36.000                                | 4.700             | 0,065     | 3,0   | 3,0   | 36.000                                  | 5.100             | 0,071     | 1,2   | 1,2   |
|                                   | 8,0            | 36.000                                | 4.600             | 0,064     | 4,0   | 8,0   | 36.000                                | 5.800             | 0,081     | 4,0   | 4,0   | 36.000                                  | 6.200             | 0,086     | 1,6   | 1,6   |
|                                   | 10,0           | 36.000                                | 5.800             | 0,081     | 5,0   | 10,0  | 36.000                                | 7.200             | 0,100     | 5,0   | 5,0   | 36.000                                  | 7.400             | 0,103     | 2,0   | 2,0   |
|                                   | 12,0           | 36.000                                | 7.200             | 0,100     | 6,0   | 12,0  | 36.000                                | 7.600             | 0,106     | 6,0   | 6,0   | 36.000                                  | 8.200             | 0,114     | 2,4   | 2,4   |

| Werkstoffgruppe<br>Material group | 45000<br>U/min | Schruppen/roughing ap=0,5xD, ae=1,0xD |                   |           |       |       | Schruppen/roughing ap=0,5xD, ae=0,5xD |                   |           |       |       | Schlichten/finishing ap=0,2xD, ae=0,2xD |                   |           |       |       |
|-----------------------------------|----------------|---------------------------------------|-------------------|-----------|-------|-------|---------------------------------------|-------------------|-----------|-------|-------|-----------------------------------------|-------------------|-----------|-------|-------|
|                                   |                | d1                                    | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                 | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm | ae mm                                   | min <sup>-1</sup> | Vf mm/min | fz mm | ap mm |
| 14                                | 0,1            | 45.000                                | 170               | 0,002     | 0,05  | 0,1   | 45.000                                | 250               | 0,003     | 0,05  | 0,05  | 45.000                                  | 340               | 0,004     | 0,02  | 0,02  |
|                                   | 0,2            | 45.000                                | 180               | 0,002     | 0,1   | 0,2   | 45.000                                | 270               | 0,003     | 0,1   | 0,1   | 45.000                                  | 360               | 0,004     | 0,04  | 0,04  |
|                                   | 0,3            | 45.000                                | 180               | 0,002     | 0,15  | 0,3   | 45.000                                | 270               | 0,003     | 0,15  | 0,15  | 45.000                                  | 360               | 0,004     | 0,06  | 0,06  |
|                                   | 0,4            | 45.000                                | 360               | 0,004     | 0,2   | 0,4   | 45.000                                | 450               | 0,005     | 0,2   | 0,2   | 45.000                                  | 550               | 0,006     | 0,08  | 0,08  |
|                                   | 0,5            | 45.000                                | 450               | 0,005     | 0,25  | 0,5   | 45.000                                | 640               | 0,007     | 0,25  | 0,25  | 45.000                                  | 730               | 0,008     | 0,1   | 0,1   |
|                                   | 0,6            | 45.000                                | 540               | 0,006     | 0,3   | 0,6   | 45.000                                | 730               | 0,008     | 0,3   | 0,3   | 45.000                                  | 900               | 0,010     | 0,12  | 0,12  |
|                                   | 0,8            | 45.000                                | 720               | 0,008     | 0,4   | 0,8   | 45.000                                | 900               | 0,010     | 0,4   | 0,4   | 45.000                                  | 1.100             | 0,012     | 0,16  | 0,16  |
|                                   | 1,0            | 45.000                                | 900               | 0,010     | 0,5   | 1,0   | 45.000                                | 1.100             | 0,012     | 0,5   | 0,5   | 45.000                                  | 1.400             | 0,016     | 0,2   | 0,2   |
|                                   | 1,2            | 45.000                                | 900               | 0,010     | 0,6   | 1,2   | 45.000                                | 1.100             | 0,012     | 0,6   | 0,6   | 45.000                                  | 1.400             | 0,016     | 0,24  | 0,24  |
|                                   | 1,5            | 45.000                                | 1.300             | 0,014     | 0,75  | 1,5   | 45.000                                | 1.600             | 0,018     | 0,75  | 0,75  | 45.000                                  | 1.800             | 0,020     | 0,3   | 0,3   |
|                                   | 2,0            | 45.000                                | 1.500             | 0,017     | 1,0   | 2,0   | 45.000                                | 1.800             | 0,020     | 1,0   | 1,0   | 45.000                                  | 2.300             | 0,026     | 0,4   | 0,4   |
|                                   | 3,0            | 45.000                                | 2.200             | 0,024     | 1,5   | 3,0   | 45.000                                | 2.500             | 0,028     | 1,5   | 1,5   | 45.000                                  | 3.200             | 0,036     | 0,6   | 0,6   |
|                                   | 4,0            | 45.000                                | 2.900             | 0,032     | 2,0   | 4,0   | 45.000                                | 3.600             | 0,040     | 2,0   | 2,0   | 45.000                                  | 4.500             | 0,050     | 0,8   | 0,8   |
|                                   | 5,0            | 45.000                                | 3.600             | 0,040     | 2,5   | 5,0   | 45.000                                | 4.500             | 0,050     | 2,5   | 2,5   | 45.000                                  | 5.400             | 0,060     | 1,0   | 1,0   |
|                                   | 6,0            | 45.000                                | 4.400             | 0,049     | 3,0   | 6,0   | 45.000                                | 5.900             | 0,066     | 3,0   | 3,0   | 45.000                                  | 6.300             | 0,070     | 1,2   | 1,2   |
|                                   | 8,0            | 45.000                                | 5.800             | 0,064     | 4,0   | 8,0   | 45.000                                | 7.200             | 0,080     | 4,0   | 4,0   | 45.000                                  | 7.700             | 0,086     | 1,6   | 1,6   |
|                                   | 10,0           | 45.000                                | 7.200             | 0,080     | 5,0   | 10,0  | 45.000                                | 7.400             | 0,082     | 5,0   | 5,0   | 45.000                                  | 7.800             | 0,087     | 2,0   | 2,0   |
|                                   | 12,0           | 45.000                                | 7.400             | 0,082     | 6,0   | 12,0  | 45.000                                | 7.800             | 0,087     | 6,0   | 6,0   | 45.000                                  | 8.200             | 0,091     | 2,4   | 2,4   |

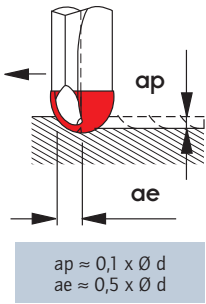
Diese Schnittdaten stehen in Abhängigkeit der Auskraglänge. Korrigieren Sie gegebenenfalls Vc + fz sowie ae und ap um ein optimales Ergebnis zu erzielen!  
This cutting data depends upon the projecting length. If neccessary correct Vc + fz as well as ae and ap for archieving an optimal result!

|                                                                                                                                                             |      |         |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|---------|
| Empfohlene Schnittdaten für DIAMANT-beschichtete Schruppfräser / HSC-Bearbeitung<br>Recommended cutting data for diamond coated solid carbide end mills HSC | Art. | 30.6591 | 30.6593 |
|                                                                                                                                                             |      | 30.6592 |         |

| d1 [mm] | 14.1<br>Vc (m/min)<br>Feine<br>Graphitkörnung | 14.2<br>Vc (m/min)<br>Mittlere<br>Graphitkörnung | 14.3<br>Vc (m/min)<br>Grobe<br>Graphitkörnung | Vf<br>(mm/min) | ap<br>(mm) | ae<br>(mm) |
|---------|-----------------------------------------------|--------------------------------------------------|-----------------------------------------------|----------------|------------|------------|
| 3       | 400                                           | 600                                              | 800                                           | 3000 - 5000    | 2          | 3          |
| 4       | 400                                           | 600                                              | 800                                           | 3500 - 5500    | 3          | 4          |
| 5       | 400                                           | 600                                              | 800                                           | 3750 - 6250    | 4          | 5          |
| 6       | 400                                           | 600                                              | 800                                           | 4000 - 7000    | 5          | 6          |
| 8       | 400                                           | 600                                              | 800                                           | 4500 - 8000    | 6          | 8          |
| 10      | 400                                           | 600                                              | 800                                           | 5000 - 8500    | 9          | 10         |
| 12      | 400                                           | 600                                              | 800                                           | 6000 - 9000    | 10         | 12         |
| 16      | 400                                           | 600                                              | 800                                           | 7000 - 10000   | 12         | 16         |

|      |         |         |         |         |                                                                                                      |
|------|---------|---------|---------|---------|------------------------------------------------------------------------------------------------------|
| Art. | 30.6522 | 30.6523 | 30.6524 | 30.6526 | Empfohlene Schnittdaten für PKD-Schaftfräser<br>Recommended cutting data for PCD-ball milling cutter |
|      | 30.6530 | 30.6531 | 30.6532 | 30.6534 |                                                                                                      |

| Material                                                                    | Vc        | Vorschub pro Zahn/Feed per tooth fz mm |                   |                   |                   |                   |                    |                     |                     |                     |
|-----------------------------------------------------------------------------|-----------|----------------------------------------|-------------------|-------------------|-------------------|-------------------|--------------------|---------------------|---------------------|---------------------|
|                                                                             |           | Ø d1<br>2,00                           | Ø d1<br>3,00-4,00 | Ø d1<br>4,00-5,00 | Ø d1<br>5,00-6,00 | Ø d1<br>6,00-8,00 | Ø d1<br>8,00-10,00 | Ø d1<br>10,00-12,00 | Ø d1<br>12,00-14,00 | Ø d1<br>14,00-20,00 |
| Kupfer-Legierung – gut zerspanbar<br>(Messing – Bronze)                     | 600-700   | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| Kupfer-Legierung – schwer zerspanbar<br>(Aluminium – Bronze) (CuAlFe/Ampco) | 400-600   | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| Aluminium-Knetlegierung –<br>Magnesiumlegierung                             | 1000-2000 | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| Aluminium-Gusslegierung                                                     | 800-1800  | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| Aluminium-Gusslegierung                                                     | 600-1200  | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| Gold, Silber                                                                | 400-750   | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| Graphit                                                                     | 600-1000  | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |
| WC und Keramik grün                                                         | 400-700   | 0,006-0,03                             | 0,010-0,04        | 0,012-0,05        | 0,016-0,06        | 0,018-0,08        | 0,025-0,10         | 0,04-0,12           | 0,04-0,15           | 0,04-0,20           |



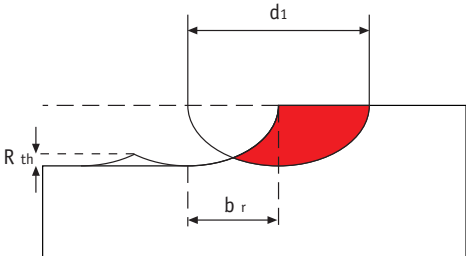
Kopierfräsen  
Copying milling

Theoret. Rauhtiefe  $R_{th}$  (in mm)  
Theoretical rough milling depth  $R_{th}$  (in mm)

$$R_{th} = \frac{d_1}{2} \cdot \sqrt{\frac{d_1^2 - b_r^2}{4}}$$

Zeilensprung  $b_r$  (in mm)  
Line spring  $b_r$  (in mm)

$$b_r = 2 \cdot \sqrt{R_{th} \cdot (d_1 - R_{th})}$$



Rauhtiefen nach DIN  
Rough milling depth as per the requirements of DIN

| $R_{max.} \leq 0,001$ | $R_{max.}$ Angabe<br>Specification | entspricht<br>$R_{\sigma}$ -Wert<br>equates $R_{\sigma}$ -value | Rauheits-<br>kennzahl<br>Roughness coefficient |
|-----------------------|------------------------------------|-----------------------------------------------------------------|------------------------------------------------|
| 71 - 10               | 100                                | 17 - 26                                                         | N11                                            |
| 50 - 71               | 71                                 | 12 - 18                                                         |                                                |
| 40 - 50               | 50                                 | 9 - 13                                                          | N10                                            |
| 31,5 - 40             | 40                                 | 6,3 - 10                                                        |                                                |
| 25 - 31,5             | 31,5                               | 5,2 - 7,6                                                       | N9                                             |
| 18 - 25               | 25                                 | 3,5 - 6                                                         |                                                |
| 12,5 - 18             | 18                                 | 2,5 - 4                                                         | N8                                             |
| 8 - 12,5              | 12,5                               | 1,5 - 2,8                                                       |                                                |
| 5 - 8                 | 8                                  | 0,8 - 1,8                                                       | N7                                             |
| 2,5 - 5               | 5                                  | 0,4 - 1                                                         | N6                                             |
| 1,4 - 2,5             | 2,5                                | 0,2 - 0,47                                                      | N5                                             |
| 0,14 - 1,4            | 1,4                                | 0,025 - 0,25                                                    | N1 - N4                                        |



Empfohlene Richtwerte zu Vollhartmetallfräsern für exotisches Material  
Recommended cutting data for solid carbide mills for exotic materials

Art. 30.7421

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material | Festigkeit<br>Strength<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min | ap max. | Ø 6,0            | Ø 8,0            | Ø 10,0           | Ø 12,0           | Ø 16/20          |  |
|-----------------------------------|-----------------------|---------------------------------------------|----------------------------------------------------------|---------|------------------|------------------|------------------|------------------|------------------|--|
|                                   |                       |                                             | Zc m/min<br>± 10%                                        |         | fz = mm<br>Z x 4 | fz = mm<br>Z x 4 | fz = mm<br>Z x 4 | fz = mm<br>Z x 4 | fz = mm<br>Z x 4 |  |
| 1.1                               | St 37 2               | < 450                                       | 250                                                      | 1,0 x D | 0,028            | 0,048            | 0,08             | 0,10             | 0,12             |  |
| 1.2                               | C 45                  | < 650                                       | 240                                                      | 1,0 x D | 0,025            | 0,045            | 0,07             | 0,09             | 0,11             |  |
| 1.3                               | 16 Cr Mo 44           | < 850                                       | 230                                                      | 1,0 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 2.1                               | 45 Ni Cr 6            | < 600                                       | 210                                                      | 1,0 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 2.2                               | 100 Cr Mo 5           | < 950                                       | 190                                                      | 1,0 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 2.3                               | 41 Cr Al Mo 7         | < 1100                                      | 170                                                      | 1,0 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 2.5                               | 34 Cr Al 6            | < 1000                                      | 190                                                      | 1,0 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 2.6                               | 31 Cr Mo V9           | > 1000                                      | 160                                                      | 1,0 x D | 0,015            | 0,030            | 0,05             | 0,07             | 0,08             |  |
| 3.1                               | X 36 Cr Mo 7          | < 700                                       | 180                                                      | 1,5 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 3.2                               | S 6-5-2               | < 1400                                      | 160                                                      | 1,5 x D | 0,020            | 0,030            | 0,05             | 0,07             | 0,09             |  |
| 4.1                               | X 6 Cr 13             | < 700                                       | 130                                                      | 1,0 x D | 0,012            | 0,025            | 0,04             | 0,05             | 0,07             |  |
| 4.2                               | X 38 Cr 13            | < 700                                       | 120                                                      | 1,0 x D | 0,012            | 0,025            | 0,04             | 0,05             | 0,07             |  |
| 4.3                               | X 2 Cr Ni Mo 17.113.2 | < 1100                                      | 100                                                      | 1,0 x D | 0,012            | 0,025            | 0,04             | 0,05             | 0,07             |  |
| 5.3                               | Monel 400             | < 1200                                      | 50                                                       | 0,5 x D | 0,010            | 0,020            | 0,03             | 0,04             | 0,05             |  |
| 5.5                               | Inconell 718          | < 1300                                      | 30                                                       | 0,5 x D | 0,010            | 0,020            | 0,03             | 0,04             | 0,05             |  |
| 6.1                               | Ti 1                  | < 850                                       | 80                                                       | 1,0 x D | 0,020            | 0,040            | 0,06             | 0,08             | 0,10             |  |
| 6.2                               | Ti Al 6 V4            | < 1200                                      | 60                                                       | 1,0 x D | 0,015            | 0,030            | 0,05             | 0,06             | 0,08             |  |
| 10.1                              | Cu Zn 39 Pb 3         | < 400                                       | 300                                                      | 1,0 x D | 0,030            | 0,040            | 0,07             | 0,10             | 0,12             |  |
| 10.2                              | Cu Zn 30              | < 400                                       | 330                                                      | 1,0 x D | 0,030            | 0,040            | 0,07             | 0,10             | 0,12             |  |
| 10.2.1                            | Cu Be 2               | < 1200                                      | 160                                                      | 1,0 x D | 0,030            | 0,040            | 0,07             | 0,10             | 0,12             |  |
| 10.3                              | Su Cu                 | < 300                                       | 300                                                      | 1,0 x D | 0,030            | 0,040            | 0,07             | 0,10             | 0,12             |  |

Empfohlene Richtwerte zu Vollhartmetallfräsern für exotisches Material  
Recommended cutting data for solid carbide mills for exotic materials

Art. 30.7486

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material |    | Ø 2    | Ø 3    | Ø 4   | Ø 5   | Ø 6   | Ø 8   | Ø 10  | Ø 12  |
|-----------------------------------|-----------------------|----|--------|--------|-------|-------|-------|-------|-------|-------|
|                                   |                       |    |        |        |       |       |       |       |       |       |
| 4.1 - 4.2 - 4.3                   | X10CrAl13             | ap | 0,10   | 0,15   | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60  |
|                                   | X8Cr14                | ae | 0,10   | 0,15   | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60  |
|                                   | 16CrMo44              | n  | 16.000 | 10.000 | 8.000 | 6.500 | 5.500 | 4.000 | 3.200 | 2.600 |
|                                   | X12CrNiMo12           | vf | 640    | 400    | 320   | 260   | 440   | 320   | 380   | 400   |
| 5.1                               | NiMo28                | ap | 0,10   | 0,15   | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60  |
| 5.2                               | Monell400             | ae | 0,10   | 0,15   | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60  |
| 5.3                               | Inconell718           | n  | 9.500  | 6.500  | 4.800 | 4.000 | 3.200 | 2.500 | 1.900 | 1.600 |
| 5.4                               |                       | vf | 400    | 260    | 200   | 190   | 180   | 200   | 220   | 160   |
| 5.5                               |                       |    |        |        |       |       |       |       |       |       |
| 6.1 - 6.2                         | TiAl6V4               | ap | 0,10   | 0,15   | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60  |
|                                   |                       | ae | 0,10   | 0,15   | 0,20  | 0,25  | 0,30  | 0,40  | 0,50  | 0,60  |
|                                   |                       | n  | 12.500 | 8.500  | 6.500 | 5.000 | 4.200 | 3.200 | 2.500 | 2.100 |
|                                   |                       | vf | 500    | 340    | 260   | 240   | 250   | 380   | 450   | 500   |

VORTEILE HSC-FRÄSEN  
ADVANTAGES FOR HSC MILLING

- 1 Verkürzung der Fräszeit um 20 bis 50%.  
Shortening of the milling time from 20 up to 50%.
- 2 Reduzierung der manuellen Nacharbeit bis zu 80%.  
Reduction of the hand retro-processing by up to 80%.

Fazit/Conclusion:  
Beim HSC-Fräsen reduziert sich die Herstellung und Durchlaufzeit um ca. 50%.  
With HSC milling the manufacturing process and through put time is reduced by approximately 50%.

Anwendungshinweis/Application instructions:

- a) Zum Schruppen und Vorschlichten verwenden Sie torische Fräser.  
Utilize toric grinders for rough cutting and pre-finishing.
- b) Zur Fertigbearbeitung/Schlichten sollten 3D-Radiusfräser eingesetzt werden.  
3D radius cutters should be utilized for finishing processes/plane processing.

Bild/Picture 1

Bohrerschnitt

Bild/Picture 2

Ziehschnitt

Bild/Picture 3

12°-15°

Bild/Picture 4

VC²=75%  
VC¹=25%

Der Ziehschnitt ist dem Bohrschnitt vorzuziehen.  
Mandrel cutting should be utilized in preference to drill cutting.

Vorzugsweise empfehlen wir einen Kippwinkel von 12°-15° um eine Zerspanung im Zentrum zu vermeiden.  
We preferably recommend tilted angle of 12°-15° so that a cutting in the middle can be avoided.

Diese Abbildung zeigt den positiven Einfluß des Kippwinkels auf die Schnittgeschwindigkeit  
VC¹= niedrigste Schnittgeschw.  
VC²= höchste Schnittgeschw.  
This illustration shows the positive influence of the tilted angle on the cutting speed  
VC¹= lowest cutting speed  
VC²= highest cutting speed

Art. 30.6632

Empfohlene Schnittwerte für CBN Eckenradiusfräser  
Recommended cutting data for CBN corner radius end mills

| Werkstoffgruppe<br>Material group | 8.1 – 8.11 – 12.0 / 45-55 HRC<br>Toolox – Hardox 400 – Stavax |                   |           |                | 8.2 – 12.1 / 55-60 HRC<br>Hardox 500 – Vanadis4 superclean |           |                |                   | 8.3 / 60-70 HRC<br>DC 53 – CPM 420V Pulverstahl |                |                   |           |
|-----------------------------------|---------------------------------------------------------------|-------------------|-----------|----------------|------------------------------------------------------------|-----------|----------------|-------------------|-------------------------------------------------|----------------|-------------------|-----------|
|                                   | D1* r l3                                                      | min <sup>-1</sup> | Vf mm/min | ap mm<br>ae mm | min <sup>-1</sup>                                          | Vf mm/min | ap mm<br>ae mm | min <sup>-1</sup> | Vf mm/min                                       | ap mm<br>ae mm | min <sup>-1</sup> | Vf mm/min |
| 0,3 0,03 x 1                      | 50.000                                                        | 300-400           | 0,01      | 0,03           | 50.000                                                     | 200-300   | 0,01           | 0,03              | 50.000                                          | 100-200        | 0,005             | 0,03      |
| 0,3 0,03 x 2                      | 50.000                                                        | 200-300           | 0,008     | 0,03           | 50.000                                                     | 150-250   | 0,008          | 0,03              | 50.000                                          | 80-150         | 0,003             | 0,03      |
| 0,4 0,04 x 1                      | 50.000                                                        | 400-500           | 0,01      | 0,04           | 50.000                                                     | 200-350   | 0,01           | 0,04              | 50.000                                          | 200-300        | 0,01              | 0,04      |
| 0,4 0,04 x 2                      | 50.000                                                        | 300-400           | 0,008     | 0,04           | 50.000                                                     | 200-250   | 0,008          | 0,04              | 50.000                                          | 150-200        | 0,01              | 0,04      |
| 0,5 0,05 x 1                      | 50.000                                                        | 600-700           | 0,015     | 0,07           | 50.000                                                     | 600-700   | 0,015          | 0,07              | 50.000                                          | 500-600        | 0,01              | 0,07      |
| 0,5 0,05 x 2                      | 50.000                                                        | 500-600           | 0,01      | 0,07           | 50.000                                                     | 500-600   | 0,01           | 0,06              | 50.000                                          | 400-500        | 0,01              | 0,06      |
| 0,5 0,05 x 3                      | 50.000                                                        | 400-500           | 0,008     | 0,07           | 50.000                                                     | 400-500   | 0,008          | 0,06              | 50.000                                          | 300-400        | 0,01              | 0,06      |
| 0,8 0,08 x 1                      | 50.000                                                        | 700-800           | 0,015     | 0,07           | 50.000                                                     | 700-800   | 0,015          | 0,07              | 50.000                                          | 500-600        | 0,012             | 0,07      |
| 0,8 0,08 x 2                      | 50.000                                                        | 600-700           | 0,01      | 0,07           | 50.000                                                     | 600-700   | 0,012          | 0,07              | 50.000                                          | 400-500        | 0,012             | 0,07      |
| 0,8 0,08 x 3                      | 50.000                                                        | 400-500           | 0,008     | 0,07           | 50.000                                                     | 400-500   | 0,012          | 0,06              | 50.000                                          | 300-400        | 0,01              | 0,06      |
| 1,0 0,10 x 1                      | 40.000                                                        | 900               | 0,03      | 0,3            | 40.000                                                     | 900       | 0,03           | 0,2               | 35.000                                          | 700            | 0,03              | 0,2       |
| 1,0 0,10 x 2                      | 40.000                                                        | 900               | 0,03      | 0,3            | 40.000                                                     | 900       | 0,03           | 0,2               | 35.000                                          | 700            | 0,03              | 0,2       |
| 1,0 0,10 x 3                      | 40.000                                                        | 800               | 0,03      | 0,3            | 40.000                                                     | 800       | 0,03           | 0,2               | 35.000                                          | 700            | 0,03              | 0,2       |
| 1,0 0,10 x 4                      | 40.000                                                        | 800               | 0,03      | 0,3            | 40.000                                                     | 800       | 0,03           | 0,2               | 35.000                                          | 600            | 0,03              | 0,2       |
| 1,0 0,10 x 5                      | 40.000                                                        | 700               | 0,02      | 0,2            | 40.000                                                     | 700       | 0,03           | 0,2               | 35.000                                          | 600            | 0,03              | 0,2       |
| 1,0 0,10 x 6                      | 40.000                                                        | 700               | 0,02      | 0,2            | 40.000                                                     | 700       | 0,03           | 0,2               | 35.000                                          | 600            | 0,03              | 0,2       |
| 1,2 0,12 x 2                      | 40.000                                                        | 900               | 0,03      | 0,3            | 40.000                                                     | 900       | 0,03           | 0,3               | 35.000                                          | 700            | 0,03              | 0,3       |
| 1,2 0,12 x 3                      | 40.000                                                        | 900               | 0,03      | 0,3            | 40.000                                                     | 900       | 0,03           | 0,3               | 35.000                                          | 700            | 0,03              | 0,3       |
| 1,2 0,12 x 4                      | 40.000                                                        | 900               | 0,03      | 0,3            | 40.000                                                     | 900       | 0,03           | 0,3               | 35.000                                          | 700            | 0,03              | 0,3       |
| 1,2 0,12 x 5                      | 40.000                                                        | 900               | 0,03      | 0,3            | 40.000                                                     | 900       | 0,03           | 0,3               | 35.000                                          | 700            | 0,03              | 0,3       |
| 1,2 0,12 x 6                      | 40.000                                                        | 800               | 0,03      | 0,3            | 40.000                                                     | 800       | 0,03           | 0,3               | 35.000                                          | 600            | 0,03              | 0,3       |
| 1,5 0,15 x 2                      | 30.000                                                        | 900               | 0,04      | 0,5            | 30.000                                                     | 900       | 0,04           | 0,5               | 25.000                                          | 800            | 0,04              | 0,5       |
| 1,5 0,15 x 3                      | 30.000                                                        | 900               | 0,04      | 0,5            | 30.000                                                     | 900       | 0,04           | 0,5               | 25.000                                          | 800            | 0,04              | 0,5       |
| 1,5 0,15 x 4                      | 30.000                                                        | 900               | 0,04      | 0,5            | 30.000                                                     | 900       | 0,04           | 0,5               | 25.000                                          | 800            | 0,04              | 0,5       |
| 1,5 0,15 x 5                      | 30.000                                                        | 900               | 0,04      | 0,5            | 30.000                                                     | 900       | 0,04           | 0,5               | 25.000                                          | 800            | 0,04              | 0,5       |
| 1,5 0,15 x 6                      | 30.000                                                        | 900               | 0,04      | 0,4            | 30.000                                                     | 800       | 0,04           | 0,4               | 25.000                                          | 700            | 0,04              | 0,4       |
| 1,5 0,15 x 7                      | 30.000                                                        | 800               | 0,04      | 0,4            | 30.000                                                     | 800       | 0,04           | 0,4               | 25.000                                          | 700            | 0,04              | 0,4       |
| 1,5 0,15 x 8                      | 30.000                                                        | 800               | 0,04      | 0,4            | 30.000                                                     | 800       | 0,04           | 0,4               | 25.000                                          | 700            | 0,04              | 0,4       |
| 2,0 0,20 x 2                      | 20.000                                                        | 900               | 0,08-0,15 | 0,6            | 20.000                                                     | 900       | 0,06-0,12      | 0,5               | 15.000                                          | 800            | 0,05-0,10         | 0,5       |
| 2,0 0,20 x 3                      | 20.000                                                        | 900               | 0,08-0,15 | 0,6            | 20.000                                                     | 900       | 0,06-0,12      | 0,5               | 15.000                                          | 800            | 0,05-0,10         | 0,5       |
| 2,0 0,20 x 4                      | 20.000                                                        | 900               | 0,08-0,15 | 0,6            | 20.000                                                     | 900       | 0,06-0,12      | 0,5               | 15.000                                          | 800            | 0,05-0,10         | 0,5       |
| 2,0 0,20 x 5                      | 20.000                                                        | 900               | 0,08-0,15 | 0,6            | 20.000                                                     | 900       | 0,06-0,12      | 0,5               | 15.000                                          | 800            | 0,05-0,10         | 0,5       |
| 2,0 0,20 x 6                      | 20.000                                                        | 900               | 0,08-0,15 | 0,6            | 20.000                                                     | 900       | 0,06-0,12      | 0,5               | 15.000                                          | 800            | 0,05-0,10         | 0,5       |
| 2,0 0,20 x 7                      | 20.000                                                        | 900               | 0,08-0,15 | 0,6            | 20.000                                                     | 900       | 0,06-0,12      | 0,5               | 15.000                                          | 600            | 0,05-0,10         | 0,4       |
| 2,0 0,20 x 8                      | 20.000                                                        | 700               | 0,08-0,15 | 0,5            | 20.000                                                     | 700       | 0,06-0,12      | 0,4               | 15.000                                          | 600            | 0,05-0,10         | 0,4       |
| 2,0 0,20 x 9                      | 20.000                                                        | 700               | 0,08-0,15 | 0,5            | 20.000                                                     | 700       | 0,06-0,12      | 0,4               | 15.000                                          | 600            | 0,05-0,10         | 0,4       |
| 2,0 0,20 x 10                     | 20.000                                                        | 700               | 0,08-0,15 | 0,5            | 20.000                                                     | 700       | 0,06-0,12      | 0,4               | 15.000                                          | 600            | 0,05-0,10         | 0,4       |
| 2,0 0,20 x 12                     | 20.000                                                        | 600               | 0,08-0,15 | 0,4            | 20.000                                                     | 600       | 0,06-0,12      | 0,3               | 15.000                                          | 500            | 0,05-0,10         | 0,3       |

Art. 30.6228

Empfohlene Schnittwerte für Karnasch HPC- und Alu- Fräser  
Recommended cutting data for Karnasch high performance alu end mills

| Werkstoffgruppe<br>Material group | 9.1<br>AL Mg 1 |                    | 9.2<br>Al Cu Bi Pb |                    | 9.3<br>Al Si 6     |                    | 10.1 / 10.2<br>Cu Zin 39 Pb / Cu Zn 30 |                    | 10.3<br>E Cu 57    |                    | 11.1<br>PMMA       |                    |
|-----------------------------------|----------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                                   | D1* l3         | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm                     | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm | Vc mm/min<br>fz/mm |
| 2,0 6                             | 500            | 0,020              | 500                | 0,025              | 240                | 0,020              | 250                                    | 0,020              | 200                | 0,020              | 500                | 0,020              |
| 3,0 10                            | 500            | 0,030              | 500                | 0,035              | 240                | 0,030              | 250                                    | 0,020              | 200                | 0,020              | 500                | 0,030              |
| 4,0 14                            | 500            | 0,040              | 500                | 0,030              | 240                | 0,020              | 250                                    | 0,020              | 200                | 0,020              | 500                | 0,040              |
| 5,0 16                            | 500            | 0,040              | 500                | 0,040              | 240                | 0,025              | 250                                    | 0,030              | 200                | 0,025              | 500                | 0,040              |
| 6,0 20                            | 500            | 0,050              | 500                | 0,050              | 240                | 0,04               | 250                                    | 0,040              | 200                | 0,030              | 500                | 0,050              |
| 6,0 30                            | 400            | 0,050              | 400                | 0,050              | 200                | 0,04               | 200                                    | 0,040              | 180                | 0,030              | 400                | 0,050              |
| 6,0 40                            | 300            | 0,050              | 300                | 0,050              | 160                | 0,04               | 150                                    | 0,040              | 160                | 0,030              | 300                | 0,050              |
| 8,0 35                            | 500            | 0,060              | 500                | 0,060              | 240                | 0,05               | 250                                    | 0,040              | 200                | 0,040              | 500                | 0,060              |
| 8,0 45                            | 400            | 0,060              | 400                | 0,060              | 200                | 0,05               | 200                                    | 0,040              | 180                | 0,040              | 400                | 0,060              |
| 8,0 55                            | 300            | 0,060              | 300                | 0,060              | 160                | 0,05               | 150                                    | 0,040              | 160                | 0,040              | 300                | 0,060              |
| 10,0 35                           | 500            | 0,065              | 500                | 0,065              | 240                | 0,06               | 250                                    | 0,050              | 200                | 0,050              | 500                | 0,065              |
| 10,0 45                           | 400            | 0,065              | 400                | 0,065              | 200                | 0,06               | 200                                    | 0,050              | 180                | 0,050              | 400                | 0,065              |
| 10,0 55                           | 300            | 0,065              | 300                | 0,065              | 160                | 0,06               | 150                                    | 0,050              | 160                | 0,050              | 300                | 0,065              |
| 12,0 35                           | 500            | 0,070              | 500                | 0,070              | 240                | 0,07               | 250                                    | 0,060              | 200                | 0,060              | 500                | 0,070              |
| 12,0 55                           | 400            | 0,070              | 400                | 0,070              | 200                | 0,07               | 200                                    | 0,060              | 180                | 0,060              | 400                | 0,070              |
| 12,0 70                           | 300            | 0,070              | 300                | 0,070              | 160                | 0,07               | 150                                    | 0,060              | 160                | 0,060              | 300                | 0,070              |

ae = Ø < 4mm max 1,0 x D

ap = Ø < 4mm max 0,5 x D

ae = Ø > 4mm max 1,0 x D

ap = Ø > 4mm max 1,0 x D

Empfohlene Schnittdaten für Karnasch CBN-Radiusfräser  
Recommended cutting data for Karnasch CBN ball nose mills

Art. 30.6633

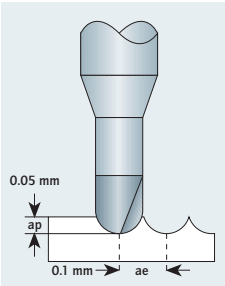
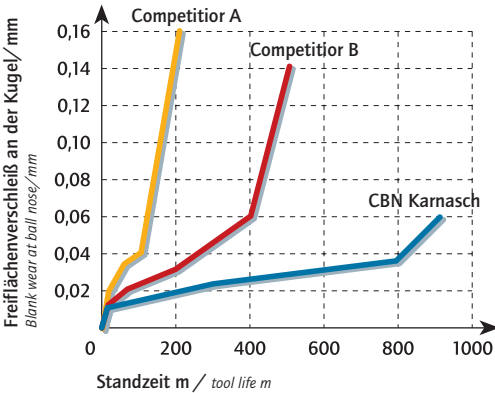
| Werkstoffgruppe<br>Material group | d1   | I <sub>3</sub> | 8.1 - 8.11 - 12.0 / 45-55 HRC<br>Toolox - Hardox 400 - Stavax |           |       |       | 8.2 - 12.1 / 55-60 HRC<br>Hardox 500 - Vanadis4 superclean |           |       |       | 8.3 / 60-70 HRC<br>DC 53 - CPM 420V Pulverstahl |           |       |       |
|-----------------------------------|------|----------------|---------------------------------------------------------------|-----------|-------|-------|------------------------------------------------------------|-----------|-------|-------|-------------------------------------------------|-----------|-------|-------|
|                                   |      |                | min <sup>-1</sup>                                             | Vf mm/min | ap mm | ae mm | min <sup>-1</sup>                                          | Vf mm/min | ap mm | ae mm | min <sup>-1</sup>                               | Vf mm/min | ap mm | ae mm |
| 0,2 x                             | 0,6  |                | 50.000                                                        | 500       | 0,005 | 0,005 | 50.000                                                     | 400       | 0,005 | 0,005 | 50.000                                          | 300       | 0,003 | 0,003 |
| 0,2 x                             | 1,2  |                | 50.000                                                        | 300       | 0,005 | 0,005 | 50.000                                                     | 250       | 0,005 | 0,005 | 50.000                                          | 120       | 0,003 | 0,003 |
| 0,3 x                             | 1,0  |                | 50.000                                                        | 800       | 0,005 | 0,005 | 50.000                                                     | 450       | 0,005 | 0,005 | 50.000                                          | 350       | 0,003 | 0,005 |
| 0,3 x                             | 2,0  |                | 50.000                                                        | 500       | 0,005 | 0,005 | 50.000                                                     | 300       | 0,005 | 0,005 | 50.000                                          | 250       | 0,003 | 0,005 |
| 0,4 x                             | 1,0  |                | 50.000                                                        | 1.200     | 0,005 | 0,010 | 50.000                                                     | 800       | 0,005 | 0,010 | 50.000                                          | 600       | 0,005 | 0,005 |
| 0,4 x                             | 2,0  |                | 50.000                                                        | 600       | 0,005 | 0,010 | 50.000                                                     | 600       | 0,005 | 0,010 | 50.000                                          | 400       | 0,005 | 0,005 |
| 0,4 x                             | 3,0  |                | 50.000                                                        | 400       | 0,005 | 0,010 | 50.000                                                     | 400       | 0,005 | 0,010 | 50.000                                          | 300       | 0,005 | 0,005 |
| 0,4 x                             | 4,0  |                | 50.000                                                        | 200       | 0,005 | 0,010 | 50.000                                                     | 200       | 0,005 | 0,010 | 50.000                                          | 200       | 0,005 | 0,005 |
| 0,5 x                             | 1,0  |                | 50.000                                                        | 1.600     | 0,010 | 0,010 | 50.000                                                     | 1.300     | 0,010 | 0,010 | 50.000                                          | 900       | 0,005 | 0,010 |
| 0,5 x                             | 2,0  |                | 50.000                                                        | 900       | 0,010 | 0,010 | 50.000                                                     | 800       | 0,010 | 0,010 | 50.000                                          | 700       | 0,005 | 0,008 |
| 0,5 x                             | 3,0  |                | 50.000                                                        | 700       | 0,010 | 0,010 | 50.000                                                     | 600       | 0,010 | 0,010 | 50.000                                          | 400       | 0,005 | 0,008 |
| 0,5 x                             | 4,0  |                | 50.000                                                        | 500       | 0,010 | 0,010 | 50.000                                                     | 400       | 0,010 | 0,010 | 50.000                                          | 200       | 0,005 | 0,008 |
| 0,5 x                             | 5,0  |                | 50.000                                                        | 300       | 0,010 | 0,010 | 50.000                                                     | 200       | 0,010 | 0,010 | 50.000                                          | 100       | 0,005 | 0,008 |
| 0,6 x                             | 2,0  |                | 50.000                                                        | 1.800     | 0,010 | 0,020 | 50.000                                                     | 1.400     | 0,010 | 0,020 | 50.000                                          | 1.100     | 0,010 | 0,010 |
| 0,6 x                             | 3,0  |                | 40.000                                                        | 1.600     | 0,010 | 0,020 | 40.000                                                     | 1.200     | 0,010 | 0,020 | 40.000                                          | 900       | 0,010 | 0,010 |
| 0,6 x                             | 4,0  |                | 30.000                                                        | 1.200     | 0,010 | 0,010 | 30.000                                                     | 900       | 0,010 | 0,010 | 30.000                                          | 700       | 0,005 | 0,005 |
| 0,6 x                             | 5,0  |                | 30.000                                                        | 800       | 0,010 | 0,010 | 30.000                                                     | 700       | 0,005 | 0,010 | 30.000                                          | 500       | 0,005 | 0,005 |
| 0,6 x                             | 6,0  |                | 30.000                                                        | 600       | 0,010 | 0,010 | 30.000                                                     | 500       | 0,005 | 0,005 | 30.000                                          | 300       | 0,005 | 0,005 |
| 0,8 x                             | 2,0  |                | 50.000                                                        | 2.000     | 0,030 | 0,050 | 50.000                                                     | 1.500     | 0,030 | 0,050 | 50.000                                          | 1.300     | 0,030 | 0,050 |
| 0,8 x                             | 3,0  |                | 50.000                                                        | 1.800     | 0,020 | 0,040 | 50.000                                                     | 1.200     | 0,030 | 0,050 | 50.000                                          | 1.100     | 0,020 | 0,040 |
| 0,8 x                             | 4,0  |                | 40.000                                                        | 1.500     | 0,010 | 0,030 | 40.000                                                     | 1.000     | 0,020 | 0,030 | 40.000                                          | 900       | 0,020 | 0,030 |
| 0,8 x                             | 5,0  |                | 30.000                                                        | 1.200     | 0,010 | 0,020 | 30.000                                                     | 800       | 0,010 | 0,020 | 30.000                                          | 700       | 0,010 | 0,020 |
| 0,8 x                             | 6,0  |                | 30.000                                                        | 900       | 0,010 | 0,010 | 30.000                                                     | 700       | 0,010 | 0,010 | 30.000                                          | 600       | 0,010 | 0,010 |
| 0,8 x                             | 7,0  |                | 30.000                                                        | 700       | 0,010 | 0,010 | 30.000                                                     | 600       | 0,005 | 0,010 | 30.000                                          | 500       | 0,005 | 0,008 |
| 0,8 x                             | 8,0  |                | 30.000                                                        | 500       | 0,005 | 0,005 | 30.000                                                     | 500       | 0,005 | 0,008 | 30.000                                          | 400       | 0,005 | 0,005 |
| 1,0 x                             | 2,0  |                | 50.000                                                        | 2.800     | 0,050 | 0,050 | 50.000                                                     | 2.500     | 0,030 | 0,050 | 50.000                                          | 2.300     | 0,020 | 0,030 |
| 1,0 x                             | 3,0  |                | 50.000                                                        | 2.700     | 0,050 | 0,050 | 50.000                                                     | 2.200     | 0,030 | 0,050 | 50.000                                          | 2.000     | 0,020 | 0,003 |
| 1,0 x                             | 4,0  |                | 45.000                                                        | 2.400     | 0,030 | 0,050 | 45.000                                                     | 2.400     | 0,020 | 0,030 | 45.000                                          | 1.500     | 0,020 | 0,020 |
| 1,0 x                             | 5,0  |                | 40.000                                                        | 2.000     | 0,020 | 0,050 | 40.000                                                     | 2.000     | 0,020 | 0,030 | 40.000                                          | 1.200     | 0,010 | 0,020 |
| 1,0 x                             | 6,0  |                | 30.000                                                        | 1.500     | 0,020 | 0,030 | 30.000                                                     | 1.600     | 0,010 | 0,020 | 30.000                                          | 1.000     | 0,010 | 0,010 |
| 1,0 x                             | 7,0  |                | 25.000                                                        | 1.400     | 0,010 | 0,030 | 25.000                                                     | 1.200     | 0,010 | 0,020 | 25.000                                          | 900       | 0,010 | 0,010 |
| 1,0 x                             | 8,0  |                | 20.000                                                        | 1.200     | 0,010 | 0,030 | 20.000                                                     | 1.000     | 0,010 | 0,020 | 20.000                                          | 800       | 0,010 | 0,010 |
| 1,0 x                             | 9,0  |                | 15.000                                                        | 1.000     | 0,010 | 0,020 | 15.000                                                     | 800       | 0,005 | 0,010 | 15.000                                          | 700       | 0,005 | 0,008 |
| 1,0 x                             | 10,0 |                | 12.000                                                        | 800       | 0,010 | 0,020 | 12.000                                                     | 700       | 0,005 | 0,008 | 12.000                                          | 600       | 0,005 | 0,005 |
| 1,2 x                             | 2,0  |                | 48.000                                                        | 2.500     | 0,050 | 0,050 | 48.000                                                     | 2.500     | 0,030 | 0,050 | 48.000                                          | 2.300     | 0,020 | 0,030 |
| 1,2 x                             | 3,0  |                | 45.000                                                        | 2.400     | 0,030 | 0,050 | 45.000                                                     | 2.400     | 0,020 | 0,030 | 45.000                                          | 2.000     | 0,020 | 0,020 |
| 1,2 x                             | 4,0  |                | 42.000                                                        | 2.300     | 0,020 | 0,050 | 42.000                                                     | 2.300     | 0,020 | 0,030 | 42.000                                          | 1.500     | 0,010 | 0,020 |
| 1,2 x                             | 5,0  |                | 40.000                                                        | 2.200     | 0,020 | 0,050 | 40.000                                                     | 2.000     | 0,020 | 0,030 | 40.000                                          | 1.200     | 0,010 | 0,020 |
| 1,2 x                             | 6,0  |                | 38.000                                                        | 2.100     | 0,020 | 0,030 | 38.000                                                     | 1.600     | 0,010 | 0,020 | 38.000                                          | 1.000     | 0,010 | 0,010 |
| 1,2 x                             | 7,0  |                | 35.000                                                        | 2.000     | 0,020 | 0,030 | 35.000                                                     | 1.500     | 0,010 | 0,020 | 35.000                                          | 900       | 0,010 | 0,010 |
| 1,2 x                             | 8,0  |                | 32.000                                                        | 1.800     | 0,020 | 0,030 | 32.000                                                     | 1.200     | 0,010 | 0,020 | 32.000                                          | 800       | 0,010 | 0,010 |
| 1,2 x                             | 10,0 |                | 30.000                                                        | 1.500     | 0,010 | 0,020 | 30.000                                                     | 800       | 0,005 | 0,010 | 30.000                                          | 700       | 0,005 | 0,008 |
| 1,2 x                             | 12,0 |                | 28.000                                                        | 1.000     | 0,010 | 0,010 | 28.000                                                     | 700       | 0,005 | 0,008 | 28.000                                          | 500       | 0,005 | 0,005 |
| 1,5 x                             | 4,0  |                | 50.000                                                        | 4.000     | 0,050 | 0,100 | 50.000                                                     | 4.000     | 0,050 | 0,050 | 50.000                                          | 3.000     | 0,020 | 0,050 |
| 1,5 x                             | 6,0  |                | 40.000                                                        | 3.000     | 0,030 | 0,050 | 40.000                                                     | 2.500     | 0,040 | 0,040 | 40.000                                          | 2.000     | 0,010 | 0,030 |
| 1,5 x                             | 8,0  |                | 35.000                                                        | 2.000     | 0,020 | 0,030 | 35.000                                                     | 1.700     | 0,010 | 0,030 | 35.000                                          | 1.200     | 0,010 | 0,010 |
| 1,5 x                             | 10,0 |                | 32.000                                                        | 1.500     | 0,020 | 0,020 | 32.000                                                     | 1.200     | 0,010 | 0,020 | 32.000                                          | 800       | 0,005 | 0,010 |
| 1,5 x                             | 12,0 |                | 28.000                                                        | 1.200     | 0,010 | 0,020 | 28.000                                                     | 1.000     | 0,010 | 0,010 | 28.000                                          | 600       | 0,005 | 0,008 |
| 1,5 x                             | 15,0 |                | 25.000                                                        | 800       | 0,010 | 0,010 | 25.000                                                     | 700       | 0,010 | 0,005 | 25.000                                          | 500       | 0,005 | 0,005 |
| 2,0 x                             | 2,0  |                | 50.000                                                        | 5.000     | 0,120 | 0,120 | 50.000                                                     | 4.500     | 0,100 | 0,100 | 50.000                                          | 4.000     | 0,070 | 0,070 |
| 2,0 x                             | 3,0  |                | 50.000                                                        | 4.000     | 0,100 | 0,100 | 50.000                                                     | 4.500     | 0,070 | 0,070 | 50.000                                          | 3.500     | 0,050 | 0,050 |
| 2,0 x                             | 4,0  |                | 50.000                                                        | 4.000     | 0,100 | 0,100 | 50.000                                                     | 4.000     | 0,050 | 0,050 | 50.000                                          | 3.000     | 0,030 | 0,050 |
| 2,0 x                             | 5,0  |                | 50.000                                                        | 4.000     | 0,100 | 0,100 | 50.000                                                     | 3.800     | 0,050 | 0,050 | 50.000                                          | 2.800     | 0,030 | 0,050 |
| 2,0 x                             | 6,0  |                | 40.000                                                        | 4.000     | 0,050 | 0,080 | 40.000                                                     | 3.500     | 0,030 | 0,030 | 40.000                                          | 2.500     | 0,020 | 0,030 |
| 2,0 x                             | 8,0  |                | 35.000                                                        | 3.000     | 0,030 | 0,050 | 35.000                                                     | 2.500     | 0,020 | 0,030 | 35.000                                          | 1.800     | 0,010 | 0,020 |
| 2,0 x                             | 10,0 |                | 25.000                                                        | 2.000     | 0,020 | 0,030 | 25.000                                                     | 1.500     | 0,010 | 0,030 | 25.000                                          | 1.200     | 0,010 | 0,020 |
| 2,0 x                             | 12,0 |                | 20.000                                                        | 1.500     | 0,020 | 0,030 | 20.000                                                     | 1.200     | 0,010 | 0,030 | 20.000                                          | 1.000     | 0,010 | 0,020 |
| 2,0 x                             | 15,0 |                | 18.000                                                        | 1.000     | 0,010 | 0,020 | 18.000                                                     | 900       | 0,010 | 0,020 | 18.000                                          | 800       | 0,010 | 0,010 |
| 2,0 x                             | 18,0 |                | 15.000                                                        | 800       | 0,010 | 0,010 | 15.000                                                     | 800       | 0,010 | 0,010 | 15.000                                          | 600       | 0,008 | 0,008 |
| 2,0 x                             | 20,0 |                | 12.000                                                        | 600       | 0,008 | 0,008 | 12.000                                                     | 500       | 0,008 | 0,008 | 12.000                                          | 400       | 0,005 | 0,005 |
| 3,0 x                             | 5,0  |                | 40.000                                                        | 5.000     | 0,150 | 0,150 | 40.000                                                     | 4.000     | 0,100 | 0,100 | 40.000                                          | 3.000     | 0,080 | 0,080 |
| 3,0 x                             | 8,0  |                | 30.000                                                        | 4.000     | 0,100 | 0,100 | 30.000                                                     | 3.000     | 0,080 | 0,080 | 30.000                                          | 2.000     | 0,060 | 0,060 |
| 3,0 x                             | 10,0 |                | 22.000                                                        | 3.000     | 0,050 | 0,050 | 22.000                                                     | 2.000     | 0,040 | 0,040 | 22.000                                          | 1.500     | 0,040 | 0,040 |
| 3,0 x                             | 15,0 |                | 15.000                                                        | 1.500     | 0,030 | 0,050 | 15.000                                                     | 1.000     | 0,030 | 0,030 | 15.000                                          | 1.000     | 0,030 | 0,030 |
| 3,0 x                             | 20,0 |                | 10.000                                                        | 1.000     | 0,010 | 0,020 | 10.000                                                     | 800       | 0,020 | 0,020 | 10.000                                          | 800       | 0,020 | 0,020 |

Vergleichstest:

Wettbewerb A: Vollhartmetall  
Competitor A: carbide

Wettbewerb B: CBN  
Competitor B: CBN

CBN-Karnasch 30.6633  
CBN-Karnasch 30.6633



|                    |                                                                |
|--------------------|----------------------------------------------------------------|
| Art. 30.6633       | CBN Ø 2,0 x l3 = 4                                             |
| Werkstoff/material | SKD11 (62HRC)                                                  |
| Drehzahl/speed     | 20.000 min <sup>-1</sup> (40m/min)                             |
| Vorschub/feed      | 1,700 mm/min                                                   |
| Kühlung/Coolant    | Luft / air                                                     |
| Maschine/machine   | Vertikal BAZ / HSKE32<br>Vertical machining center /<br>HSKE32 |

| Werkstoffgruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                                                                                  |                     | d1=2mm   | d1=3mm   | d1=4mm  | d1=5mm   | d1=6mm   | d1=8mm  | d1=10mm | d1=12mm |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------|----------|---------|----------|----------|---------|---------|---------|
| 4.1                               | 3.7024-3.7025<br>3.7034-3.7035<br>3.7055-3.7064<br>Reintitan                                                                                                                                                                                                                                                                        | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 217   | vc 170   | vc 170  | vc 162   | vc 172   | vc 163  | vc 185  | vc 207  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 34500  | n 18100  | n 13500 | n 10300  | n 9100   | n 6500  | n 5900  | n 5500  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,015 | fz 0,03  | fz 0,04 | fz 0,02  | fz 0,025 | fz 0,05 | fz 0,06 | fz 0,07 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 2070  | vf 2172  | vf 2160 | vf 824   | vf 910   | vf 1300 | vf 1416 | vf 1540 |
| 4.2                               | 3.7105-3.7115<br>3.7124-3.7184<br>Titan < 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                     | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 60    | vc 60    | vc 60   | vc 60    | vc 63    | vc 60   | vc 69   | vc 75   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 9600   | n 6400   | n 4800  | n 3800   | n 3350   | n 2400  | n 2200  | n 2000  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,03 | fz 0,015 | fz 0,02  | fz 0,03 | fz 0,04 | fz 0,05 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 384   | vf 640   | vf 576  | vf 228   | vf 268   | vf 288  | vf 352  | vf 400  |
| 4.3                               | 3.7154-3.7164<br>3.7124<br>Titan > 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                            | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 47    | vc 48    | vc 48   | vc 46    | vc 49    | vc 48   | vc 53   | vc 60   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 7500   | n 5100   | n 3800  | n 2900   | n 2600   | n 1900  | n 1700  | n 1600  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,03 | fz 0,015 | fz 0,02  | fz 0,03 | fz 0,04 | fz 0,05 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 300   | vf 510   | vf 456  | vf 174   | vf 208   | vf 228  | vf 272  | vf 320  |
| 5.1                               | 1.3911-1.3926<br>1.3927<br>Nickel 100%                                                                                                                                                                                                                                                                                              | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 248   | vc 248   | vc 248  | vc 242   | vc 258   | vc 246  | vc 280  | vc 313  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 39400  | n 26400  | n 19700 | n 15400  | n 13700  | n 9800  | n 8900  | n 8300  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,04 | fz 0,02  | fz 0,025 | fz 0,05 | fz 0,06 | fz 0,07 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 1576  | vf 2640  | vf 3152 | vf 1232  | vf 1370  | vf 1960 | vf 2136 | vf 2324 |
| 5.2                               | 1.3912-1.3981<br>Nickellegierung<br>< 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                         | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 50    | vc 50    | vc 50   | vc 49    | vc 53    | vc 50   | vc 57   | vc 64   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 7900   | n 5300   | n 4000  | n 3100   | n 2800   | n 2000  | n 1800  | n 1700  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,03 | fz 0,015 | fz 0,02  | fz 0,03 | fz 0,04 | fz 0,05 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 316   | vf 530   | vf 480  | vf 186   | vf 224   | vf 240  | vf 288  | vf 340  |
| 5.3                               | 1.3913-1.3915-1.3916<br>1.3917-1.3918-1.3920<br>1.3921-1.3922-1.3923<br>1.3924-1.3928-2.4360<br>2.4375-2.4602-2.4630<br>2.4631-2.4634-2.4636<br>2.4642-2.4650-2.4654<br>2.4662-2.4665-2.4668<br>2.4669-2.4672-2.4674<br>2.4676-2.4816-2.4851<br>2.4856-2.4858-2.4916<br>2.4973-2.4983<br>Nickellegierung<br>> 900 N/mm <sup>2</sup> | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 29    | vc 29    | vc 29   | vc 28    | vc 30    | vc 30   | vc 35   | vc 38   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 4600   | n 3100   | n 2300  | n 1800   | n 1600   | n 1200  | n 1100  | n 1000  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,03 | fz 0,015 | fz 0,02  | fz 0,03 | fz 0,04 | fz 0,05 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 184   | vf 310   | vf 276  | vf 108   | vf 128   | vf 144  | vf 176  | vf 200  |
|                                   | 2.4633<br>Nickellegierung<br>> 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                                | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 20    | vc 20    | vc 20   | vc 20    | vc 21    | vc 20   | vc 24   | vc 26   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 3200   | n 2150   | n 1600  | n 1300   | n 1100   | n 800   | n 750   | n 700   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,03 | fz 0,015 | fz 0,02  | fz 0,03 | fz 0,04 | fz 0,05 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 128   | vf 215   | vf 192  | vf 78    | vf 88    | vf 96   | vf 120  | vf 140  |
|                                   | 2.4670-2.4672<br>2.4674<br>Nickellegierung<br>> 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                               | ae mm               | ae 1     | ae 1,5   | ae 2    | ae 2,5   | ae 3     | ae 4    | ae 5    | ae 6    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap 0,25  | ap 0,3   | ap 0,5  | ap 1,25  | ap 1,5   | ap 2    | ap 2,5  | ap 3    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc 26    | vc 26    | vc 26   | vc 25    | vc 28    | vc 25   | vc 30   | vc 34   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n 4100   | n 2800   | n 2100  | n 1600   | n 1500   | n 1000  | n 950   | n 900   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz 0,01  | fz 0,025 | fz 0,03 | fz 0,015 | fz 0,02  | fz 0,03 | fz 0,04 | fz 0,05 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf 164   | vf 280   | vf 252  | vf 96    | vf 120   | vf 120  | vf 152  | vf 180  |



Empfohlene Richtwerte für 3D-Radiusfräser "FOURWIN"  
Recommended cutting data for solid carbide 3D-ball nose end mill "FOURWIN"

TITAN

Schlichten  
Finishing

Art. 30.7485

| Werkstoffgruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                                                                                  |                     | d1=2mm |       | d1=3mm |       | d1=4mm |       | d1=5mm |       | d1=6mm |       | d1=8mm |       | d1=10mm |       | d1=12mm |       |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|---------|-------|---------|-------|
| 4.1                               | 3.7024-3.7025<br>3.7034-3.7035<br>3.7055-3.7064<br>Reintitan                                                                                                                                                                                                                                                                        | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 302   | vc     | 291   | vc     | 303   | vc     | 317   | vc     | 337   | vc     | 322   | vc      | 364   | vc      | 407   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 48100 | n      | 30900 | n      | 24100 | n      | 20200 | n      | 17900 | n      | 12800 | n       | 11600 | n       | 10800 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,05  | fz     | 0,08  | fz     | 0,115 | fz     | 0,07  | fz     | 0,1   | fz     | 0,16  | fz      | 0,18  | fz      | 0,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 9620  | vf     | 9888  | vf     | 11086 | vf     | 5656  | vf     | 7160  | vf     | 8192  | vf      | 8352  | vf      | 8640  |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
| 4.2                               | 3.7105-3.7115<br>3.7124-3.7184<br>Titan < 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                     | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 121   | vc     | 117   | vc     | 121   | vc     | 127   | vc     | 136   | vc     | 128   | vc      | 148   | vc      | 162   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 19200 | n      | 12400 | n      | 9600  | n      | 8100  | n      | 7200  | n      | 5100  | n       | 4700  | n       | 4300  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,045 | fz     | 0,08  | fz     | 0,1   | fz     | 0,055 | fz     | 0,07  | fz     | 0,12  | fz      | 0,15  | fz      | 0,19  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 3456  | vf     | 3968  | vf     | 3840  | vf     | 1782  | vf     | 2016  | vf     | 2448  | vf      | 2820  | vf      | 3268  |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
| 4.3                               | 3.7154-3.7164<br>3.7124<br>Titan > 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                            | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 94    | vc     | 91    | vc     | 94    | vc     | 99    | vc     | 106   | vc     | 101   | vc      | 113   | vc      | 128   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 15000 | n      | 9600  | n      | 7500  | n      | 6300  | n      | 5600  | n      | 4000  | n       | 3600  | n       | 3400  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,045 | fz     | 0,08  | fz     | 0,1   | fz     | 0,055 | fz     | 0,07  | fz     | 0,12  | fz      | 0,15  | fz      | 0,19  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 2700  | vf     | 3072  | vf     | 3000  | vf     | 1386  | vf     | 1568  | vf     | 1920  | vf      | 2160  | vf      | 2584  |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
| 5.1                               | 1.3911-1.3926<br>1.3927<br>Nickel 100%                                                                                                                                                                                                                                                                                              | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 415   | vc     | 401   | vc     | 415   | vc     | 435   | vc     | 464   | vc     | 440   | vc      | 503   | vc      | 566   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 66000 | n      | 42500 | n      | 33000 | n      | 27700 | n      | 24600 | n      | 17500 | n       | 16000 | n       | 15000 |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,05  | fz     | 0,08  | fz     | 0,115 | fz     | 0,07  | fz     | 0,1   | fz     | 0,16  | fz      | 0,18  | fz      | 0,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 13200 | vf     | 13600 | vf     | 15180 | vf     | 7756  | vf     | 9840  | vf     | 11200 | vf      | 11520 | vf      | 12000 |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
| 5.2                               | 1.3912-1.3981<br>Nickellegierung<br>< 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                         | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 91    | vc     | 88    | vc     | 91    | vc     | 96    | vc     | 102   | vc     | 98    | vc      | 110   | vc      | 124   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 14500 | n      | 9300  | n      | 7200  | n      | 6100  | n      | 5400  | n      | 3900  | n       | 3500  | n       | 3300  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,045 | fz     | 0,08  | fz     | 0,1   | fz     | 0,055 | fz     | 0,07  | fz     | 0,12  | fz      | 0,15  | fz      | 0,19  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 2610  | vf     | 2976  | vf     | 2880  | vf     | 1342  | vf     | 1512  | vf     | 1872  | vf      | 2100  | vf      | 2508  |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
| 5.3                               | 1.3913-1.3915-1.3916<br>1.3917-1.3918-1.3920<br>1.3921-1.3922-1.3923<br>1.3924-1.3928-2.4360<br>2.4375-2.4602-2.4630<br>2.4631-2.4634-2.4636<br>2.4642-2.4650-2.4654<br>2.4662-2.4665-2.4668<br>2.4669-2.4672-2.4674<br>2.4676-2.4816-2.4851<br>2.4856-2.4858-2.4916<br>2.4973-2.4983<br>Nickellegierung<br>> 900 N/mm <sup>2</sup> | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 53    | vc     | 51    | vc     | 53    | vc     | 55    | vc     | 59    | vc     | 58    | vc      | 63    | vc      | 72    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 8400  | n      | 5400  | n      | 4200  | n      | 3500  | n      | 3100  | n      | 2300  | n       | 2000  | n       | 1900  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,045 | fz     | 0,08  | fz     | 0,1   | fz     | 0,055 | fz     | 0,07  | fz     | 0,12  | fz      | 0,15  | fz      | 0,19  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 1512  | vf     | 1728  | vf     | 1680  | vf     | 770   | vf     | 868   | vf     | 1104  | vf      | 1200  | vf      | 1444  |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
|                                   | 2.4633<br>Nickellegierung<br>> 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                                                | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 37    | vc     | 36    | vc     | 38    | vc     | 39    | vc     | 42    | vc     | 40    | vc      | 44    | vc      | 49    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 5900  | n      | 3800  | n      | 3000  | n      | 2500  | n      | 2200  | n      | 1600  | n       | 1400  | n       | 1300  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,045 | fz     | 0,08  | fz     | 0,1   | fz     | 0,055 | fz     | 0,07  | fz     | 0,12  | fz      | 0,15  | fz      | 0,19  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 1062  | vf     | 1216  | vf     | 1200  | vf     | 550   | vf     | 616   | vf     | 768   | vf      | 840   | vf      | 988   |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |
|                                   | 2.4670-2.4672<br>2.4674<br>Nickellegierung<br>> 900 N/mm <sup>2</sup>                                                                                                                                                                                                                                                               | ae mm               | ae     | 0,2   | ae     | 0,3   | ae     | 0,4   | ae     | 0,5   | ae     | 0,6   | ae     | 0,8   | ae      | 1     | ae      | 1,2   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | ap mm               | ap     | 0,05  | ap     | 0,075 | ap     | 0,1   | ap     | 0,125 | ap     | 0,15  | ap     | 0,2   | ap      | 0,25  | ap      | 0,3   |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vc m/min.           | vc     | 48    | vc     | 46    | vc     | 48    | vc     | 50    | vc     | 53    | vc     | 50    | vc      | 57    | vc      | 64    |
|                                   |                                                                                                                                                                                                                                                                                                                                     | n min <sup>-1</sup> | n      | 7600  | n      | 4800  | n      | 3800  | n      | 3200  | n      | 2800  | n      | 2000  | n       | 1800  | n       | 1700  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | fz mm               | fz     | 0,045 | fz     | 0,08  | fz     | 0,1   | fz     | 0,055 | fz     | 0,07  | fz     | 0,12  | fz      | 0,15  | fz      | 0,19  |
|                                   |                                                                                                                                                                                                                                                                                                                                     | Vf mm/min.          | vf     | 1368  | vf     | 1568  | vf     | 1520  | vf     | 704   | vf     | 784   | vf     | 960   | vf      | 1080  | vf      | 1292  |
|                                   |                                                                                                                                                                                                                                                                                                                                     |                     |        |       |        |       |        |       |        |       |        |       |        |       |         |       |         |       |

| Werkstoffgruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                                            |                                                                           | d1=2mm                                                   | d1=3mm                                                      | d1=4mm                                                  | d1=5mm                                                     | d1=6mm                                                  | d1=8mm                                                | d1=10mm                                                 | d1=12mm                                               |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|
| 2.1                               | 1.4104<br>Rostfreier Stahl,<br>geschwefelt                                                                                                                                                                                                                                                    | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 82<br>n 13100<br>fz 0,01<br>vf 524 | ae 1,5<br>ap 0,3<br>vc 82<br>n 8700<br>fz 0,025<br>vf 870   | ae 2<br>ap 0,5<br>vc 83<br>n 6600<br>fz 0,03<br>vf 792  | ae 2,5<br>ap 1,25<br>vc 82<br>n 5200<br>fz 0,015<br>vf 312 | ae 3<br>ap 1,5<br>vc 87<br>n 4600<br>fz 0,015<br>vf 276 | ae 4<br>ap 2<br>vc 83<br>n 3300<br>fz 0,02<br>vf 264  | ae 5<br>ap 2,5<br>vc 94<br>n 3000<br>fz 0,04<br>vf 480  | ae 6<br>ap 3<br>vc 106<br>n 2800<br>fz 0,05<br>vf 560 |
|                                   | 1.4305<br>Rostfreier Stahl,<br>geschwefelt                                                                                                                                                                                                                                                    | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 99<br>n 15800<br>fz 0,01<br>vf 632 | ae 1,5<br>ap 0,3<br>vc 99<br>n 10500<br>fz 0,025<br>vf 1050 | ae 2<br>ap 0,5<br>vc 99<br>n 7900<br>fz 0,03<br>vf 948  | ae 2,5<br>ap 1,25<br>vc 97<br>n 6200<br>fz 0,015<br>vf 372 | ae 3<br>ap 1,5<br>vc 104<br>n 5500<br>fz 0,02<br>vf 440 | ae 4<br>ap 2<br>vc 98<br>n 3900<br>fz 0,025<br>vf 312 | ae 5<br>ap 2,5<br>vc 113<br>n 3600<br>fz 0,04<br>vf 576 | ae 6<br>ap 3<br>vc 124<br>n 3300<br>fz 0,05<br>vf 660 |
| 2.2                               | 1.4110-1.4112-1.4192<br>1.4319-1.4404-1.4406<br>1.4408-1.4429-1.4435<br>1.4436-1.4438-1.4439<br>1.4441-1.4452-1.4528<br>1.4541-1.4542-1.4545<br>1.4546-1.4550-1.4552<br>1.4568-1.4718-1.4724<br>1.4731-1.4742-1.4760<br>1.4762-1.4828-1.4871<br>1.4873-1.4912-1.4961<br>Rostfrei-austenitisch | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 66<br>n 10500<br>fz 0,01<br>vf 420 | ae 1,5<br>ap 0,3<br>vc 66<br>n 7000<br>fz 0,025<br>vf 700   | ae 2<br>ap 0,5<br>vc 67<br>n 5300<br>fz 0,03<br>vf 636  | ae 2,5<br>ap 1,25<br>vc 64<br>n 4100<br>fz 0,015<br>vf 246 | ae 3<br>ap 1,5<br>vc 70<br>n 3700<br>fz 0,015<br>vf 222 | ae 4<br>ap 2<br>vc 65<br>n 2600<br>fz 0,02<br>vf 208  | ae 5<br>ap 2,5<br>vc 75<br>n 2400<br>fz 0,04<br>vf 384  | ae 6<br>ap 3<br>vc 83<br>n 2200<br>fz 0,05<br>vf 440  |
|                                   | 1.4301-1.4306<br>1.4308-1.4310<br>1.4311-1.4312<br>Rostfrei-austenitisch                                                                                                                                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 79<br>n 12600<br>fz 0,01<br>vf 504 | ae 1,5<br>ap 0,3<br>vc 79<br>n 8400<br>fz 0,025<br>vf 840   | ae 2<br>ap 0,5<br>vc 79<br>n 6300<br>fz 0,03<br>vf 756  | ae 2,5<br>ap 1,25<br>vc 79<br>n 5000<br>fz 0,015<br>vf 300 | ae 3<br>ap 1,5<br>vc 83<br>n 4400<br>fz 0,015<br>vf 264 | ae 4<br>ap 2<br>vc 80<br>n 3200<br>fz 0,02<br>vf 256  | ae 5<br>ap 2,5<br>vc 91<br>n 2900<br>fz 0,04<br>vf 464  | ae 6<br>ap 3<br>vc 102<br>n 2700<br>fz 0,05<br>vf 540 |
|                                   | 1.4303<br>Rostfrei-austenitisch                                                                                                                                                                                                                                                               | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 73<br>n 11600<br>fz 0,01<br>vf 464 | ae 1,5<br>ap 0,3<br>vc 73<br>n 7800<br>fz 0,025<br>vf 780   | ae 2<br>ap 0,5<br>vc 73<br>n 5800<br>fz 0,03<br>vf 696  | ae 2,5<br>ap 1,25<br>vc 72<br>n 4600<br>fz 0,015<br>vf 276 | ae 3<br>ap 1,5<br>vc 75<br>n 4000<br>fz 0,015<br>vf 240 | ae 4<br>ap 2<br>vc 73<br>n 2900<br>fz 0,02<br>vf 232  | ae 5<br>ap 2,5<br>vc 82<br>n 2600<br>fz 0,04<br>vf 416  | ae 6<br>ap 3<br>vc 91<br>n 2400<br>fz 0,05<br>vf 480  |
|                                   | 1.4571-1.4580<br>1.4581-1.4583<br>Rostfrei-austenitisch                                                                                                                                                                                                                                       | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 60<br>n 6500<br>fz 0,01<br>vf 380  | ae 1,5<br>ap 0,3<br>vc 60<br>n 6400<br>fz 0,025<br>vf 640   | ae 2<br>ap 0,5<br>vc 60<br>n 4800<br>fz 0,03<br>vf 576  | ae 2,5<br>ap 1,25<br>vc 58<br>n 3700<br>fz 0,015<br>vf 222 | ae 3<br>ap 1,5<br>vc 62<br>n 3300<br>fz 0,015<br>vf 198 | ae 4<br>ap 2<br>vc 60<br>n 2400<br>fz 0,02<br>vf 192  | ae 5<br>ap 2,5<br>vc 69<br>n 2200<br>fz 0,04<br>vf 352  | ae 6<br>ap 3<br>vc 75<br>n 2000<br>fz 0,05<br>vf 400  |
|                                   | 1.4833-1.4841<br>1.4842-1.4845<br>1.4864-1.4941<br>Rostfrei-austenitisch                                                                                                                                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 50<br>n 10600<br>fz 0,01<br>vf 424 | ae 1,5<br>ap 0,3<br>vc 50<br>n 5750<br>fz 0,025<br>vf 575   | ae 2<br>ap 0,5<br>vc 50<br>n 4000<br>fz 0,015<br>vf 240 | ae 2,5<br>ap 1,25<br>vc 52<br>n 3300<br>fz 0,015<br>vf 198 | ae 3<br>ap 1,5<br>vc 57<br>n 3000<br>fz 0,015<br>vf 180 | ae 4<br>ap 2<br>vc 78<br>n 3100<br>fz 0,03<br>vf 372  | ae 5<br>ap 2,5<br>vc 60<br>n 1900<br>fz 0,04<br>vf 304  | ae 6<br>ap 3<br>vc 68<br>n 1800<br>fz 0,05<br>vf 360  |
|                                   | 1.4000-1.4001<br>1.4002-1.4005<br>1.4006-1.4008<br>1.4016-1.4021<br>1.4028-1.4031<br>1.4034-1.4125<br>1.4313-1.4460<br>1.4462-1.4510<br>1.4511-1.4512<br>1.4521<br>Rostfrei-austenitisch,<br>ferritisch,<br>martensitisch                                                                     | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 54<br>n 8600<br>fz 0,01<br>vf 344  | ae 1,5<br>ap 0,3<br>vc 54<br>n<br>fz 0,025<br>vf            | ae 2<br>ap 0,5<br>vc 54<br>n 4300<br>fz 0,025<br>vf 430 | ae 2,5<br>ap 1,25<br>vc 53<br>n 3400<br>fz 0,015<br>vf 204 | ae 3<br>ap 1,5<br>vc 57<br>n 3000<br>fz 0,015<br>vf 180 | ae 4<br>ap 2<br>vc 55<br>n 2200<br>fz 0,02<br>vf 176  | ae 5<br>ap 2,5<br>vc 63<br>n 2000<br>fz 0,04<br>vf 320  | ae 6<br>ap 3<br>vc 68<br>n 1800<br>fz 0,05<br>vf 360  |
| 2.3                               | 1.4000-1.4001<br>1.4002-1.4005<br>1.4006-1.4008<br>1.4016-1.4021<br>1.4028-1.4031<br>1.4034-1.4125<br>1.4313-1.4460<br>1.4462-1.4510<br>1.4511-1.4512<br>1.4521<br>Rostfrei-austenitisch,<br>ferritisch,<br>martensitisch                                                                     | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 54<br>n 8600<br>fz 0,01<br>vf 344  | ae 1,5<br>ap 0,3<br>vc 54<br>n<br>fz 0,025<br>vf            | ae 2<br>ap 0,5<br>vc 54<br>n 4300<br>fz 0,025<br>vf 430 | ae 2,5<br>ap 1,25<br>vc 53<br>n 3400<br>fz 0,015<br>vf 204 | ae 3<br>ap 1,5<br>vc 57<br>n 3000<br>fz 0,015<br>vf 180 | ae 4<br>ap 2<br>vc 55<br>n 2200<br>fz 0,02<br>vf 176  | ae 5<br>ap 2,5<br>vc 63<br>n 2000<br>fz 0,04<br>vf 320  | ae 6<br>ap 3<br>vc 68<br>n 1800<br>fz 0,05<br>vf 360  |
| 2.4                               | 1.4558-1.4563<br>1.4854-1.4958<br>1.4977-1.4980<br>1.4563-1.4876<br>1.4958-1.4980<br>Chrom-Nickel-<br>Legierung, hochfest<br>> 1250 N/mm <sup>2</sup>                                                                                                                                         | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 1<br>ap 0,25<br>vc 36<br>n 5700<br>fz 0,01<br>vf 228  | ae 1,5<br>ap 0,3<br>vc 36<br>n 3800<br>fz 0,02<br>vf 304    | ae 2<br>ap 0,5<br>vc 36<br>n 2900<br>fz 0,025<br>vf 290 | ae 2,5<br>ap 1,25<br>vc 36<br>n 2300<br>fz 0,015<br>vf 138 | ae 3<br>ap 1,5<br>vc 38<br>n 2000<br>fz 0,015<br>vf 120 | ae 4<br>ap 2<br>vc 35<br>n 1400<br>fz 0,02<br>vf 112  | ae 5<br>ap 2,5<br>vc 41<br>n 1300<br>fz 0,03<br>vf 156  | ae 6<br>ap 3<br>vc 45<br>n 1200<br>fz 0,05<br>vf 240  |

Empfohlene Richtwerte für VHM-3D-Radiusfräser "FOURWIN"  
Recommended cutting data for solid carbide 3D-ball nose end mill "FOURWIN"

INOX  
Schlichten  
Finishing  
Art. 30.7487

| Werkstoffgruppe<br>Material group | Werkstoff/Material                                                                                                                                                                                                                                                                            |                                                                           | d1=2mm                                                        | d1=3mm                                                        | d1=4mm                                                     | d1=5mm                                                         | d1=6mm                                                      | d1=8mm                                                     | d1=10mm                                                   | d1=12mm                                                    |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|
| 2.1                               | 1.4104<br>Rostfreier Stahl,<br>geschwefelt                                                                                                                                                                                                                                                    | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 138<br>n 22000<br>fz 0,045<br>vf 3960 | ae 0,3<br>ap 0,075<br>vc 134<br>n 14200<br>fz 0,08<br>vf 4544 | ae 0,4<br>ap 0,1<br>vc 138<br>n 11000<br>fz 0,1<br>vf 4400 | ae 0,5<br>ap 0,125<br>vc 145<br>n 9200<br>fz 0,055<br>vf 2024  | ae 0,6<br>ap 0,15<br>vc 145<br>n 8200<br>fz 0,07<br>vf 2296 | ae 0,8<br>ap 0,2<br>vc 148<br>n 5900<br>fz 0,12<br>vf 2832 | ae 1<br>ap 0,25<br>vc 167<br>n 5300<br>fz 0,15<br>vf 3180 | ae 1,2<br>ap 0,3<br>vc 188<br>n 5000<br>fz 0,19<br>vf 3800 |
|                                   | 1.4305<br>Rostfreier Stahl,<br>geschwefelt                                                                                                                                                                                                                                                    | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 166<br>n 26400<br>fz 0,045<br>vf 4752 | ae 0,3<br>ap 0,075<br>vc 160<br>n 17000<br>fz 0,08<br>vf 5440 | ae 0,4<br>ap 0,1<br>vc 166<br>n 13200<br>fz 0,1<br>vf 5280 | ae 0,5<br>ap 0,125<br>vc 174<br>n 11100<br>fz 0,055<br>vf 2442 | ae 0,6<br>ap 0,15<br>vc 185<br>n 9800<br>fz 0,07<br>vf 2744 | ae 0,8<br>ap 0,2<br>vc 176<br>n 7000<br>fz 0,12<br>vf 3360 | ae 1<br>ap 0,25<br>vc 201<br>n 6400<br>fz 0,15<br>vf 3840 | ae 1,2<br>ap 0,3<br>vc 222<br>n 5900<br>fz 0,19<br>vf 4484 |
| 2.2                               | 1.4110-1.4112-1.4192<br>1.4319-1.4404-1.4406<br>1.4408-1.4429-1.4435<br>1.4436-1.4438-1.4439<br>1.4441-1.4452-1.4528<br>1.4541-1.4542-1.4545<br>1.4546-1.4550-1.4552<br>1.4568-1.4718-1.4724<br>1.4731-1.4742-1.4760<br>1.4762-1.4828-1.4871<br>1.4873-1.4912-1.4961<br>Rostfrei-austenitisch | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 111<br>n 17600<br>fz 0,045<br>vf 3168 | ae 0,3<br>ap 0,075<br>vc 107<br>n 11300<br>fz 0,08<br>vf 3616 | ae 0,4<br>ap 0,1<br>vc 111<br>n 8800<br>fz 0,1<br>vf 3520  | ae 0,5<br>ap 0,125<br>vc 140<br>n 7400<br>fz 0,055<br>vf 1628  | ae 0,6<br>ap 0,15<br>vc 124<br>n 6600<br>fz 0,07<br>vf 1848 | ae 0,8<br>ap 0,2<br>vc 118<br>n 4700<br>fz 0,12<br>vf 2256 | ae 1<br>ap 0,25<br>vc 135<br>n 4300<br>fz 0,15<br>vf 2580 | ae 1,2<br>ap 0,3<br>vc 151<br>n 4000<br>fz 0,19<br>vf 3040 |
|                                   | 1.4301-1.4306<br>1.4308-1.4310<br>1.4311-1.4312<br>Rostfrei-austenitisch                                                                                                                                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 133<br>n 21100<br>fz 0,045<br>vf 3798 | ae 0,3<br>ap 0,075<br>vc 128<br>n 13600<br>fz 0,08<br>vf 4352 | ae 0,4<br>ap 0,1<br>vc 133<br>n 10600<br>fz 0,1<br>vf 4240 | ae 0,5<br>ap 0,125<br>vc 140<br>n 8900<br>fz 0,055<br>vf 1958  | ae 0,6<br>ap 0,15<br>vc 149<br>n 7900<br>fz 0,07<br>vf 2212 | ae 0,8<br>ap 0,2<br>vc 141<br>n 5600<br>fz 0,12<br>vf 2688 | ae 1<br>ap 0,25<br>vc 160<br>n 5100<br>fz 0,15<br>vf 3060 | ae 1,2<br>ap 0,3<br>vc 181<br>n 4800<br>fz 0,19<br>vf 3648 |
|                                   | 1.4303<br>Rostfrei-austenitisch                                                                                                                                                                                                                                                               | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 122<br>n 19400<br>fz 0,045<br>vf 3492 | ae 0,3<br>ap 0,075<br>vc 118<br>n 12500<br>fz 0,08<br>vf 4000 | ae 0,4<br>ap 0,1<br>vc 122<br>n 9700<br>fz 0,1<br>vf 3880  | ae 0,5<br>ap 0,125<br>vc 127<br>n 8100<br>fz 0,055<br>vf 1782  | ae 0,6<br>ap 0,15<br>vc 136<br>n 7200<br>fz 0,07<br>vf 2016 | ae 0,8<br>ap 0,2<br>vc 131<br>n 5200<br>fz 0,12<br>vf 2496 | ae 1<br>ap 0,25<br>vc 148<br>n 4700<br>fz 0,15<br>vf 2820 | ae 1,2<br>ap 0,3<br>vc 166<br>n 4400<br>fz 0,19<br>vf 3344 |
|                                   | 1.4571-1.4580<br>1.4581-1.4583<br>Rostfrei-austenitisch                                                                                                                                                                                                                                       | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 100<br>n 15900<br>fz 0,045<br>vf 2862 | ae 0,3<br>ap 0,075<br>vc 96<br>n 10200<br>fz 0,08<br>vf 3264  | ae 0,4<br>ap 0,1<br>vc 101<br>n 8000<br>fz 0,1<br>vf 3200  | ae 0,5<br>ap 0,125<br>vc 105<br>n 6700<br>fz 0,055<br>vf 1474  | ae 0,6<br>ap 0,15<br>vc 111<br>n 5900<br>fz 0,07<br>vf 1652 | ae 0,8<br>ap 0,2<br>vc 106<br>n 4200<br>fz 0,12<br>vf 2016 | ae 1<br>ap 0,25<br>vc 119<br>n 3800<br>fz 0,15<br>vf 2280 | ae 1,2<br>ap 0,3<br>vc 136<br>n 3600<br>fz 0,19<br>vf 2736 |
|                                   | 1.4833-1.4841<br>1.4842-1.4845<br>1.4864-1.4941<br>Rostfrei-austenitisch                                                                                                                                                                                                                      | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 89<br>n 14100<br>fz 0,045<br>vf 2538  | ae 0,3<br>ap 0,075<br>vc 86<br>n 9100<br>fz 0,08<br>vf 2912   | ae 0,4<br>ap 0,1<br>vc 89<br>n 7100<br>fz 0,1<br>vf 2840   | ae 0,5<br>ap 0,125<br>vc 93<br>n 5900<br>fz 0,055<br>vf 1298   | ae 0,6<br>ap 0,15<br>vc 100<br>n 5300<br>fz 0,07<br>vf 1484 | ae 0,8<br>ap 0,2<br>vc 96<br>n 3800<br>fz 0,12<br>vf 1824  | ae 1<br>ap 0,25<br>vc 107<br>n 3400<br>fz 0,15<br>vf 2040 | ae 1,2<br>ap 0,3<br>vc 121<br>n 3200<br>fz 0,19<br>vf 2432 |
|                                   | 1.4000-1.4001<br>1.4002-1.4005<br>1.4006-1.4008<br>1.4016-1.4021<br>1.4028-1.4031<br>1.4034-1.4125<br>1.4313-1.4460<br>1.4462-1.4510<br>1.4511-1.4512<br>1.4521<br>Rostfrei-austenitisch,<br>ferritisch,<br>martensitisch                                                                     | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 91<br>n 14400<br>fz 0,045<br>vf 2592  | ae 0,3<br>ap 0,075<br>vc 87<br>n 9200<br>fz 0,08<br>vf 2944   | ae 0,4<br>ap 0,1<br>vc 91<br>n 7200<br>fz 0,1<br>vf 2880   | ae 0,5<br>ap 0,125<br>vc 94<br>n 6000<br>fz 0,055<br>vf 1320   | ae 0,6<br>ap 0,15<br>vc 102<br>n 5400<br>fz 0,07<br>vf 1512 | ae 0,8<br>ap 0,2<br>vc 97<br>n 3850<br>fz 0,12<br>vf 1848  | ae 1<br>ap 0,25<br>vc 110<br>n 3500<br>fz 0,15<br>vf 2100 | ae 1,2<br>ap 0,3<br>vc 121<br>n 3200<br>fz 0,19<br>vf 2432 |
| 2.3                               | 1.4558-1.4563<br>1.4854-1.4958<br>1.4977-1.4980<br>1.4563-1.4876<br>1.4958-1.4980<br>Chrom-Nickel-<br>Legierung, hochfest<br>> 1250 N/mm <sup>2</sup>                                                                                                                                         | ae mm<br>ap mm<br>Vc m/min.<br>n min <sup>-1</sup><br>fz mm<br>Vf mm/min. | ae 0,2<br>ap 0,05<br>vc 60<br>n 9500<br>fz 0,045<br>vf 1710   | ae 0,3<br>ap 0,075<br>vc 58<br>n 6100<br>fz 0,08<br>vf 1952   | ae 0,4<br>ap 0,1<br>vc 60<br>n 4800<br>fz 0,1<br>vf 1920   | ae 0,5<br>ap 0,125<br>vc 63<br>n 4000<br>fz 0,055<br>vf 880    | ae 0,6<br>ap 0,15<br>vc 66<br>n 3500<br>fz 0,07<br>vf 980   | ae 0,8<br>ap 0,2<br>vc 63<br>n 2500<br>fz 0,12<br>vf 1200  | ae 1<br>ap 0,25<br>vc 72<br>n 2300<br>fz 0,15<br>vf 1380  | ae 1,2<br>ap 0,3<br>vc 83<br>n 2200<br>fz 0,19<br>vf 1672  |
| 2.4                               |                                                                                                                                                                                                                                                                                               |                                                                           |                                                               |                                                               |                                                            |                                                                |                                                             |                                                            |                                                           |                                                            |

Art.30.743130.7432

NutfräsenSlot milling

Empfohlene Richtwerte zu Vollhartmetallfräsern für exotisches Material  
Recommended cutting data for solid carbide mills for exotic materials

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                |           | Ø 4   | Ø 5   | Ø 6   | Ø 8   | Ø 10 | Ø 12  | Ø 16  | Ø 20 | Ø 25 |
|-----------------------------------|--------------------------------------|-----------|-------|-------|-------|-------|------|-------|-------|------|------|
| 1.5                               | X36CrMo17<br>1.2316<br>< 1.000 N/mm² | Vc m/min. | 70    | 70    | 70    | 75    | 75   | 75    | 80    | 80   | 80   |
|                                   |                                      | fz mm     | 0,01  | 0,01  | 0,01  | 0,015 | 0,02 | 0,025 | 0,035 | 0,05 | 0,06 |
|                                   |                                      | ae mm     | 4     | 5     | 6     | 8     | 10   | 12    | 16    | 20   | 25   |
|                                   |                                      | ap mm     | 3     | 5     | 9     | 12    | 15   | 18    | 24    | 30   | 30   |
| 1.6                               | S6-5-2<br>1.3343<br>< 1.400 N/mm²    | Vc m/min. | 90    | 90    | 90    | 90    | 92   | 95    | 100   | 100  | 100  |
|                                   |                                      | fz mm     | 0,01  | 0,01  | 0,02  | 0,025 | 0,03 | 0,045 | 0,07  | 0,09 | 0,1  |
|                                   |                                      | ae mm     | 4     | 5     | 6     | 8     | 10   | 12    | 16    | 20   | 25   |
|                                   |                                      | ap mm     | 3     | 5     | 6     | 8     | 9    | 12    | 15    | 15   | 15   |
| 2.3                               | X6Cr13<br>1.4000<br>< 700 N/mm²      | Vc m/min. | 50    | 50    | 50    | 53    | 55   | 55    | 55    | 55   | 55   |
|                                   |                                      | fz mm     | 0,015 | 0,015 | 0,015 | 0,02  | 0,03 | 0,04  | 0,03  | 0,04 | 0,05 |
|                                   |                                      | ae mm     | 4     | 5     | 6     | 8     | 10   | 12    | 16    | 20   | 25   |
|                                   |                                      | ap mm     | 2     | 3     | 5     | 6     | 8    | 9     | 24    | 30   | 30   |
| 2.3                               | X38Cr13<br>1.4031<br>< 700 N/mm²     | Vc m/min. | 50    | 50    | 50    | 53    | 55   | 55    | 55    | 55   | 55   |
|                                   |                                      | fz mm     | 0,01  | 0,01  | 0,015 | 0,02  | 0,03 | 0,04  | 0,03  | 0,04 | 0,05 |
|                                   |                                      | ae mm     | 4     | 5     | 6     | 8     | 10   | 12    | 16    | 20   | 25   |
|                                   |                                      | ap mm     | 3     | 5     | 5     | 6     | 8    | 9     | 24    | 30   | 30   |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                        |           | Ø 4  | Ø 5  | Ø 6  | Ø 8   | Ø 10 | Ø 12  | Ø 16 | Ø 20  | Ø 25 |
|-----------------------------------|----------------------------------------------|-----------|------|------|------|-------|------|-------|------|-------|------|
| 2.2                               | X2CrNiMo17.13.2<br>1.4404<br>< 1.100 N/mm²   | Vc m/min. | 60   | 60   | 55   | 60    | 60   | 60    | 60   | 60    | 70   |
|                                   |                                              | fz mm     | 0,01 | 0,01 | 0,01 | 0,02  | 0,02 | 0,025 | 0,03 | 0,04  | 0,05 |
|                                   |                                              | ae mm     | 4    | 5    | 6    | 8     | 10   | 12    | 16   | 20    | 25   |
|                                   |                                              | ap mm     | 2    | 5    | 4    | 4     | 8    | 9     | 12   | 30    | 30   |
| 5.3                               | Monel 400<br>2.4360<br>Inconel 718<br>2.4668 | Vc m/min. | 25   | 25   | 25   | 26    | 28   | 28    | 29   | 29    | 30   |
|                                   |                                              | fz mm     | 0,02 | 0,02 | 0,01 | 0,015 | 0,02 | 0,025 | 0,04 | 0,045 | 0,05 |
|                                   |                                              | ae mm     | 4    | 5    | 6    | 8     | 10   | 12    | 16   | 20    | 25   |
|                                   |                                              | ap mm     | 2    | 5    | 9    | 12    | 15   | 18    | 24   | 30    | 30   |
| 4.1                               | Ti<br>3.7024<br>< 800 N/mm²                  | Vc m/min. | 120  | 115  | 100  | 100   | 110  | 120   | 120  | 115   | 120  |
|                                   |                                              | fz mm     | 0,03 | 0,02 | 0,03 | 0,03  | 0,04 | 0,05  | 0,04 | 0,05  | 0,05 |
|                                   |                                              | ae mm     | 4    | 5    | 6    | 8     | 10   | 12    | 16   | 20    | 25   |
|                                   |                                              | ap mm     | 2    | 5    | 5    | 6     | 8    | 9     | 24   | 30    | 30   |
| 4.3                               | TiAl6V4<br>9.7164<br>< 1.200 N/mm²           | Vc m/min. | 40   | 40   | 40   | 40    | 45   | 45    | 45   | 45    | 45   |
|                                   |                                              | fz mm     | 0,02 | 0,01 | 0,01 | 0,015 | 0,03 | 0,03  | 0,04 | 0,05  | 0,05 |
|                                   |                                              | ae mm     | 4    | 5    | 6    | 8     | 10   | 12    | 16   | 20    | 25   |
|                                   |                                              | ap mm     | 2    | 5    | 9    | 10    | 10   | 12    | 16   | 20    | 30   |

Art.30.743130.7432

UmfangfräsenSide milling

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                |           | Ø 4  | Ø 5  | Ø 6  | Ø 8  | Ø 10 | Ø 12 | Ø 16 | Ø 20 | Ø 25 |
|-----------------------------------|--------------------------------------|-----------|------|------|------|------|------|------|------|------|------|
| 1.5                               | X36CrMo17<br>1.2316<br>< 1.000 N/mm² | Vc m/min. | 100  | 110  | 130  | 130  | 130  | 130  | 140  | 140  | 140  |
|                                   |                                      | fz mm     | 0,03 | 0,03 | 0,03 | 0,06 | 0,07 | 0,08 | 0,1  | 0,11 | 0,11 |
|                                   |                                      | ae mm     | 0,4  | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                      | ap mm     | 8    | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |
| 1.6                               | S6-5-2<br>1.3343<br>< 1.400 N/mm²    | Vc m/min. | 120  | 140  | 150  | 150  | 155  | 155  | 165  | 175  | 175  |
|                                   |                                      | fz mm     | 0,04 | 0,04 | 0,04 | 0,08 | 0,1  | 0,11 | 0,13 | 0,14 | 0,16 |
|                                   |                                      | ae mm     | 0,4  | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                      | ap mm     | 8    | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |
| 2.3                               | X6Cr13<br>1.4000<br>< 700 N/mm²      | Vc m/min. | 80   | 85   | 90   | 90   | 90   | 90   | 100  | 100  | 100  |
|                                   |                                      | fz mm     | 0,03 | 0,03 | 0,03 | 0,05 | 0,06 | 0,07 | 0,1  | 0,11 | 0,12 |
|                                   |                                      | ae mm     | 0,4  | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                      | ap mm     | 8    | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |
| 2.3                               | X38Cr13<br>1.4031<br>< 700 N/mm²     | Vc m/min. | 80   | 85   | 95   | 95   | 95   | 95   | 100  | 100  | 100  |
|                                   |                                      | fz mm     | 0,03 | 0,03 | 0,03 | 0,05 | 0,06 | 0,07 | 0,1  | 0,11 | 0,12 |
|                                   |                                      | ae mm     | 0,4  | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                      | ap mm     | 8    | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                        |           | Ø 4   | Ø 5  | Ø 6  | Ø 8  | Ø 10 | Ø 12 | Ø 16 | Ø 20 | Ø 25 |
|-----------------------------------|----------------------------------------------|-----------|-------|------|------|------|------|------|------|------|------|
| 2.2                               | X2CrNiMo17.13.2<br>1.4404<br>< 1.100 N/mm²   | Vc m/min. | 95    | 90   | 95   | 95   | 95   | 95   | 100  | 100  | 100  |
|                                   |                                              | fz mm     | 0,045 | 0,03 | 0,03 | 0,05 | 0,06 | 0,07 | 0,1  | 0,11 | 0,12 |
|                                   |                                              | ae mm     | 0,2   | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                              | ap mm     | 8     | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |
| 5.3                               | Monel 400<br>2.4360<br>Inconel 718<br>2.4668 | Vc m/min. | 50    | 50   | 50   | 55   | 55   | 55   | 60   | 60   | 60   |
|                                   |                                              | fz mm     | 0,03  | 0,03 | 0,03 | 0,05 | 0,06 | 0,07 | 0,1  | 0,11 | 0,12 |
|                                   |                                              | ae mm     | 0,04  | 0,05 | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                              | ap mm     | 8     | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |
| 4.1                               | Ti<br>3.7024<br>< 800 N/mm²                  | Vc m/min. | 100   | 100  | 120  | 130  | 130  | 130  | 140  | 140  | 145  |
|                                   |                                              | fz mm     | 0,03  | 0,03 | 0,03 | 0,05 | 0,06 | 0,07 | 0,1  | 0,11 | 0,12 |
|                                   |                                              | ae mm     | 0,4   | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                              | ap mm     | 8     | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |
| 4.3                               | TiAl6V4<br>9.7164<br>< 1.200 N/mm²           | Vc m/min. | 90    | 100  | 100  | 100  | 105  | 105  | 110  | 110  | 115  |
|                                   |                                              | fz mm     | 0,04  | 0,04 | 0,03 | 0,05 | 0,06 | 0,07 | 0,09 | 0,11 | 0,12 |
|                                   |                                              | ae mm     | 0,4   | 0,5  | 0,6  | 0,8  | 1    | 1,2  | 1,6  | 2    | 2,5  |
|                                   |                                              | ap mm     | 8     | 10   | 12   | 16   | 20   | 24   | 32   | 40   | 40   |

TESTERGEBNISSE

HPC-Fräsen/Milling

10,0 Ø x  = 25 / Z=4 · Art. 30.7431

Material: 1.4305 - X8CrNiS18-9 - 750 N/mm²  
Nutenfräsen/Slot milling

Vc = 120 m/min.  
fz = 0,05 mm  
U/min. = 3800 min⁻¹  
ae = 10 mm  
ap = 10 mm

HPC-Fräsen/Milling

10,0 Ø x  = 25 / Z=4 · Art. 30.7431

Material: 1.4305 X8CrNiS18-9 - 750 N/mm²  
Umfangfräsen/Circumference milling

Vc = 120 m/min.  
fz = 0,05 mm  
ae = 15,0 mm  
ap = 5,0 mm

HPC-Fräsen/Milling

10,0 Ø x  = 25 / Z=4 · Art. 30.7421

Material: 1.4571 - <700 N/mm²  
Umfangfräsen/Circumference milling

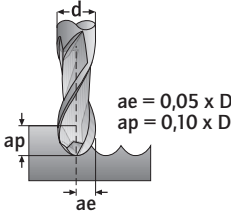
Vc = 100 m/min.  
fz = 0,04 mm  
ae = 1,0 mm  
ap = 15,0 mm

Art.30.6217

Richtwerte für den Einsatz von Karnasch Vollhartmetall-Fräsern für HSC- Bearbeitung  
Recommended cutting data for Karnasch solid carbide end mills high speed cutting

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material             | Festigkeit<br>Strength<br>N/mm² | n/Vf   | Ø 1,0  | Ø 2,0  | Ø 3,0  | Ø 4,0  | Ø 6,0  | Ø 8,0  | Ø 10,0 | Ø 12,0 |
|-----------------------------------|-----------------------------------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 9.1                               | Al Mg 1                           |                                 | n/min¹ | 65.000 | 58.000 | 50.000 | 45.000 | 36.000 | 28.000 | 24.000 | 21.000 |
|                                   |                                   | < 250                           | mm/min | 1.000  | 2.400  | 4.000  | 4.000  | 4.200  | 4.100  | 4.000  | 3.800  |
| 9.2                               | Al Mg Si 1                        |                                 | n/min¹ | 62.000 | 54.000 | 48.000 | 47.000 | 34.000 | 25.000 | 21.000 | 20.000 |
|                                   |                                   | < 350                           | mm/min | 1.200  | 2.200  | 3.000  | 3.800  | 4.100  | 4.000  | 4.000  | 3.500  |
| 9.3-9.4-9.5                       | GDA Si 12 (Cu)<br>G-Al Cu 4 Ti Mg |                                 | n/min¹ | 19.000 | 14.000 | 12.000 | 11.000 | 8.000  | 6.000  | 4.800  | 3.500  |
|                                   |                                   | < 350                           | mm/min | 400    | 600    | 700    | 900    | 1.000  | 1.000  | 1.000  | 1.000  |
| 10.3                              | E - Cu 58                         |                                 | n/min¹ | 25.000 | 19.000 | 16.000 | 14.000 | 11.000 | 8.500  | 6.500  | 5.000  |
|                                   |                                   | < 350                           | mm/min | 400    | 600    | 700    | 900    | 1.000  | 1.000  | 1.000  | 1.000  |

1. Falls diese Drehzahlen vorhanden sind, ist die maximal mögliche Drehzahl zu wählen und die Vorschübe anzupassen.  
When using low speed machines, use the maximum speed and adjust the feed rate.
2. Beim Trockenfräsen Vc und fz auf 70% der Schnittwerte reduzieren.  
In dry milling (recommended air blow), reduce the rotation and feed to 70% to table values.
3. Bei aufkommenden Vibrationen, Schnittwerte anpassen.  
Adjust milling condition, when unusual vibration, different sound occur by cutting.
4. Als Spannmittel empfehlen wir die Schrumpftechnik.  
We recommend as a clamping device the shrinking technique.





Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung  
Recommended cutting data for diamond coated solid carbide end mills HSC

Schruppen  
roughing  
▼

Art. 30.6560

| Werkstoff<br>Material | Schruppen<br>roughing<br>▼        | HSK 40 - HSK 32 - SK 40             |                                                       |          |                         |                      |                                |                                          |
|-----------------------|-----------------------------------|-------------------------------------|-------------------------------------------------------|----------|-------------------------|----------------------|--------------------------------|------------------------------------------|
| Graphit               | d1 x l3                           | Vc<br>m/min                         | n<br>min <sup>1</sup>                                 | ap<br>mm | ae<br>mm                | fz<br>mm             | Vf<br>mm/min.                  | Q<br>cm <sup>3</sup> / min. <sup>1</sup> |
|                       | 6,0 x 30<br>6,0 x 60              | 480 - 600<br>400 - 500              | 25.500 - 32.000<br>21.000 - 26.000                    | ≈ 6      | ≈ 4,0<br>≈ 2,5          | 0,09<br>0,06         | ≈ 11.000<br>≈ 6.500            | ≈ 28,0<br>≈ 9,0                          |
|                       | 8,0 x 30<br>8,0 x 60<br>8,0 x 100 | 480 - 600<br>400 - 500<br>300 - 400 | 19.000 - 24.000<br>16.000 - 20.000<br>12.000 - 18.000 | ≈ 8      | ≈ 6,0<br>≈ 3,5<br>≈ 2,0 | 0,12<br>0,80<br>0,60 | ≈ 11.000<br>≈ 6.500<br>≈ 4.300 | ≈ 55,0<br>≈ 20,0<br>≈ 7,0                |
|                       | 10,0x 30<br>10,0x 60<br>10,0x 100 | 480 - 600<br>450 - 550<br>400 - 500 | 15.000 - 19.000<br>14.000 - 17.000<br>13.000 - 16.000 | ≈ 10     | ≈ 8,0<br>≈ 7,5<br>≈ 5,0 | 0,15<br>0,12<br>0,10 | ≈ 11.500<br>≈ 8.000<br>≈ 6.800 | ≈ 91,0<br>≈ 66,0<br>≈ 32,0               |
|                       | 12,0x 45<br>12,0x 60              | 450 - 550<br>400 - 500              | 12.000 - 14.000<br>10.500 - 13.000                    | ≈ 12     | ≈ 10,0<br>≈ 6,0         | 0,18<br>0,14         | ≈ 10.000<br>≈ 7.500            | ≈ 120,0<br>≈ 54,0                        |
|                       |                                   |                                     |                                                       |          |                         |                      |                                |                                          |
|                       |                                   |                                     |                                                       |          |                         |                      |                                |                                          |
|                       |                                   |                                     |                                                       |          |                         |                      |                                |                                          |

Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung  
Recommended cutting data for diamond coated solid carbide end mills HSC

Schlichten  
finishing  
▼▼▼

Art. 30.6560

| Werkstoff<br>Material | Schlichten<br>finishing<br>▼▼▼    | HSK 40 - HSK 32 - SK 40             |                                                       |          |                                     |                      |                                  |  |
|-----------------------|-----------------------------------|-------------------------------------|-------------------------------------------------------|----------|-------------------------------------|----------------------|----------------------------------|--|
| Graphit               | d1 x l3                           | Vc<br>m/min                         | n<br>min <sup>1</sup>                                 | ap<br>mm | ae<br>mm                            | fz<br>mm             | Vf<br>mm/min.                    |  |
|                       | 6,0 x 30<br>6,0 x 60              | 560 - 700<br>470 - 600              | 29.000 - 37.000<br>25.000 - 31.000                    | ≈ 6      | 0,3 - 0,9<br>0,3 - 0,9              | 0,09<br>0,09         | ≈ 13.000<br>≈ 11.000             |  |
|                       | 8,0 x 30<br>8,0 x 60<br>8,0 x 100 | 560 - 700<br>470 - 600<br>400 - 500 | 22.000 - 28.000<br>19.000 - 23.500<br>15.500 - 19.500 | ≈ 8      | 0,4 ≈ 1,2<br>0,4 ≈ 1,2<br>0,4 ≈ 1,2 | 0,12<br>0,12<br>0,12 | ≈ 13.000<br>≈ 11.000<br>≈ 9.500  |  |
|                       | 10,0x 30<br>10,0x 60<br>10,0x 100 | 560 - 700<br>500 - 600<br>480 - 600 | 18.000 - 22.000<br>15.700 - 19.000<br>15.000 - 19.000 | ≈ 10     | 0,4 ≈ 1,5<br>0,4 ≈ 1,5<br>0,4 ≈ 1,5 | 0,15<br>0,15<br>0,15 | ≈ 13.000<br>≈ 11.500<br>≈ 11.000 |  |
|                       | 12,0x 45<br>12,0x 60              | 500 - 600<br>480 - 550              | 13.000 - 15.500<br>12.500 - 14.300                    | ≈ 12     | 0,4 ≈ 1,8<br>0,4 ≈ 1,8              | 0,18<br>0,18         | ≈ 11.000<br>≈ 10.000             |  |
|                       |                                   |                                     |                                                       |          |                                     |                      |                                  |  |
|                       |                                   |                                     |                                                       |          |                                     |                      |                                  |  |
|                       |                                   |                                     |                                                       |          |                                     |                      |                                  |  |

Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung  
Recommended cutting data for diamond coated solid carbide end mills HSC

Schruppen  
roughing  
▼

Art. 30.6560

| Werkstoff<br>Material | Schruppen<br>roughing<br>▼        | HSK 63 - HSK 50 - SK 40             |                                                 |                         |                         |                      |                               |                                          |
|-----------------------|-----------------------------------|-------------------------------------|-------------------------------------------------|-------------------------|-------------------------|----------------------|-------------------------------|------------------------------------------|
| Graphit               | d1 x l3                           | Vc<br>m/min                         | n<br>min <sup>1</sup>                           | ap<br>mm                | ae<br>mm                | fz<br>mm             | Vf<br>mm/min.                 | Q<br>cm <sup>3</sup> / min. <sup>1</sup> |
|                       | 6,0 x 30<br>6,0 x 60              | 150 - 190<br>130 - 160              | 8.000 - 10.000<br>6.500 - 8.500                 | ≈ 3,0<br>≈ 1,6          | ≈ 4,0<br>≈ 2,5          | 0,09<br>0,06         | ≈ 3.500<br>≈ 2.100            | ≈ 42,0<br>≈ 9,0                          |
|                       | 8,0 x 30<br>8,0 x 60<br>8,0 x 100 | 150 - 190<br>130 - 160<br>110 - 130 | 6.000 - 7.500<br>5.000 - 6.500<br>4.100 - 5.100 | ≈ 4,0<br>≈ 2,2<br>≈ 1,5 | ≈ 6,0<br>≈ 3,5<br>≈ 2,5 | 0,12<br>0,08<br>0,05 | ≈ 3.600<br>≈ 2.100<br>≈ 1.020 | ≈ 87,0<br>≈ 18,0<br>≈ 6,0                |
|                       | 10,0x 30<br>10,0x 60<br>10,0x 100 | 150 - 190<br>130 - 170<br>120 - 160 | 4.800 - 6.000<br>4.400 - 5.500<br>4.100 - 5.100 | ≈ 5,0<br>≈ 4,0<br>≈ 3,0 | ≈ 8,0<br>≈ 6,0<br>≈ 4,5 | 0,15<br>0,12<br>0,10 | ≈ 3.600<br>≈ 2.800<br>≈ 2.100 | ≈ 144,0<br>≈ 70,0<br>≈ 30,0              |
|                       | 12,0x 45<br>12,0x 60              | 140 - 180<br>110 - 130              | 3.600 - 4.700<br>2.800 - 3.400                  | ≈ 6,0<br>≈ 4,0          | ≈ 9,0<br>≈ 6,0          | 0,20<br>0,15         | ≈ 3.800<br>≈ 2.000            | ≈ 152,0<br>≈ 82,0                        |
|                       |                                   |                                     |                                                 |                         |                         |                      |                               |                                          |
|                       |                                   |                                     |                                                 |                         |                         |                      |                               |                                          |
|                       |                                   |                                     |                                                 |                         |                         |                      |                               |                                          |

Empfohlene Schnittdaten für DIAMANT-beschichtete Fräswerkzeuge / HSC-Bearbeitung  
Recommended cutting data for diamond coated solid carbide end mills HSC

Schlichten  
finishing  
▼▼▼

Art. 30.6560

| Werkstoff<br>Material | Schlichten<br>finishing<br>▼▼▼     | HSK 63 - HSK 50 - SK 40             |                                                 |                         |                                           |                      |                               |  |
|-----------------------|------------------------------------|-------------------------------------|-------------------------------------------------|-------------------------|-------------------------------------------|----------------------|-------------------------------|--|
| Graphit               | Schlichten<br>Finishing<br>d1 x l3 | Vc<br>m/min <sup>1</sup>            | n<br>min <sup>1</sup>                           | ap<br>mm                | ae<br>mm                                  | fz<br>mm             | Vf<br>mm/min.                 |  |
|                       | 6,0 x 30<br>6,0 x 60               | 150 - 190<br>130 - 160              | 8.000 - 10.000<br>6.800 - 8.500                 | ≈ 3,0<br>≈ 1,6          | 0,3 - 0,9<br>0,3 - 0,9                    | 0,08<br>0,08         | ≈ 4.000<br>≈ 2.700            |  |
|                       | 8,0 x 30<br>8,0 x 60<br>8,0 x 100  | 150 - 190<br>130 - 160<br>110 - 130 | 6.000 - 7.500<br>5.000 - 6.500<br>4.100 - 5.100 | ≈ 4,0<br>≈ 2,2<br>≈ 1,5 | 0,4 - 1,2<br>0,4 - 1,2<br>0,4 - 1,2       | 0,12<br>0,12<br>0,12 | ≈ 3.600<br>≈ 3.100<br>≈ 2.400 |  |
|                       | 10,0x 30<br>10,0x 60<br>10,0x 100  | 150 - 190<br>130 - 170<br>120 - 160 | 4.800 - 6.000<br>4.400 - 5.500<br>4.100 - 5.100 | ≈ 5,0<br>≈ 4,0<br>≈ 3,0 | ≈ 0,5 - 1,5<br>≈ 0,5 - 1,5<br>≈ 0,5 - 1,5 | 0,15<br>0,15<br>0,15 | ≈ 3.600<br>≈ 3.300<br>≈ 3.000 |  |
|                       | 12,0x 45<br>12,0x 60               | 140 - 180<br>110 - 130              | 3.600 - 4.700<br>2.800 - 3.400                  | ≈ 6,0<br>≈ 4,0          | ≈ 0,6 - 1,8<br>≈ 0,6 - 1,8                | 0,18<br>0,18         | ≈ 3.400<br>≈ 2.400            |  |
|                       |                                    |                                     |                                                 |                         |                                           |                      |                               |  |
|                       |                                    |                                     |                                                 |                         |                                           |                      |                               |  |
|                       |                                    |                                     |                                                 |                         |                                           |                      |                               |  |

Art. 30.6432

Empfohlene Richtwerte für HPC-Schruppen Extrem Rapid Cutter Stahl -GG-GGG-GTW-GTS  
Recommended cutting data for HPC-roughing extreme rapid cutter steel -GG-GGG-GTW-GTS

| Werkstoff<br>Material |                  |                     | Ø 3    | Ø 4    | Ø 5    | Ø 6    | Ø 8   | Ø 10  | Ø 12  | Ø 16  | Ø 20  |
|-----------------------|------------------|---------------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|
| 1.1 / 1.2             | < 800<br>N/mm²   | ae mm               | 3,0    | 4,0    | 5,0    | 6,0    | 8,0   | 10,0  | 12,0  | 16,0  | 20,0  |
|                       |                  | ap mm               | 1,5    | 2,0    | 2,5    | 3,0    | 4,0   | 5,0   | 6,0   | 8,0   | 10,0  |
|                       |                  | Vc m/min.           | 180    | 190    | 210    | 210    | 210   | 210   | 215   | 225   | 230   |
|                       |                  | n min <sup>-1</sup> | 9.500  | 15.000 | 13.500 | 11.000 | 8.300 | 6.700 | 5.700 | 4.500 | 3.600 |
|                       |                  | fz mm               | 0,016  | 0,021  | 0,025  | 0,022  | 0,042 | 0,055 | 0,065 | 0,082 | 0,10  |
|                       |                  | Vf m/min.           | 1.260  | 1.60   | 1.000  | 960    | 1.400 | 1.500 | 1.450 | 1.500 | 1.480 |
| 1.3                   | < 1.100<br>N/mm² | ae mm               | 3,0    | 4,0    | 5,0    | 6,0    | 8,0   | 10,0  | 12,0  | 16,0  | 20,0  |
|                       |                  | ap mm               | 1,5    | 2,0    | 2,5    | 3,0    | 4,0   | 5,0   | 6,0   | 8,0   | 10,0  |
|                       |                  | Vc m/min.           | 175    | 185    | 190    | 200    | 200   | 205   | 205   | 220   | 200   |
|                       |                  | n min <sup>-1</sup> | 8.800  | 14.500 | 12.200 | 10.500 | 8.000 | 6.500 | 5.500 | 4.300 | 3.200 |
|                       |                  | fz mm               | 0,011  | 0,016  | 0,023  | 0,022  | 0,042 | 0,054 | 0,064 | 0,083 | 0,10  |
|                       |                  | Vf m/min.           | 830    | 930    | 830    | 900    | 1.350 | 1.400 | 1.400 | 1.440 | 1.300 |
| 1.4                   | < 1.300<br>N/mm² | ae mm               | 3,0    | 4,0    | 5,0    | 6,0    | 8,0   | 10,0  | 12,0  | 16,0  | 20,0  |
|                       |                  | ap mm               | 1,5    | 2,0    | 2,5    | 3,0    | 4,0   | 5,0   | 6,0   | 8,0   | 10,0  |
|                       |                  | Vc m/min.           | 135    | 157    | 160    | 170    | 170   | 175   | 175   | 185   | 190   |
|                       |                  | n min <sup>-1</sup> | 14.500 | 12.500 | 10.300 | 9.000  | 6.800 | 5.600 | 4.700 | 3.700 | 3.000 |
|                       |                  | fz mm               | 0,011  | 0,015  | 0,023  | 0,022  | 0,042 | 0,054 | 0,064 | 0,083 | 0,100 |
|                       |                  | Vf m/min.           | 630    | 750    | 940    | 790    | 1.160 | 1.200 | 1.190 | 1.200 | 1.200 |
| 7.1<br>GG             | < 325<br>N/mm²   | ae mm               | 3,0    | 4,0    | 5,0    | 6,0    | 8,0   | 10,0  | 12,0  | 16,0  | 20,0  |
|                       |                  | ap mm               | 1,5    | 2,0    | 2,5    | 3,0    | 4,0   | 5,0   | 6,0   | 8,0   | 10,0  |
|                       |                  | Vc m/min.           | 140    | 150    | 160    | 160    | 160   | 165   | 165   | 175   | 175   |
|                       |                  | n min <sup>-1</sup> | 15.000 | 11.500 | 10.400 | 8.400  | 6.400 | 5.200 | 4.400 | 3.500 | 2.800 |
|                       |                  | fz mm               | 0,013  | 0,019  | 0,025  | 0,022  | 0,042 | 0,054 | 0,064 | 0,080 | 0,100 |
|                       |                  | Vf m/min.           | 780    | 870    | 1.040  | 740    | 1.050 | 1.130 | 1.100 | 1.100 | 1.140 |
| 7.3<br>GGG            | < 700<br>N/mm²   | ae mm               | 3,0    | 4,0    | 5,0    | 6,0    | 8,0   | 10,0  | 12,0  | 16,0  | 20,0  |
|                       |                  | ap mm               | 1,5    | 2,0    | 2,5    | 3,0    | 4,0   | 5,0   | 6,0   | 8,0   | 10,0  |
|                       |                  | Vc m/min.           | 140    | 150    | 150    | 160    | 160   | 165   | 165   | 175   | 175   |
|                       |                  | n min <sup>-1</sup> | 15.000 | 11.700 | 9.600  | 8.400  | 6.400 | 5.200 | 4.400 | 3.500 | 2.800 |
|                       |                  | fz mm               | 0,011  | 0,015  | 0,017  | 0,022  | 0,042 | 0,054 | 0,064 | 0,080 | 0,100 |
|                       |                  | Vf m/min.           | 660    | 700    | 650    | 740    | 1.100 | 1.100 | 1.110 | 1.150 | 1.140 |

ap = 100%  
Beispiel/Example: Ø 20,0 x 55 (ap = 55 mm - ae = 5,0 mm)

Die Vorschubwerte Vf lassen sich bei optimalen Voraussetzungen um 50% erhöhen.  
(Stabile Maschine, Vibrationsfreie Werkzeug und Werkzeugschwingung, Kühlmittel)

Art. 30.6572  
30.6573

Empfohlene Schnittdaten für DIAMANT-beschichtete Schrappfräser / HSC-Bearbeitung  
Recommended cutting data for diamond coated solid carbide end mills HSC

| Werkstoff<br>Material |                                  |   |              | <br>1    | <br>2    |                        |               |          |
|-----------------------|----------------------------------|---|--------------|----------|----------|------------------------|---------------|----------|
|                       | Schruppen<br>Roughing<br>d1 x l2 | Z | Vc<br>m/min. |          |          | n<br>min <sup>-1</sup> | Vf<br>mm/min. | fz<br>mm |
| Graphit               | 3,0 x 10                         | 3 | 400          | 0,5 x D  | 1,0 x D  | 42.000                 | 9.000         | 0,07     |
|                       | 3,0 x 20                         | 3 | 350          | 0,25 x D | 0,5 x D  | 37.000                 | 7.800         | 0,07     |
|                       | 3,0 x 30                         | 3 | 300          | 0,15 x D | 0,25 x D | 32.000                 | 6.700         | 0,07     |
|                       | 3,0 x 35                         | 3 | 250          | 0,10 x D | 0,15 x D | 27.000                 | 5.600         | 0,07     |
|                       | 4,0 x 10                         | 3 | 400          | 0,5 x D  | 1,0 x D  | 32.000                 | 7.500         | 0,08     |
|                       | 4,0 x 20                         | 3 | 350          | 0,25 x D | 0,5 x D  | 28.000                 | 6.700         | 0,08     |
|                       | 4,0 x 30                         | 3 | 300          | 0,15 x D | 0,25 x D | 24.000                 | 5.800         | 0,08     |
|                       | 4,0 x 40                         | 3 | 250          | 0,10 x D | 0,15 x D | 20.000                 | 4.800         | 0,08     |
|                       | 5,0 x 20                         | 3 | 350          | 0,5 x D  | 1,0 x D  | 22.000                 | 6.600         | 0,10     |
|                       | 5,0 x 30                         | 3 | 300          | 0,25 x D | 0,5 x D  | 19.000                 | 5.700         | 0,10     |
|                       | 5,0 x 40                         | 3 | 250          | 0,15 x D | 0,25 x D | 16.000                 | 4.800         | 0,10     |
|                       | 6,0 x 30                         | 3 | 300          | 0,5 x D  | 1,0 x D  | 16.000                 | 5.700         | 0,12     |
|                       | 6,0 x 40                         | 3 | 250          | 0,25 x D | 0,5 x D  | 13.500                 | 4.800         | 0,12     |
|                       | 8,0 x 30                         | 3 | 300          | 0,5 x D  | 1,0 x D  | 12.000                 | 4.700         | 0,13     |
|                       | 8,0 x 40                         | 3 | 250          | 0,25 x D | 0,5 x D  | 10.000                 | 4.000         | 0,13     |
|                       | 10,0 x 20                        | 4 | 300          | 0,75 x D | 1,0 x D  | 9.500                  | 6.100         | 0,16     |
|                       | 10,0 x 30                        | 4 | 250          | 0,25 x D | 0,5 x D  | 8.000                  | 5.100         | 0,16     |
|                       | 10,0 x 60                        | 4 | 220          | 0,15 x D | 0,25 x D | 7.000                  | 4.500         | 0,16     |
|                       | 12,0 x 45                        | 4 | 250          | 0,25 x D | 0,5 x D  | 6.700                  | 5.800         | 0,22     |
|                       | 12,0 x 75                        | 4 | 200          | 0,15 x D | 0,25 x D | 5.400                  | 4.700         | 0,22     |
|                       | 16,0 x 45                        | 4 | 250          | 0,25 x D | 0,5 x D  | 5.000                  | 4.800         | 0,24     |
|                       | 16,0 x 75                        | 4 | 200          | 0,15 x D | 0,25 x D | 4.000                  | 3.800         | 0,24     |
|                       | 20,0 x 55                        | 4 | 250          | 0,25 x D | 0,5 x D  | 4.000                  | 4.000         | 0,25     |
|                       | 20,0 x 75                        | 4 | 220          | 0,10 x D | 0,15 x D | 3.500                  | 3.500         | 0,25     |
|                       | 20,0 x110                        | 4 | 200          | 0,05 x D | 0,75 x D | 3.200                  | 3.200         | 0,25     |

1 ap = 100%  
Beispiel/Example: Ø 20,0 x 55 (ap = 55 mm - ae = 5,0 mm)

2 ap = 50%  
Beispiel/Example: Ø 20,0 x 55 (ap = 28 mm - ae = 10,0 mm)

Empfohlene Schnittdaten für High-Performance Schaftfräser  
Recommended cutting data for solid carbide high-performance end mills

TITAN

Nutfräsen  
Slot milling

Art. 30.7428

| Werkstoffgruppe<br>Material group | Werkstoff/Material                                                                                     |                     | Ø6<br>r=0,1-0,5-1,0 | Ø8<br>r=0,2-0,5-1,0 | Ø10<br>r=0,2-0,5-1,0 | Ø12<br>r=0,2-0,5-1,0 | Ø16<br>r=0,5-1,0-2,0 | Ø20<br>r=0,5-1,0-2,0 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|
| 4.1                               | 3.7024 - 3.7034<br>3.7064 - 3.7065<br>3.7025 - 3.7035<br>3.7055<br>Grade1 - Grade2<br>Grade3 - Grade 4 | ae mm               | ae 6                | ae 8                | ae 10                | ae 12                | ae 16                | ae 20                |
|                                   |                                                                                                        | ap mm               | ap 6                | ap 8                | ap 10                | ap 12                | ap 16                | ap 20                |
|                                   |                                                                                                        | Vc m/min.           | Vc 150              | Vc 150              | Vc 165               | Vc 165               | Vc 150               | Vc 150               |
|                                   |                                                                                                        | n min <sup>-1</sup> | n 7.960             | n 5.970             | n 5.260              | n 5.260              | n 3.000              | n 2.400              |
|                                   |                                                                                                        | fz mm               | fz 0,02             | fz 0,03             | fz 0,04              | fz 0,04              | fz 0,07              | fz 0,08              |
|                                   |                                                                                                        | Vf mm/min.          | Vf 637              | Vf 716              | Vf 842               | Vf 842               | Vf 840               | Vf 768               |
| 4.2                               | 3.7105 - 3.7115<br>3.7124 - 3.7184<br>Grade12                                                          | ae mm               | ae 6                | ae 8                | ae 10                | ae 12                | ae 16                | ae 20                |
|                                   |                                                                                                        | ap mm               | ap 6                | ap 8                | ap 10                | ap 12                | ap 16                | ap 20                |
|                                   |                                                                                                        | Vc m/min.           | Vc 60               | Vc 60               | Vc 60                | Vc 60                | Vc 70                | Vc 70                |
|                                   |                                                                                                        | n min <sup>-1</sup> | n 3.180             | n 2.390             | n 1.900              | n 1.600              | n 1.400              | n 1.120              |
|                                   |                                                                                                        | fz mm               | fz 0,03             | fz 0,04             | fz 0,045             | fz 0,05              | fz 0,06              | fz 0,07              |
|                                   |                                                                                                        | Vf mm/min.          | Vf 382              | Vf 382              | Vf 342               | Vf 320               | Vf 336               | Vf 314               |
| 4.3                               | 3.7154 - 3.7164<br>3.7165 - 3.7174<br>Grade5                                                           | ae mm               | ae 6                | ae 8                | ae 10                | ae 12                | ae 16                | ae 20                |
|                                   |                                                                                                        | ap mm               | ap 6                | ap 8                | ap 10                | ap 12                | ap 16                | ap 20                |
|                                   |                                                                                                        | Vc m/min.           | Vc 50               | Vc 50               | Vc 50                | Vc 50                | Vc 55                | Vc 55                |
|                                   |                                                                                                        | n min <sup>-1</sup> | n 2.660             | n 1.990             | n 1.600              | n 1.330              | n 1.100              | n 880                |
|                                   |                                                                                                        | fz mm               | fz 0,025            | fz 0,025            | fz 0,04              | fz 0,06              | fz 0,06              | fz 0,06              |
|                                   |                                                                                                        | Vf mm/min.          | Vf 266              | Vf 199              | Vf 256               | Vf 319               | Vf 264               | Vf 211               |

Empfohlene Schnittdaten für High-Performance Schaftfräser  
Recommended cutting data for solid carbide high-performance end mills

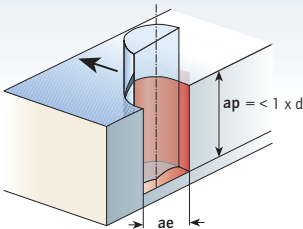
TITAN

Umfangfräsen  
Side milling

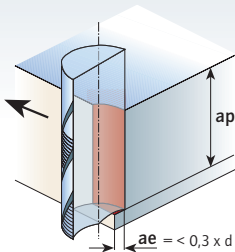
Art. 30.7428

| Werkstoffgruppe<br>Material group | Werkstoff/Material                                                                                     |                     | Ø6<br>r=0,1-0,5-1,0 | Ø8<br>r=0,2-0,5-1,0 | Ø10<br>r=0,2-0,5-1,0 | Ø12<br>r=0,2-0,5-1,0 | Ø16<br>r=0,5-1,0-2,0 | Ø20<br>r=0,5-1,0-2,0 |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|
| 4.1                               | 3.7024 - 3.7034<br>3.7064 - 3.7065<br>3.7025 - 3.7035<br>3.7055<br>Grade1 - Grade2<br>Grade3 - Grade 4 | ae mm               | ae 0,6              | ae 0,8              | ae 1,0               | ae 1,2               | ae 1,6               | ae 2,0               |
|                                   |                                                                                                        | ap mm               | ap 9                | ap 12               | ap 15                | ap 18                | ap 24                | ap 30                |
|                                   |                                                                                                        | Vc m/min.           | Vc 310              | Vc 320              | Vc 330               | Vc 330               | Vc 350               | Vc 350               |
|                                   |                                                                                                        | n min <sup>-1</sup> | n 16.500            | n 12.800            | n 10.500             | n 8.800              | n 7.000              | n 5.600              |
|                                   |                                                                                                        | fz mm               | fz 0,05             | fz 0,1              | fz 0,12              | fz 0,13              | fz 0,15              | fz 0,16              |
|                                   |                                                                                                        | Vf mm/min.          | Vf 3.300            | Vf 5.120            | Vf 5.040             | Vf 4.576             | Vf 4.200             | Vf 3.584             |
| 4.2                               | 3.7105 - 3.7115<br>3.7124 - 3.7184<br>Grade12                                                          | ae mm               | ae 0,6              | ae 0,8              | ae 1,0               | ae 1,2               | ae 1,6               | ae 2,0               |
|                                   |                                                                                                        | ap mm               | ap 9                | ap 12               | ap 15                | ap 18                | ap 24                | ap 30                |
|                                   |                                                                                                        | Vc m/min.           | Vc 140              | Vc 145              | Vc 150               | Vc 150               | Vc 155               | Vc 160               |
|                                   |                                                                                                        | n min <sup>-1</sup> | n 7.430             | n 5.770             | n 4.780              | n 3.980              | n 3.090              | n 2.550              |
|                                   |                                                                                                        | fz mm               | fz 0,05             | fz 0,06             | fz 0,075             | fz 0,09              | fz 0,11              | fz 0,13              |
|                                   |                                                                                                        | Vf mm/min.          | Vf 1.486            | Vf 1.385            | Vf 1.434             | Vf 1.433             | Vf 1.360             | Vf 1.326             |
| 4.3                               | 3.7154 - 3.7164<br>3.7165 - 3.7174<br>Grade5                                                           | ae mm               | ae 0,6              | ae 0,8              | ae 1,0               | ae 1,2               | ae 1,6               | ae 2,0               |
|                                   |                                                                                                        | ap mm               | ap 9                | ap 12               | ap 15                | ap 18                | ap 24                | ap 30                |
|                                   |                                                                                                        | Vc m/min.           | Vc 110              | Vc 110              | Vc 115               | Vc 115               | Vc 120               | Vc 120               |
|                                   |                                                                                                        | n min <sup>-1</sup> | n 5.840             | n 4.380             | n 3.660              | n 3.050              | n 2.390              | n 1.910              |
|                                   |                                                                                                        | fz mm               | fz 0,04             | fz 0,06             | fz 0,07              | fz 0,09              | fz 0,11              | fz 0,13              |
|                                   |                                                                                                        | Vf mm/min.          | Vf 934              | Vf 1.051            | Vf 1.025             | Vf 1.098             | Vf 1.052             | Vf 993               |

Nuten/Schruppen  
Slot milling/Roughing



Umfangfräsen/Schlichten  
Circumference milling/Finishing



Die Schnittwerte gelten für:  
ap = 1xD    ae = 0,3 x D  
Bei anderen Spanungsquerschnitten  
Schnittwerte entsprechend anpassen.  
Bei extra langer Ausführung sind die  
Schnittwerte um 50 % zu reduzieren

Cutting data refers to:  
ap = 1xD    ae = 0,3 x D  
For different cutting volumes, adjust  
cutting data correspondingly.  
For extra long design reduce cutting  
data by approximately 50 %.

| Werkstoffgruppe<br>Material group | Werkstoff / Material                                                                     | Vc Schnittgeschwin-<br>digkeit · m/min.<br>Cutting speed | Fräserdurchmesser/Dimension D in mm    |       |       |       |       |       |       |
|-----------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------|-------|-------|-------|-------|-------|-------|
|                                   |                                                                                          |                                                          | 3-4                                    | 5-6   | 8     | 10    | 12    | 16    | 20    |
|                                   |                                                                                          |                                                          | Vorschub pro Zahn/Feed per tooth fz mm |       |       |       |       |       |       |
| 9.1<br>9.2                        | Aluminium/aluminium<br>- Knetlegierung nicht gehärtet                                    |                                                          |                                        |       |       |       |       |       |       |
|                                   | - Magnesium Knetlegierung                                                                | 500 - 2000                                               | 0,03                                   | 0,04  | 0,06  | 0,07  | 0,08  | 0,10  | 0,12  |
|                                   | - wrought alloy, unhardened                                                              |                                                          | -0,05                                  | -0,08 | -0,12 | -0,15 | -0,18 | -0,20 | -0,25 |
|                                   | - magnesium wrought alloy                                                                |                                                          |                                        |       |       |       |       |       |       |
| 9.1<br>9.2                        | Aluminium/aluminium<br>- Knetlegierung ausgehärtet                                       |                                                          |                                        |       |       |       |       |       |       |
|                                   | - Gußlegierung bis 6% Si                                                                 | 300 - 1000                                               | 0,03                                   | 0,04  | 0,06  | 0,07  | 0,08  | 0,10  | 0,12  |
|                                   | - wrought alloy, hardend                                                                 |                                                          | -0,05                                  | -0,08 | -0,12 | -0,15 | -0,18 | -0,20 | -0,25 |
|                                   | - casting alloy up to 6% Si                                                              |                                                          |                                        |       |       |       |       |       |       |
| 9.3<br>9.4                        | Aluminium/aluminium<br>- Gußlegierung über 6% Si                                         | 200 - 600                                                | 0,02                                   | 0,03  | 0,04  | 0,05  | 0,06  | 0,08  | 0,10  |
|                                   | - casting alloy over 6% Si                                                               |                                                          | -0,04                                  | -0,06 | -0,08 | -0,10 | -0,12 | -0,15 | -0,20 |
|                                   |                                                                                          |                                                          |                                        |       |       |       |       |       |       |
| 10.1                              | Kupfer/chopper<br>- unlegiert                                                            |                                                          |                                        |       |       |       |       |       |       |
|                                   | - Knetlegierung nicht ausgehärtet                                                        |                                                          |                                        |       |       |       |       |       |       |
|                                   | - Knetlegierung ausgehärtet                                                              | 120 - 300                                                | 0,02                                   | 0,03  | 0,04  | 0,05  | 0,06  | 0,08  | 0,10  |
|                                   | - unalloyed                                                                              |                                                          | -0,04                                  | -0,06 | -0,08 | -0,10 | -0,12 | -0,15 | -0,20 |
|                                   | - wrought alloy, unhardened                                                              |                                                          |                                        |       |       |       |       |       |       |
| 10.2<br>10.3                      | Messing/brass<br>- Cu/Zn kurz- und langspanend                                           |                                                          |                                        |       |       |       |       |       |       |
|                                   | - Bronze CuSn kurz- und langspanend                                                      | 100 - 600                                                | 0,01                                   | 0,02  | 0,03  | 0,05  | 0,06  | 0,08  | 0,08  |
|                                   | - CuZn short- and long-chipping                                                          |                                                          | -0,04                                  | -0,06 | -0,08 | -0,10 | -0,15 | -0,18 | -0,20 |
|                                   | - bronze, CuSn short- and long-chipping                                                  |                                                          |                                        |       |       |       |       |       |       |
|                                   | Faserverstärkte Kunststoffeff.B.Kohlefaser<br>fiber reinforced plastic e.g. carbon fibre |                                                          |                                        |       |       |       |       |       |       |
| 11.1<br>11.2<br>11.4              | Kunststoffe<br>- Thermoplast, Duroplast                                                  | 160 - 500                                                | 0,01                                   | 0,02  | 0,03  | 0,05  | 0,06  | 0,08  | 0,10  |
|                                   | plastics                                                                                 |                                                          | -0,04                                  | -0,06 | -0,08 | -0,10 | -0,12 | -0,15 | -0,20 |
|                                   | - thermoplastic, duroplastic                                                             |                                                          |                                        |       |       |       |       |       |       |



Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer mit Innenkühlung ab Ø 0,8 – Ø 2,9  
Recommended cutting data for solid carbide twist drill, with interior cooling supply

Art. 22.0322

Wir empfehlen eine Pilotbohrung bei überlangen Werkzeugen mit 18xD. Verwenden Sie für diese Pilotbohrung die Art-Nr. 22.0341 – 4xD ohne Innenkühlung. Alternativ Art-Nr. 22.0322 mit Innenkühlung in den kürzesten lieferbaren Ausführung. Diese Pilotbohrer sind mit der Durchmesertoleranz m7 auf die überlangen Werkzeuge mit tol. h7 abgestimmt. Empfohlene Bohrtiefe der Pilotbohrung 3-5xD. Kühlmitteldruck 30-80 bar.

We recommended a pilot drilling for the excess length tools art-no. 22.0322 - 18xD. Please use for the pilot drilling our art-no. 22.0341 – 4xD without interior cooling. Alternative art-no. 22.0322 with interior cooling in the shortest l3 version. These pilot drills are, with the diameter tolerance m7, to the excess lenght tools with tolerance h7 coordinated. Recommended drilling dept of the pilot borehole 3-5xD. Coolant pressure 30-80 bar.

| KfV                                | 6xD                              | 12xD                | 18xD                                        | Die in den Schnittwerttabellen enthaltenen Richtwerte gelten nur beim Einsatz von Schrumpf- oder Hydrodehnspannfuttern. |  |
|------------------------------------|----------------------------------|---------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--|
|                                    | 0,8                              | 0,6                 | 0,4                                         |                                                                                                                         |  |
| Werkstoffgruppe<br>Material group  | Werkstoff                        | Festigkeit<br>Härte | Schnittge-<br>schwindig-<br>keit Vc (m/min) | Vorschub pro Umdrehung (mm)<br>bezogen auf Bohrerdurchmesserbereich<br>1,0 - 2,9 Ø                                      |  |
| 1.1 – 1.2<br>1.3                   | St37, St42, C22, GS38            | bis 600 N/mm²       | 100-120                                     | 0,07 - 0,15                                                                                                             |  |
|                                    | St50, St60, C35, GS52            | bis 700 N/mm²       | 85-105                                      | 0,07 - 0,15                                                                                                             |  |
|                                    | St70, C45, GS62                  | über 700 N/mm²      | 75-90                                       | 0,05 - 0,12                                                                                                             |  |
| 1.4 – 1.5<br>2.1 – 2.2 – 3.1       | 16MnCr45, 42CrMo4, 50CrNi13, C60 | bis 900 N/mm²       | 65-85                                       | 0,06 - 0,12                                                                                                             |  |
|                                    | 90 MnCrV8, 100Cr6                | bis 1000 N/mm²      | 50-70                                       | 0,05 - 0,12                                                                                                             |  |
|                                    | X210Cr12, 34 CrAlNi7             | über 1000 N/mm²     | 40-60                                       | 0,05 - 0,12                                                                                                             |  |
| 4.1 – 4.2<br>4.3                   | X12Cr Nis 18 8                   |                     | 35-60                                       | 0,04 - 0,08                                                                                                             |  |
|                                    | X10CrNiNb 18 9                   |                     | 35-60                                       | 0,04 - 0,08                                                                                                             |  |
|                                    | GG 20, GGG40, GTS45              | bis 200 HB          | 85-105                                      | 0,15 - 0,25                                                                                                             |  |
| 7.1 – 7.2 – 7.3<br>7.4 – 7.5 – 7.6 | GG30, GGG60, GTW40               | bis 250 HB          | 75-90                                       | 0,15 - 0,25                                                                                                             |  |
|                                    | GG40, GGG70, GTS70               | über 250 HB         | 65-80                                       | 0,15 - 0,25                                                                                                             |  |
| 8.4                                |                                  | 350-450 HB          | 40-70                                       | 0,06 - 0,12                                                                                                             |  |

Die angegebenen Richtwerte für die Schnittgeschwindigkeit Vc sind je nach Bohrtiefe bezogen auf den Durchmesser mit dem Korrekturfaktor KfV zu multiplizieren.

The indicated standard values for the cutting speed Vc depends on drilling depth related to the diameter to multiply by the correction factor KfV.

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer mit Innenkühlung ab Ø 2,0 – Ø 2,95 24xD – 30xD  
Recommended cutting data for solid carbide twist drill, with interior cooling supply

Art. 22.0322

| Werkstoffe<br>Work Material                                        | Werkstoffgruppe<br>Material Group | Festigkeit in<br>N/mm | Ø 2.00-2.95           |                  |
|--------------------------------------------------------------------|-----------------------------------|-----------------------|-----------------------|------------------|
|                                                                    |                                   |                       | Cutting Speed (m/min) | Feed (mm/rev)    |
| Baustahl<br>Mild Steel                                             | 1.1                               | ≤ 600                 | 60 (50-70)            | 0.10 (0.08-0.12) |
| Kohlenstoffstahl<br>Legierter Stahl<br>Carbon Steel<br>Alloy Steel | 1.2-2.1-2.2                       | 600-950               | 50 (40-60)            | 0.09 (0.06-0.12) |
|                                                                    | 2.2-2.3-2.5-2.6                   | 950-1200              | 50 (40-60)            | 0.07 (0.05-0.10) |
| Edelstahl<br>Stainless Steel                                       | 3.1                               | 680                   | 30 (20-40)            | 0.06 (0.04-0.08) |
| Guss<br>Cast Iron                                                  | 7.1-7.2                           | ≤ 105 HB              | 50 (40-60)            | 0.09 (0.06-0.12) |
| Kugelgraphitguss<br>Ductile Cast Iron                              | 7.4                               | ≤ 133 HB              | 50 (40-60)            | 0.07 (0.05-0.10) |
| Wärmfeste Legierungen<br>Heat Resistant Alloy                      | 31-32                             | ≤ 280 HB              | 15 (10-20)            | 0.03 (0.01-0.05) |

Praxistest Minibohrer Vollhartmetall mit Innenkühlung

Art. 22.0322

12 x D Bohren ab 0,8 mm mit Innenkühlung ist nicht jedermann's Sache!

Als Vorreiter in Sachen HSC-Bohren mit Bohrtiefen über 5 x D haben wir uns in der Branche einen Namen gemacht. Weltweit haben wir bei unzähligen Kunden die Bearbeitungszeiten um bis zu 600% reduziert und gleichzeitig die Prozesssicherheit und Standzeit um ein vielfaches erhöhen können.

Das neueste Produkt sind MINI-Vollhartmetallbohrer **ab 0,8 mm mit Innenkühlung** mit einer **Bohrtiefe von 18 x D**. Der Wettbewerbsdruck unserer Kunden in der weltweit zunehmenden Globalisierung hat uns dazu bewogen diesen Schritt zu gehen. Diese HSC-Minibohrer **mit Innenkühlung 6 x D und 12 x D** können in den Abmessungen 1,0 mm bis 2,9 mm um 0,1 mm steigend ab Lager geliefert werden.

Ab 3,0 mm bis 20,0 mm können Sie auf das bestehende Programm in 3 x D / 5 x D / 8 x D / 12 x D zurückgreifen.

12 x D drilling starting from 0,8 mm with interior cooling supply isn't everyones thing.

As pioneer in HSC-drills with drilling depths over 5 x D our reputation is well known all over the world. Productive time of our customer decreased up to 600%. Increased process security and cutting-edge live at the same time.

The latest products are Mini-solid carbide drills, starting from 0,8 mm with interior cooling supply with drilling depht up to 12 x D.

The competition-pressure from our customers in the worldwide increasing globalization forced us into this direction.

These HSC-Mini drills **with interior cooling supply 6 x D and 18 x D** can be supplied in the dimensions 1,0 mm to 2,9 mm in 0,1 mm steps from stock.

From 3,0 mm to 20,0 mm see our existing program in 3 x D, 5 x D, 8 x D, 12 x D.

| Werkstoffgruppe<br>Material group | Ø<br>mm | Bohrtiefe<br>mm | Vc<br>m/min | n<br>U/min | f<br>mm/U | Vf<br>mm / min |
|-----------------------------------|---------|-----------------|-------------|------------|-----------|----------------|
| C 45<br>C 45                      | 1,0     | 10              | 60          | 18800      | 0,05      | 950            |
|                                   | 1,0     | 10              | 60          | 18800      | 0,10      | 1880           |
| X 5 Cr Ni Cu Nb 16 - 4            | 2,0     | 24              | 42          | 6600       | 0,08      | 530            |
| X 5 Cr Ni Mo 17122                | 2,0     | 20              | 65          | 10300      | 0,12      | 1230           |
| 99% Titan<br>(Dentalimplantat)    | 2,5     | 25              | 30          | 3800       | 0,015     | 57             |
| 42 Cr Mo 4                        | 2,9     | 30              | 75          | 8200       | 0,09      | 740            |
| Inconel 718                       | 2,2     | 13              | 12          | 1700       | 0,05      | 85             |

| Werkstoffe<br>Work Material                      | Werkstoff-<br>gruppe<br>Material<br>Group | Festigkeit [N/mm²]<br>Härte HB | Beispiele                           | Schnittgeschwindigkeit v <sub>c</sub><br>[m/min] |         | Empfohlener Vorschub f [mm/U] für Durchmesserbereiche |            |             |              |              |
|--------------------------------------------------|-------------------------------------------|--------------------------------|-------------------------------------|--------------------------------------------------|---------|-------------------------------------------------------|------------|-------------|--------------|--------------|
|                                                  |                                           |                                |                                     | 22.0404                                          | 22.0530 | 3 bis 5 mm                                            | 5 bis 8 mm | 8 bis 12 mm | 12 bis 16 mm | 16 bis 20 mm |
| Unlegierte Stähle, Stahlguss                     | 1.1-1.2                                   | ≤ 600 N/mm²                    | St37, St42, C22, GS38               | 75-95                                            |         | 0,08-0,14                                             | 0,12-0,20  | 0,15-0,25   | 0,16-0,28    | 0,20-0,32    |
|                                                  | 2.1-2.2                                   | ≤ 700 N/mm²                    | St50, St60, C45, GS62               | 65-85                                            |         | 0,08-0,14                                             | 0,12-0,20  | 0,15-0,25   | 0,16-0,28    | 0,20-0,32    |
|                                                  | 3-4-5                                     | > 700 N/mm²                    | St70, C70                           | 60-80                                            |         | 0,08-0,15                                             | 0,12-0,22  | 0,15-0,28   | 0,16-0,30    | 0,20-0,33    |
| Legierte Stähle                                  | 6-7                                       | ≤ 900 N/mm²                    | 16MnCr5, 90MnCrV8                   | 50-70                                            |         | 0,08-0,15                                             | 0,12-0,22  | 0,15-0,28   | 0,16-0,30    | 0,20-0,33    |
|                                                  | 8-9                                       | ≤ 1000 N/mm²                   | 100Cr6, 42CrMo4                     | 40-60                                            |         | 0,08-0,12                                             | 0,10-0,15  | 0,11-0,20   | 0,12-0,24    | 0,14-0,25    |
|                                                  | 10-11                                     | > 1000 N/mm²                   | X210Cr13, 34CrAlNi7                 | 40-50                                            |         | 0,08-0,12                                             | 0,10-0,15  | 0,11-0,20   | 0,12-0,24    | 0,14-0,25    |
| Inox                                             | 14.1-14.2                                 |                                | X5 CrNi 18 9 (V2A)                  | 40-60                                            |         | 0,04-0,08                                             | 0,05-0,15  | 0,06-0,12   | 0,09-0,16    | 0,12-0,20    |
| Rost- und säurebeständige Stähle (Cr-Ni-legiert) | 14.3-14.4                                 |                                | X10 CrNiMoTi 18 10, G-X40 CrNi 27 4 | 40-50                                            |         | 0,03-0,06                                             | 0,04-0,08  | 0,05-0,10   | 0,06-0,12    | 0,06-0,12    |
| Grauguss, legierter Grauguss                     | 15-16                                     | ≤ 200 HB                       | GG10, GG15                          | 80-110                                           |         | 0,08-0,20                                             | 0,12-0,25  | 0,16-0,32   | 0,20-0,36    | 0,24-0,40    |
|                                                  |                                           | ≤ 250 HB                       | GG20, GG25, GTW40                   | 70-100                                           |         | 0,08-0,15                                             | 0,10-0,20  | 0,12-0,28   | 0,16-0,32    | 0,20-0,36    |
|                                                  |                                           | > 250 HB                       | GG30, GG40, GTS70                   | 60-80                                            |         | 0,08-0,15                                             | 0,10-0,20  | 0,12-0,28   | 0,16-0,32    | 0,20-0,36    |
| Sphäroguss, Vermikularguss, Temperguss           | 17-18                                     | ≤ 600 N/mm²                    | GGG40, GGG50                        | 65-80                                            |         | 0,08-0,15                                             | 0,10-0,20  | 0,16-0,28   | 0,24-0,32    | 0,28-0,40    |
|                                                  |                                           | > 600 N/mm²                    | GGG60, GGG70, GGV                   | 60-75                                            |         | 0,06-0,12                                             | 0,08-0,15  | 0,14-0,25   | 0,20-0,28    | 0,24-0,32    |
| Aluminium (Si-Gehalt < 10%)                      | 21-22                                     |                                | GD-ALSi9Cu3, ALSi7Mg0,6             |                                                  | 100-250 | 0,08-0,20                                             | 0,12-0,28  | 0,20-0,36   | 0,24-0,40    | 0,28-0,44    |
| Aluminium (Si-Gehalt > 10%)                      | 23-24<br>25.1                             |                                | GD-ALSi12(Cu), ALSi17Cu4Mg (Alusil) |                                                  | 100-160 | 0,08-0,20                                             | 0,12-0,28  | 0,20-0,36   | 0,24-0,40    | 0,28-0,44    |
| Kupfer                                           | 26-27-28                                  |                                | G-CuZn15, CuZn37, CuSn8             |                                                  | 100-200 | 0,08-0,20                                             | 0,12-0,28  | 0,20-0,36   | 0,24-0,40    | 0,28-0,44    |
| Messing, Bronze                                  |                                           |                                | G-CuZn15, CuZn37, CuSn8             |                                                  | 100-180 | 0,08-0,20                                             | 0,12-0,28  | 0,20-0,36   | 0,24-0,40    | 0,28-0,44    |

| Korrekturfaktoren Kv für f (mm/U) beim Anbohren |           |                      |
|-------------------------------------------------|-----------|----------------------|
| Neigung<br>Werkstückoberfläche                  | Kv<br>3xD | Kv<br>5xD            |
| 0°                                              | 0,5       | 0,4                  |
| 15°                                             | 0,5       | 0,25                 |
| 30°                                             | 0,4       | nicht empfehlenswert |
| 45°                                             | 0,25      | nicht empfehlenswert |

- Beim Anbohren Vorschub f (mm/U) mit Korrekturfaktor Kv multiplizieren
- Anbohren mit reduziertem Vorschub bis Werkzeug auf 0,25xD im ganzen Ø schneidet
- Bei schrägem Anbohren: Zurückfahren mit doppeltem Vorschub f (mm/U)
- Nach dem Anbohren mit reduziertem Vorschub (Korrekturfaktor) wird mit dem Vorschub f (mm/U) gemäß Schnittdatenempfehlung ohne Korrekturfaktoren weitergebohrt.

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer mit Innenkühlung

Recommended cutting data for solid carbide twist drill, with interior cooling supply

TESTERGEBNIS: Material 3.2315 Al Mg Si 1 / Bohrtiefe 180 mm Ø 6

| Bohrstrategie                                       |   |                        | Bohrstrategie                                            |   |                       |
|-----------------------------------------------------|---|------------------------|----------------------------------------------------------|---|-----------------------|
| Pilotbohrer Art. 22.0409 / Ø 6,0 tol. m7 x 35 (5xD) |   |                        | Tieflochbohrer Art. 22.0392 / Ø 6,0 tol. h7 x 180 (30xD) |   |                       |
| Vc                                                  | = | 280 m/min              | Vc                                                       | = | 120 m/min             |
| n                                                   | = | 15000 min <sup>1</sup> | n                                                        | = | 6300 min <sup>1</sup> |
| f                                                   | = | 0,2 mm/U               | f                                                        | = | 0,2 mm/U              |
| ap                                                  | = | 2 x D (12mm)           | ap                                                       | = | 30 x D (180 mm)       |
| Emulsion/Kühlmitteldruck 70bar                      |   |                        | Emulsion/Kühlmitteldruck 70bar                           |   |                       |

| Werkstoff-<br>gruppe | Werkstoff    | Festigkeit<br>N/mm <sup>2</sup> | Schnittgeschwindig-<br>keit Vc (m/min) | Ø 3 - 6     | Ø 6 - 10    | Ø 10 - 12   |
|----------------------|--------------|---------------------------------|----------------------------------------|-------------|-------------|-------------|
| 9.1                  | Al Mg 1      | < 250                           | 180 - 230                              | 0,20 - 0,30 | 0,30 - 0,60 | 0,30 - 0,60 |
| 9.2                  | Al Mg Si 1   | < 350                           | 150 - 200                              | 0,20 - 0,30 | 0,30 - 0,60 | 0,30 - 0,60 |
| 9.3                  | G Al Si 11   | < 250                           | 140 - 180                              | 0,25 - 0,45 | 0,20 - 0,40 | 0,20 - 0,40 |
| 9.4                  | G Al Si 7 Mg | < 450                           | 120 - 160                              | 0,25 - 0,45 | 0,20 - 0,40 | 0,20 - 0,40 |

 **Vollhartmetall-Hochleistungs-Flachkopfborher 180°**

Durch die spezielle Geometrie des 180° Hochleistungs-Flachkopfborher können schwierigste Bohroperationen bei höchsten Standzeiten prozesssicher gebohrt werden. Durch die 4-Fasengeometrie werden optimale Rundheiten und Oberflächen in der Bohrung erzielt. Durch das Zusammenspiel der DMC-X2-Beschichtung, der polierten Spannuten und der optimierten Spannutengeometrie, wird ein sehr guter Spänetransport sichergestellt.

 **Solid Carbide High-Performance 180° shallow drills**

It is possible to drill difficult drilling operations by a maximum tool life, through the special geometry of our 180° shallow drill. We realize an optimal roundness and surface quality of the hole, through our 4-chamfergeometry. Because of the interaction of our DMC-X2 coating, the polished flute and the optimized flutegeometry, we ensure a smooth chip remove.

 **Taladro de cabeza plana - metal duro - alto rendimiento 180°**

Mediante la geometría especial del Taladro de cabeza plana de gran rendimiento de 180° se pueden realiza difíciles operaciones de taladro con procedimientos seguros y de mayor durabilidad. Mediante la geometría de 4 chaflanes se obtienen redondeces y superficies óptimas en el taladrado. Mediante la interacción del recubrimiento DMC-X2, la ranura de fijación pulida y la geometría de ranura de fijación optimizada, se asegura una muy buena evacuación de virutas.

 **Твердосплавное высокопроизводительное сверло с плоским торцом 180°**

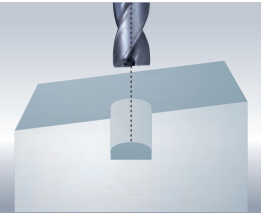
Благодаря специальной геометрии высокопроизводительного сверла с плоским торцом 180° могут безопасно и надежно осуществляться самые сложные виды сверлильных работ. Благодаря 4-фасочной геометрии режущей части сверла достигаются оптимальные показатели округлости отверстия и качества обработки его поверхности. Благодаря сочетанию покрытия DMC-X2 с полированными стружечными канавками и их оптимизированной геометрии гарантируется очень хороший отвод стружки.

 **Einsatzmöglichkeiten der Karnasch Hochleistungs-Flachkopfborher 180°**

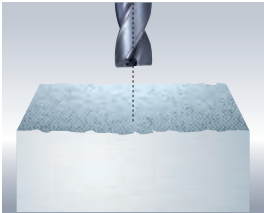
 **Possible applications for the Karnasch 180° shallow drills**

 **Aplicaciones del taladro de cabeza plana de alto rendimiento 180° de Karnasch**

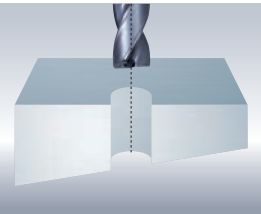
 **Возможности применения высокопроизводительного сверла с плоским торцом 180° от фирмы Karnasch**



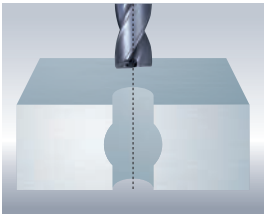
-  Anbohren auf schrägen Flächen 3xD bis 45° / 5xD bis 15°
-  Pilot drilling on bevel surfaces
-  Perforaciones en superficies inclinadas
-  Засверливание в наклонные поверхности



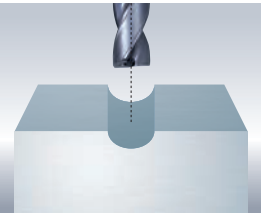
-  Anbohren auf unebenem Grund
-  Drilling on uneven surfaces
-  Perforación de fondo irregular
-  Засверливание в неровное дно



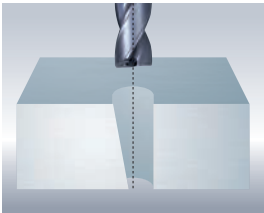
-  Bohrungen mit schrägem Bohrungsaustritt
-  Holes with irregular exit
-  Perforaciones con salida inclinada
-  Сверление наклонных выходных отверстий



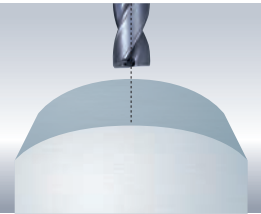
-  Bohrungen durch Querbohrungen
-  Drilling through croll holes
-  Perforación por orificios pasantes transversales
-  Сверление пересекающихся отверстий



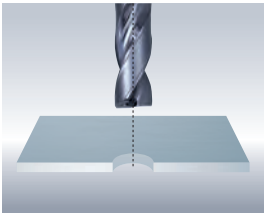
-  Bohren auf konkaven Flächen
-  Drilling in concave surfaces
-  Perforar superficies cóncavas
-  Сверление в вогнутых поверхностях



-  Bohren in konische Bohrungen
-  Drilling in conical holes
-  Perforación en orificios cónicos
-  Сверление в конических отверстиях



-  Anbohren auf konvexen Flächen
-  Drilling in convex surfaces
-  Perforaciones en superficies convexas
-  Засверливание в выпуклые поверхности



-  Bohrungen durch dünne Bleche
-  Drilling through thin sheets
-  Perforaciones a través de hojas finas
-  Отверстия в тонких металлических листах

Bohrstrategie von Karnasch – VHM- Bohrer bis 12 mm Durchmesser und über 18xD Ausraglänge l3  
Drilling strategy from Karnasch – VHM drill bits up to 12 mm in diameter and in excess of 18xD protection length l3

Drehzahl in Abhängigkeit von Durchmesser und Ausraglänge l3

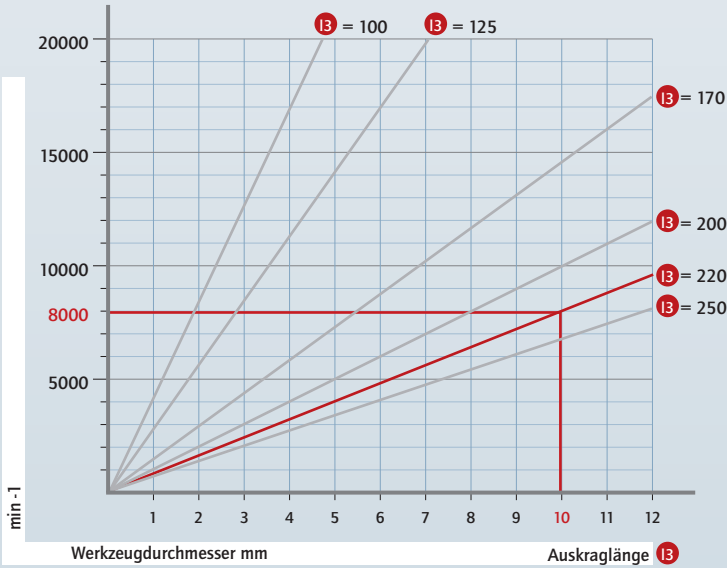
Überhöhte Drehzahlen können im Extremfall durch Zentrifugalkräfte zum Werkzeugbruch führen. Zu hohe Anfangsbeschleunigung sowie plötzliche Richtungsänderungen dieser überlangen schlanken Werkzeuge sind zu vermeiden.

Karnasch empfiehlt daher Drehzahlkritische Bereiche nicht zu überschreiten (siehe Tabelle).

The drill speed is dependent on the diameter and protection length l3

Excessive drill speeds could result in the tool breaking through the centrifugal force created. You should avoid drastically increasing the speed of the drill from the outset, as well as abruptly changing the direction of these long, slender tools.

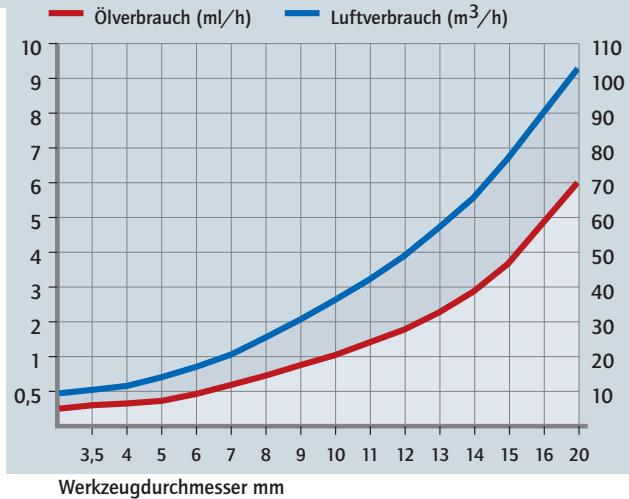
Karnasch therefore recommends that you do not exceed the critical speed ranges (see the tables).



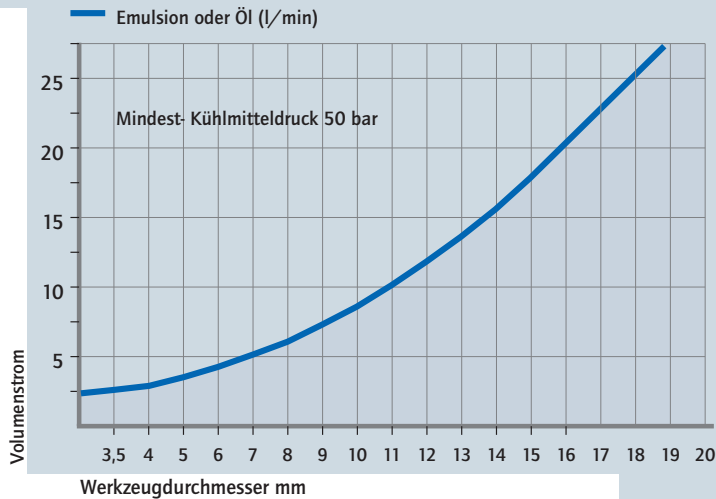
Beispiel:  
Durchmesser d1 = 10 mm  
Ausraglänge l3 = 220 mm  
Drehzahlkritischer Bereich max. 8000 min<sup>-1</sup>

Information zum Einsatz der Karnasch VHM- Hochleistungsbohrer mit Innenkühlung < 40xD

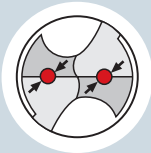
Kühlschmierstoffmengen bei der MMKS- Bearbeitung



Kühlschmierstoffmengen bei konventioneller Kühlung



Kühlmittel-Durchflussmenge / Emulsion



| d1 | d2          | Ø    | 10 Bar | 20 Bar | 30 Bar | 40 Bar | 50 Bar | 60 Bar |
|----|-------------|------|--------|--------|--------|--------|--------|--------|
| 6  | 3,0 - 6,0   | 0,20 | 0,6    | 0,9    | 1,1    | 1,3    | 1,4    | 1,6    |
| 6  | 3,0 - 6,0   | 0,50 | 1,6    | 2,3    | 2,8    | 3,2    | 3,6    | 3,9    |
| 8  | 6,1 - 8,0   | 1,00 | 3,2    | 4,5    | 5,5    | 6,4    | 7,1    | 7,8    |
| 10 | 8,1 - 10,0  | 1,40 | 4,5    | 6,3    | 7,7    | 8,9    | 10,0   | 11,0   |
| 12 | 10,1 - 12,0 | 1,60 | 5,1    | 7,2    | 8,9    | 10,2   | 11,4   | 12,5   |
| 14 | 12,1 - 14,0 | 2,00 | 6,4    | 9,0    | 11,1   | 12,8   | 14,3   | 15,6   |
| 16 | 14,1 - 16,0 | 2,50 | 8,0    | 11,3   | 13,8   | 16,0   | 17,9   | 19,6   |
| 18 | 16,1 - 18,0 | 2,80 | 8,9    | 12,6   | 15,5   | 17,9   | 20,0   | 21,9   |
| 20 | 18,1 - 20,0 | 3,00 | 9,6    | 13,5   | 16,6   | 19,2   | 21,4   | 23,5   |
| 25 | 20,1 - 25,0 | 3,00 | 9,6    | 13,5   | 16,6   | 19,2   | 21,4   | 23,5   |
| 32 | 25,1 - 32,0 | 3,00 | 9,6    | 13,5   | 16,6   | 19,2   | 21,4   | 23,5   |



Richtwerte für den Einsatz von KARNASCH VHM-Hochleistungsbohrern mit Innenkühlung <40xD  
Recommended cutting conditions for Karnasch solid carbide drills <40xD

Art. 22.0390

Wir empfehlen bei diesen High-Speed-Tieflochbohrern der Serie 22.0390 eine Pilotbohrung vorzunehmen. Verwenden Sie bevorzugt ein Werkzeug mit 3xD Bohrtiefe (22.0405) oder alternativ bis 5xD Bohrtiefe mit Innenkühlung. Der Spitzwinkel von 140° sowie die Durchmesser tolerance m7 sind darauf abgestimmt. Ein Mindestkühlmitteldruck von 30 bar ist ausreichend. <20xD über 20xD 50 bar. Jetzt mit 22.0390 anbohren (ca. 1-2xD) mit reduzierter Vorschub- und Schnittgeschwindigkeit ca. 40-50% der empfohlenen Werte. Danach ohne Unterbrechung die Vorschub- und Schnittgeschwindigkeit auf die empfohlenen Richtwerte erhöhen. Diese Bohrstrategie sollte ohne lüften oder Vorschubunterbrechung erfolgen. Nach Erreichen der Bohrtiefe ist die Drehzahl auf ca. 30% zu reduzieren, um aus der Bohrung heraus zu fahren. Auch ein Stillstand der Spindel kann im Extremfall von Vorteil sein. Unser Nachschleifservice garantiert Ihnen kurze Lieferzeiten mit 100% Standzeitgarantie.

We recommend that you drill a pilot hole when using series 22.0390 high-speed, deep hole drill bits. Preferentially you should use a tool with 3xD drilling depth (22.0405), or alternatively up to 5xD drilling depth with internal cooling. The point angle of 140° as well as the diameter tolerance m7 are aligned. A minimum coolant pressure of 20-30 bar is sufficient. Now drill using the 22.0390 series (approx. 1-2xD), with a reduced feed rating and cutting speed of approx. 40-50% of the recommended value. Then increase the feed rating and the cutting speed, without interruption, to the recommended benchmarks. The drilling strategy should be conducted without ventilation of interrupting the feed rate. After reaching the desired drilling depth, the drill speed should be reduced to approx. 30% in order to extract the drill from the hole. The drill being completely still can be an advantage in extreme cases. Our regrinding service ensures short delivery times and a 100% lifetime guarantee.

| Werkstoffgruppe<br>Material group | Beispiele DIN-EN                                                                                                                                                                 | Schnittgeschwindigkeit<br>Vc m/min                                                              |      |  | Vorschub pro Umdrehung (mm/U) bezogen auf den Bohrdurchmesser |      |      |      |      |      |      |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------|--|---------------------------------------------------------------|------|------|------|------|------|------|
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 3,0                                                           | 4,0  | 5,0  | 6,0  | 8,0  | 10   | 12   |
| 1.1                               | 115 Mn Pb 30<br>46 S 20<br>60 S 20<br>115 Mn 37<br>46 Pb 20                                                                                                                      |  Vc 80 - 110   | Min. |  | 0,08                                                          | 0,12 | 0,14 | 0,16 | 0,20 | 0,25 | 0,27 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,15                                                          | 0,18 | 0,20 | 0,25 | 0,30 | 0,35 | 0,40 |
| 1.2                               | C22<br>C45<br>C60<br>C30E<br>C45E<br>C 60 E<br>100 Cr Mn 6<br>43 Cr Mo 4                                                                                                         |  Vc 80 - 100   | Min. |  | 0,08                                                          | 0,12 | 0,14 | 0,16 | 0,20 | 0,25 | 0,27 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,15                                                          | 0,18 | 0,20 | 0,25 | 0,30 | 0,35 | 0,40 |
| 1.3                               | 50 Mn Si 3<br>36 Ni Cr 6<br>38 Cr 2<br>28 Cr 4<br>41 Cr 4<br>42 Cr Mo 4                                                                                                          |  Vc 80 - 100  | Min. |  | 0,08                                                          | 0,12 | 0,14 | 0,16 | 0,20 | 0,25 | 0,27 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,15                                                          | 0,18 | 0,20 | 0,25 | 0,30 | 0,35 | 0,40 |
| 2.1<br>2.2                        | 1.5752 / 14 Ni Cr 14<br>1.7043 / 38 Cr 4<br>1.7131 / 16 Mn Cr 5<br>1.7264 / 20 Cr Mo 5                                                                                           |  Vc 70 - 90  | Min. |  | 0,08                                                          | 0,12 | 0,14 | 0,16 | 0,20 | 0,25 | 0,27 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,15                                                          | 0,18 | 0,20 | 0,25 | 0,30 | 0,35 | 0,40 |
| 2.2                               | 1.8540 / 34 Cr Al 6<br>1.8519 / 31 Cr MoV 9<br>1.8550 / 34 Cr Al Ni 7                                                                                                            |  Vc 70 - 90  | Min. |  | 0,08                                                          | 0,10 | 0,11 | 0,12 | 0,15 | 0,18 | 0,20 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,16                                                          | 0,18 | 0,20 | 0,25 | 0,30 | 0,35 | 0,40 |
| 2.1                               | 1.1750 / C75W<br>1.2067 / 102 Cr 6<br>1.2080 / X210 Cr 12<br>1.2083 / X42 Cr 13<br>1.2343 / X38 Cr Mo V5<br>1.2419 / 105 WCr 6<br>1.2767 / X45Ni Cr Mo 4                         |  Vc 60 - 80  | Min. |  | 0,08                                                          | 0,10 | 0,11 | 0,12 | 0,15 | 0,18 | 0,20 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,16                                                          | 0,18 | 0,20 | 0,25 | 0,30 | 0,35 | 0,40 |
| 7.1<br>7.2                        | 0.6010 / EN-GJL-100 (GG10)<br>0.6020 / EN-GJL-200 (GG20)<br>0.6025 / EN-GJL-250 (GG25)<br>0.6030 / EN-GJL-300 (GG30)<br>0.6035 / EN-GJL-350 (GG35)<br>0.6040 / EN-GJL-400 (GG40) |  Vc 90 - 120 | Min. |  | 0,12                                                          | 0,15 | 0,16 | 0,20 | 0,25 | 0,28 | 0,30 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,16                                                          | 0,18 | 0,20 | 0,25 | 0,32 | 0,38 | 0,40 |
| 7.3<br>7.4<br>7.5<br>7.6          | 0.7040 / GGG 40<br>0.7050 / EN-GJS-500-7 (GGG50)<br>0.7070 / EN-GJS-700-2 (GGG70)<br>0.8035 / EN-GJMW-350-4 (GTW35)<br>0.8170 / EN-GJMW-700-2 (GTS70)                            |  Vc 80 - 100 | Min. |  | 0,12                                                          | 0,15 | 0,16 | 0,20 | 0,25 | 0,28 | 0,30 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,16                                                          | 0,18 | 0,20 | 0,25 | 0,32 | 0,38 | 0,40 |
| 7.3                               | EN-GJV250 (GGV25)<br>EN-GJV350 (GGV35)<br>EN-GJV400 (GGV40)<br>EN-GJV500 (GGV50)<br>Si Mo 6                                                                                      |  Vc 80 - 100 | Min. |  | 0,12                                                          | 0,15 | 0,16 | 0,20 | 0,25 | 0,28 | 0,30 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,16                                                          | 0,18 | 0,20 | 0,25 | 0,32 | 0,38 | 0,40 |
| ADI<br>800 - 1400 N               | EN-GJS-800-8 (ADI800)<br>EN-GJS-1000-5 (ADI1000)<br>EN-GJS-1200-2 (ADI1200)<br>EN-GJS-1400-1 (ADI1400)                                                                           |  Vc 70 - 90  | Min. |  | 0,10                                                          | 0,12 | 0,13 | 0,16 | 0,20 | 0,22 | 0,25 |
|                                   |                                                                                                                                                                                  |                                                                                                 |      |  | 0,12                                                          | 0,15 | 0,16 | 0,20 | 0,25 | 0,28 | 0,30 |
|                                   | TOOLOX 33<br>HB 280-330/≈7-33 HRC                                                                                                                                                |  Vc 40 - 50  | Min. |  | 0,08                                                          | 0,10 | 0,15 | 0,18 | 0,20 | 0,22 | 0,25 |
|                                   | TOOLOX 44<br>HB 410-475/≈41-47 HRC                                                                                                                                               |  Vc 30 - 40  | Max. |  | 0,08                                                          | 0,10 | 0,14 | 0,16 | 0,18 | 0,20 | 0,22 |

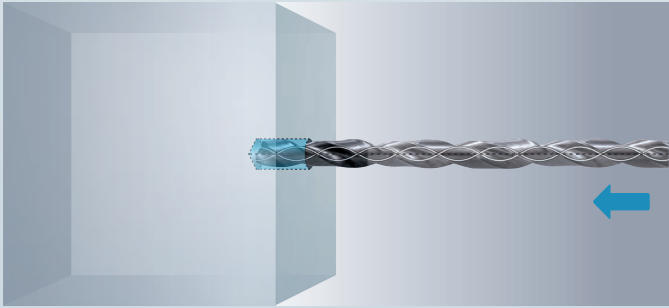
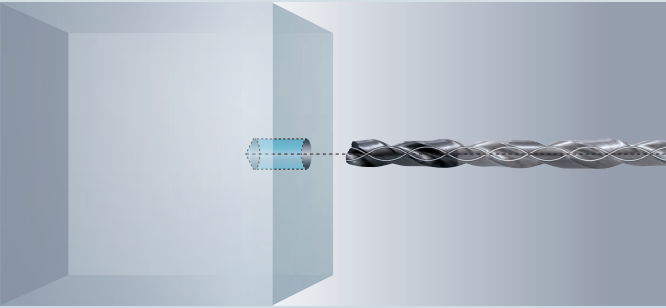
Sacklochbohrungen – Einsatzhinweise für Vollhartmetall-Hochleistungsbohrer < 40xD

- **Blind hole drilling** – Appliation instruction for Solid carbide twist drill < 40xD
- **Taladros ciegos** – Instrucciones para perforaciones de orificio ciego con el taladro de alto rendimiento de metal duro < 40xD
- **глухое отверстие** – Рекомендации по применению твердосплавного высокопроизводительного сверла для сверления глухих отверстий < 40xD

- 1

**Pilotbohrung setzen**  
**Drilling a pilot hole**  
**Taladrar previamente el orificio piloto**  
**Получение пилотного отверстия**
- 2

**Einfahren in die Pilotbohrung**  
**Enter into the pilote hole**  
**Entrar en la perforación piloto**  
**Введение сверла в пилотное отверстие**



- **1**

Für die Pilotbohrungen empfehlen wir den Einsatz der Karnasch Bohrer Art. Nr. 22.0402 oder 22.0405 in der jeweils kürzesten Ausführung.
- **2**

Bitte stellen Sie eine präzise Pilotbohrung zwischen 1,5 und 2xD her, um einen einwandfreien Bohrprozess zu gewährleisten. (Passen Sie die Pilotbohrungstiefe der Länge Ihres Tieflochbohrers an)
- **1**

We recommend to use our Karnasch solid carbide high performance twist drill 22.0402 or 22.0405 in the shortest version, to place a pilot hole.
- **2**

Please drill a precision hole between 1,5xD and 2xD, to ensure a perfect drilling process.
- **1**

Para los orificios piloto recomendamos el uso del taladro de Karnasch Art. 22.0402 o 22.0405 en la respectiva versión más corta.
- **2**

Por favor, haga una perforación piloto de precisión entre 1,5 y 2xD, para garantizar un proceso de taladro adecuado. (ajuste la profundidad de la perforación piloto a la longitud de su taladro de perforación)
- **1**

Для пилотного засверливания мы рекомендуем использовать сверла фирмы Karnasch 22.0402 или 22.0405 соответственно с самым маленьким вылетом
- **2**

Постарайтесь сделать точное пилотное отверстие размером от 1,5 до 2xD, для того чтобы обеспечить безукоризненный процесс сверления (приведите глубину пилотного отверстия в соответствие с длиной Вашего сверла для глубокого сверления)
- **Dringen Sie mit niedriger Drehzahl und ohne Kühlmittel in die Pilotbohrung ein, bis 1 mm vor den Bohrungsgrund. (Max. 300 U/min und Vf = 1000 mm/min)**

**Enter the pilot hole with low speed and without internal colling supply before 1 mm of the hole ground (max. 300 min<sup>-1</sup> and Vf = 1000 mm/min).**

**Penetre en el orificio piloto con una velocidad baja y sin refrigerante, hasta 1 mm antes del fondo de la perforación. (máx. 300 rpm y Vf = 1000 mm/min)**

**Входите в пилотное отверстие при небольшой частоте вращения и без использования охлаждающего вещества, не доходя 1 мм до дна отверстия (max 300 об/мин, скорость подачи Vf = 1000 мм/мин)**

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Weitere Informationen erhalten Sie telefonisch unter +49 6203-4039-0 oder schreiben Sie eine Mail an [info@karnasch.de](mailto:info@karnasch.de).  
For more informations please call +49 6203-4039-0 send a mail to [info@karnasch.de](mailto:info@karnasch.de).

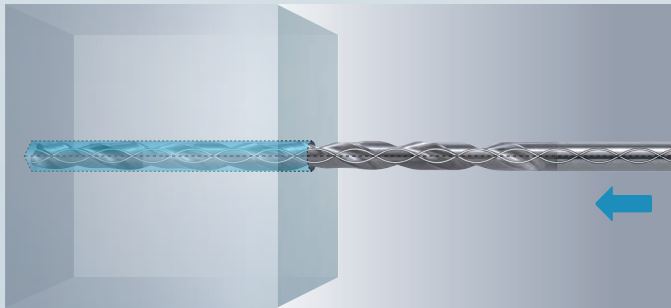
Sacklochbohrungen – Einsatzhinweise für Vollhartmetall-Hochleistungsbohrer < 40xD

🇬🇧 **Blind hole drilling** – Appliation instruction for Solid carbide twist drill < 40xD

🇪🇸 **Taladros ciegos** – Instrucciones para perforaciones de orificio ciego con el taladro de alto rendimiento de metal duro < 40xD

🇷🇺 **глухое отверстие** – Рекомендации по применению твердосплавного высокопроизводительного сверла для сверления глухих отверстий < 40xD

- 3 🇩🇪 **Tieflochbohren**  
🇬🇧 **Deep hole drilling**  
🇪🇸 **Taladrado profundo**  
🇷🇺 **Глубокое сверление**



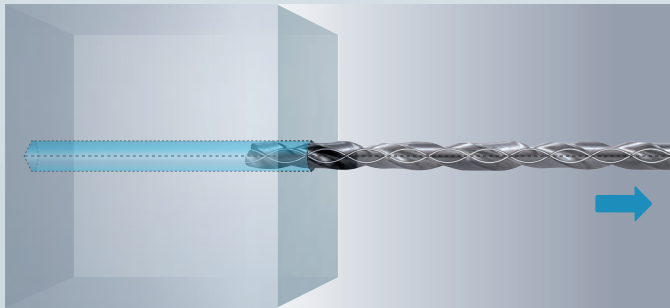
🇩🇪 Bohren Sie auf Ihre gewünschte Bohrtiefe.  
Schnittdaten und Kühlmitteldruck auf Seite 173

🇬🇧 Drill to the required depth. Cutting data and cooling preassure see  
on page 173

🇪🇸 Taladre a la profundidad que desea. Datos de corte y presión de  
refrigerante en página 173

🇷🇺 Произведите сверление на желаемую глубину. Режимы резания и  
показатели давления охлаждающего средства указаны на странице 173

- 4 🇩🇪 **Herausfahren des Bohrers**  
🇬🇧 **Retract the drill**  
🇪🇸 **Retirar el taladro**  
🇷🇺 **Вывод сверла из отверстия**



- 🇩🇪 1 Herausfahren bis zur Tiefe der Pilotbohrung mit Vf = 2000 mm/min  
2 Herausfahren des Bohrers aus der Pilotbohrung mit geringer  
Drehzahl und ohne Kühlmittel (n = 300 U/min, Vf = 2000 mm/min).

- 🇬🇧 1 Retacting of the hole until the depth of the pilot hole with Vf = 2000 mm/min.  
2 Retracting from the pilot hole with low speed and without internal  
cooling supply (n = 300 min<sup>-1</sup>, Vf = 2000 mm/min.).

- 🇪🇸 1 Retirar hasta la profundidad de la perforación piloto con Vf = 2000 mm/min.  
2 Retirar el taladro de la perforación piloto con número de revoluciones  
bajo y sin refrigerante (n = 300 min<sup>-1</sup>, Vf = 2000 mm/min.).

- 🇷🇺 1 Вывести сверло до глубины пилотного отверстия при подаче  
Vf = 2000 мм/мин.  
2 Вывести сверло из пилотного отверстия на малых оборотах и  
без использования охлаждения.

Auf schräge Werkstücke bohren - Einsatzhinweise für Vollhartmetall-Hochleistungsbohrer < 40xD

- **Drilling on oblique work piece** – Appliation instruction for Solid carbide twist drill < 40xD
- **Perforar en piezas inclinadas** – Instrucciones para perforaciones de orificio ciego con el taladro de alto rendimiento de metal duro < 40xD
- **Сверление в деталях с наклонными поверхностями** – Рекомендации по применению твердосплавного высокопроизводительного сверла для сверления глухих отверстий < 40xD

- 1

**Planbohren / Planfräsen**  
**"Face drilling / Face milling"**  
**Plan de perforación / Planeado**  
**Фрезерование**



 Bohren / Fräsen Sie eine ebene Fläche in das Werkstück mit einem Bohrer / Fräser des gleichen Durchmessers wie die der gewünschten Bohrung oder verwenden Sie unseren 180° Flachkopfbohrer Art. 22.0404.

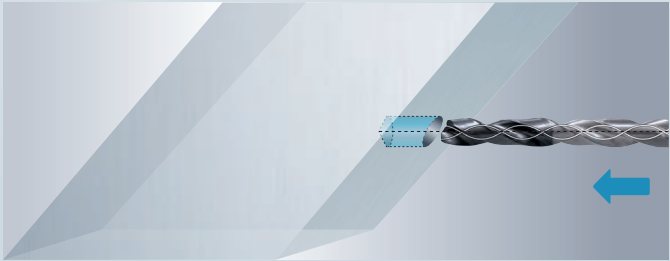
 Drill/Mill a flat surface on the work piece in the same dimension as the diameter of the hole should be or use our shallow drill 180° ref. 22.0404.

 Perforar/fresar una superficie plana en la pieza con una broca/ fresadora del mismo diámetro que la perforación deseada.

 Расточите/отфрезеруйте плоский участок на поверхности детали с помощью сверла/фрезы того же диаметра, что и желаемое отверстие.

- 2

**Pilotbohrung setzen**  
**Drilling a pilot hole**  
**Taladrar previamente el orificio piloto**  
**Получение пилотного отверстия**



-  1

Für die Pilotbohrungen empfehlen wir den Einsatz der Karnasch Bohrer Art. Nr. 22.0402 oder 22.0405 in der jeweils kürzesten Ausführung.
-  2

Bitte stellen Sie eine präzise Pilotbohrung zwischen 1,5 und 2xD her, um einen einwandfreien Bohrprozess zu gewährleisten. (Passen Sie die Pilotbohrungstiefe der Länge Ihres Tieflochbohrers an)

-  1

We recommend to use our Karnasch solid carbide high performance twist drill 22.0402 or 22.0405 in the shortest version, to place a pilot hole.
-  2

Please drill a precision hole between 1,5xD and 2xD, to ensure a perfect drilling process.

-  1

Para los orificios piloto recomendamos el uso del taladro de Karnasch Art. 22.0402 o 22.0405 en la respectiva versión más corta.
-  2

Por favor, haga una perforación piloto de precisión entre 1,5 y 2xD, para garantizar un proceso de taladro adecuado. (ajuste la profundidad de la perforación piloto a la longitud de su taladro de perforación)

-  1

Для пилотного засверливания мы рекомендуем использовать сверла фирмы Karnasch 22.0402 или 22.0405 соответственно с самым маленьким вылетом
-  2

Постарайтесь сделать точное пилотное отверстие размером от 1,5 до 2xD, для того чтобы обеспечить безукоризненный процесс сверления (приведите глубину пилотного отверстия в соответствие с длиной Вашего сверла для глубокого сверления)

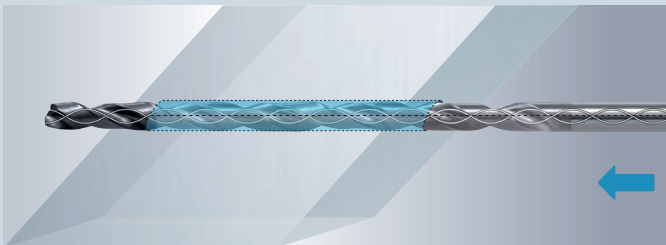


- 3  Einfahren in die Pilotbohrung  
 Enter into the pilote hole  
 Entrar en la perforación piloto  
 Введение сверла в пилотное отверстие



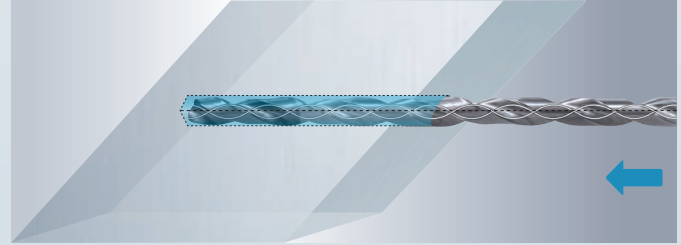
-  Dringen Sie mit niedriger Drehzahl und ohne Kühlmittel in die Pilotbohrung ein, bis 1 mm vor den Bohrungsgrund. (Max. 300 U/min und Vf = 1000 mm/min)
-  Enter the pilot hole with low speed and without internal colling supply before 1 mm of the hole ground (max. 300 min<sup>-1</sup> and Vf = 1000 mm/min).
-  Penetre en el orificio piloto con una velocidad baja y sin refrigerante, hasta 1 mm antes del fondo de la perforación. (máx. 300 rpm y Vf = 1000 mm/min)
-  Входите в пилотное отверстие при небольшой частоте вращения и без использования охлаждающего вещества, не доходя 1 мм до дна отверстия (max 300 об/мин, скорость подачи Vf = 1000 мм/мин)

- 5  Durchgangsbohrung  
 Through hole drilling  
 Orificios de paso  
 Сверление сквозных отверстий



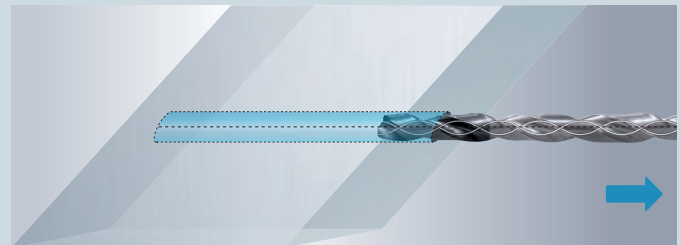
-  1 Beim Austritt aus dem Werkstück kann die Schneidkante des Bohrers ausbrechen.  
2 Verringern Sie den Vorschub auf f = 0,05 mm/U – 0,1 mm/U
-  1 The cutting edge could break if you have a angular faced drill exit.  
2 Reduce the feed rate to f = 0,05 mm/min – 0,1 mm/min
-  1 Al salir de la pieza, el borde de corte de la broca puede romper.  
2 Reduzca la velocidad de avance (Vf) a f = 0,05 mm – 0,1 mm/U
-  1 При выходе сверла из детали режущая кромка может выкрашиваться.  
2 Уменьшите подачу f до 0,05-0,1 мм/об

- 4  Tieflochbohren  
 Deep hole drilling  
 Taladrado profundo  
 Глубокое сверление



-  Bohren Sie auf Ihre gewünschte Bohrtiefe. Schnittdaten und Kühlmitteldruck auf Seite 173
-  Drill to the required depth. Cutting data and cooling preasure see on page 173
-  Taladre a la profundidad que desea. Datos de corte y presión de refrigerante en página 173
-  Произведите сверление на желаемую глубину. Режимы резания и показатели давления охлаждающего средства указаны на странице 173

- 6  Herausfahren des Bohrers  
 Retract the drill  
 Retirar el taladro  
 Вывод сверла из отверстия



-  1 Herausfahren bis zur Tiefe der Pilotbohrung mit Vf = 2000 mm/min  
2 Herausfahren des Bohrers aus der Pilotbohrung mit geringer Drehzahl und ohne Kühlmittel (n = 300 U/min, Vf = 2000 mm/min).
-  1 Retacting of the hole until the depth of the pilot hole with Vf = 2000 mm/min.  
2 Retracting from the pilot hole with low speed and without internal cooling supply (n = 300 min<sup>-1</sup>, Vf = 2000 mm/min.).
-  1 Retirar hasta la profundidad de la perforación piloto con Vf = 2000 mm/min.  
2 Retirar el taladro de la perforación piloto con número de revoluciones bajo y sin refrigerante (n = 300 min<sup>-1</sup>, Vf = 2000 mm/min.).
-  1 Вывести сверло до глубины пилотного отверстия при подаче Vf = 2000 мм/мин.  
2 Вывести сверло из пилотного отверстия на малых оборотах и без использования охлаждения.

| Werkstoffgruppe<br>Material group | Werkstoff                      | Schnittgeschwindigkeit<br>Vc m/min | Vorschub pro Umdrehung (mm/U) bezogen auf den Bohrdurchmesser |             |             |             |
|-----------------------------------|--------------------------------|------------------------------------|---------------------------------------------------------------|-------------|-------------|-------------|
|                                   |                                |                                    | 3 - 5                                                         | 5 - 7       | 7 - 10      | 12          |
| 7.1 - 7.2                         | 0.6010 / EN-GJL-100 (GG10)     | 90 - 120                           | 0,02 - 0,05                                                   | 0,04 - 0,10 | 0,10 - 0,15 | 0,12 - 0,20 |
|                                   | 0.6020 / EN-GJL-200 (GG20)     |                                    |                                                               |             |             |             |
|                                   | 0.6025 / EN-GJL-250 (GG25)     |                                    |                                                               |             |             |             |
|                                   | 0.6030 / EN-GJL-300 (GG30)     |                                    |                                                               |             |             |             |
|                                   | 0.6035 / EN-GJL-350 (GG35)     |                                    |                                                               |             |             |             |
|                                   | 0.6040 / EN-GJL-400 (GG40)     |                                    |                                                               |             |             |             |
| 7.3 - 7.4 - 7.5 - 7.6             | 0.7040 / GGG 40                | 60 - 90                            | 0,02 - 0,04                                                   | 0,03 - 0,10 | 0,08 - 0,14 | 0,10 - 0,20 |
|                                   | 0.7050 / EN-GJS-500-2 (GGG50)  |                                    |                                                               |             |             |             |
|                                   | 0.7070 / EN-GJL-700-2 (GGG70)  |                                    |                                                               |             |             |             |
|                                   | 0.8035 / EN-GJMW-350-4 (GTW35) |                                    |                                                               |             |             |             |
|                                   | 0.8170 / EN-GJMW-700-2 (GTS70) |                                    |                                                               |             |             |             |
|                                   | EN - GJV 250 (GGV 25)          |                                    |                                                               |             |             |             |
|                                   | EN - GJV 350 (GGV 35)          |                                    |                                                               |             |             |             |
|                                   | EN - GJV 400 (GGV 40)          |                                    |                                                               |             |             |             |
|                                   | EN - GJV 500 (GGV 50)          |                                    |                                                               |             |             |             |
|                                   | Si Mo 6                        |                                    |                                                               |             |             |             |

Beim Bohren mit Innenkühlung und Kühlmitteldruck von 50-60 bar ist eine Steigung des Vorschubes um 30-50% möglich.

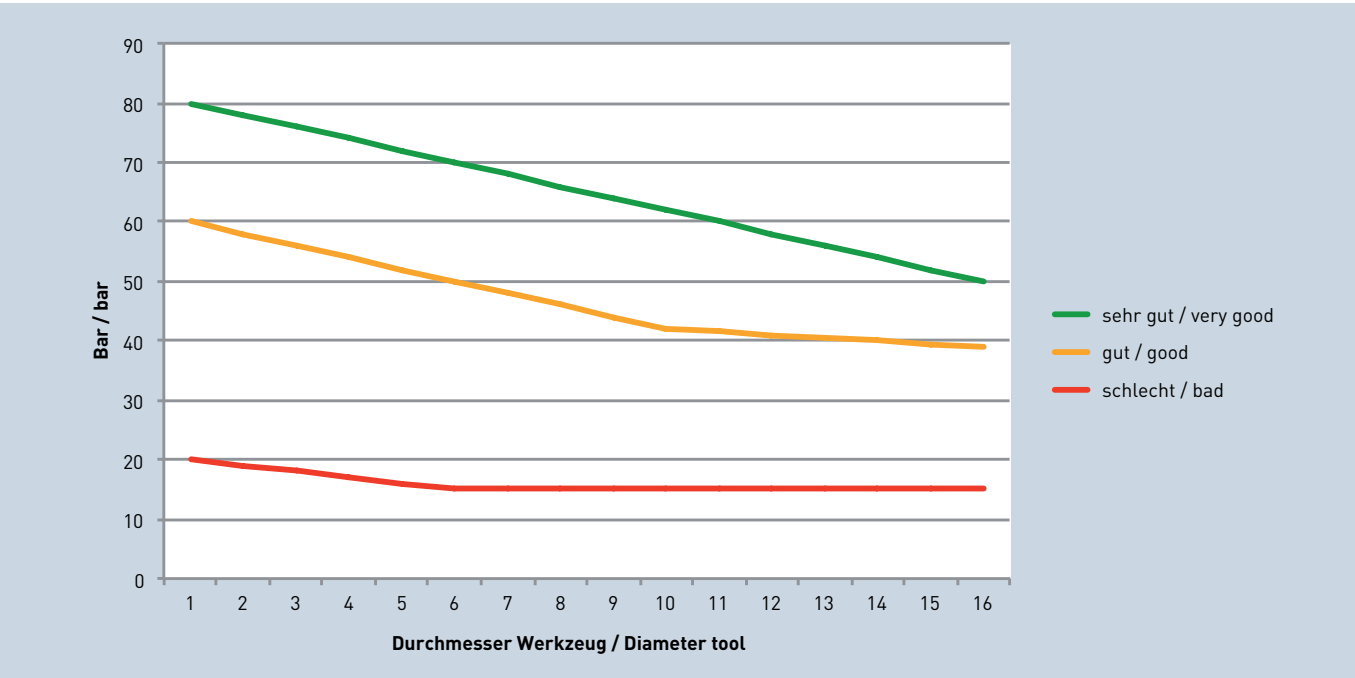
Kühlmitteldurchflußmenge für Bohrer mit verdrahter innerer Kühlmittelzufuhr  
Coolant flow for drills with twisted interior coolant supply

2 Schneiden, gedrahtte Ausführung. Durchflußmenge abhängig vom Druck (bar) und Durchmesser der Kühlmittelbohrungen. Karnasch VHM-Bohrer können drehend und nicht drehend auf allen modernen Werkzeugmaschinen zum Einsatz gebracht werden. Beim Bohren in drehende Werkstücke auf genaue Flucht vor Bohrer- und Werkstückzentrum achten.

2 cutting edges, spiral type. Flow is dependent on pressure (bar) and diameter of coolant holes. Karnasch solid carbide twist drill is used turning and non turning on all modern manufacturing machines. By drilling in turning parts please watch the corresponding centres of drill and part.

| Schaft<br>shank | Bohrer Ø<br>drill diameter | Kühlkanalbohrung<br>coolant hole diameter | Durchflußmenge l/min.<br>flow rate l/min. |        |        |        |
|-----------------|----------------------------|-------------------------------------------|-------------------------------------------|--------|--------|--------|
|                 |                            |                                           | 20 bar                                    | 30 bar | 40 bar | 50 bar |
| 6 mm            | 4,0 - 6,0 mm               | 0,6 mm                                    | 1,4                                       | 1,6    | 2,0    | 2,2    |
| 8 mm            | 6,1 - 8,0 mm               | 0,9 mm                                    | 2,8                                       | 3,5    | 4,0    | 4,5    |
| 10 mm           | 8,1 - 10,0 mm              | 1,2 mm                                    | 5,1                                       | 6,0    | 7,2    | 8,0    |
| 12 mm           | 10,1 - 12,0 mm             | 1,3 mm                                    | 6,0                                       | 7,5    | 8,5    | 9,5    |
| 14 mm           | 12,1 - 14,0 mm             | 1,6 mm                                    | 9,0                                       | 11,0   | 12,5   | 14,0   |
| 16 mm           | 14,1 - 16,0 mm             | 2,0 mm                                    | 14,0                                      | 17,0   | 20,0   | 22,0   |
| 18 mm           | 16,1 - 18,0 mm             | 2,2 mm                                    | 17,0                                      | 21,0   | 24,0   | 27,0   |
| 20 mm           | 18,1 - 20,0 mm             | 2,5 mm                                    | 22,0                                      | 27,0   | 30,0   | 35,0   |

Kühlmitteldruck (bar) in Abhängigkeit vom Werkzeugdurchmesser/Bohren 3xD - 50xD  
Coolant pressure in dependence from the tool-diameter/drill 3xD - 50xD



| Werkstoffgruppe<br>Material group  | Werkstoff                                                 | Schnittge-<br>schwindigkeit<br>Vc (m/min) | Vorschub pro Umdrehung (mm/U)<br>bezogen auf den Bohrdurchmesser |       |       |       |       |       |       |
|------------------------------------|-----------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|
|                                    |                                                           |                                           | 0,8                                                              | 1,0   | 1,2   | 1,6   | 2,0   | 2,5   | 3,0   |
| 1.1 - 1.2 - 1.3                    | St37, St42, C22, 653P<br>St50, St 60, CK45,<br>C35, 45Mn6 | 90 - 160                                  | <0,10                                                            | <0,12 | <0,15 | <0,20 | <0,25 | <0,28 | <0,35 |
| 1.4 - 1.5 - 2.1                    | 53MnSi4, 16MnCr5<br>90MnCrV8, 31NiCr14<br>CK60, 41CrAlMo7 | 70 - 120                                  | <0,04                                                            | <0,06 | <0,14 | <0,25 | <0,28 | <0,30 | <0,35 |
| 2.1                                | 100Cr6, 20MnCr5,<br>31CrMo12, 42CrMo4,<br>14CrNi14        | 50 - 100                                  | <0,06                                                            | <0,08 | <0,12 | <0,16 | <0,20 | <0,22 | <0,25 |
| 3.1 - 3.2                          | X210CrW12, X165CrMoV12,<br>75CrMoNi6, 56NiCrMoV7          | 30 - 60                                   | <0,07                                                            | <0,12 | <0,15 | <0,20 | <0,25 | <0,28 | <0,30 |
| 7.1 - 7.2 - 7.3<br>7.4 - 7.5 - 7.6 | GG20 - GG 50<br>GGG40 - GGG70<br>GTW/GTS                  | < 150                                     | <0,15                                                            | <0,20 | <0,25 | <0,30 | <0,35 | <0,40 | <0,45 |

Bei Bohrtiefen **über 4 x D** empfehlen wir die **"Soft Inn"** Strategie. Diese Bohrstrategie begünstigt den Späne-transport und erhöht die Produktions-sicherheit um ein vielfaches.

**Kein Anzentrieren oder Führungs-bohrungen.** Dadurch reduzieren Sie Ihre **Produktionszeiten um ca. 15%** sowie die **Lagerkosten um 50 %**.

- I. Die Toleranz der Bohrspindel sollte weniger als 0,002 mm betragen.  
*The run out with a drill in a spindle should be less than 0,002 mm.*
- II. Wir empfehlen für diese High-Tech-Produkte den Einsatz von Schrumpf-haltern.  
*The shrink fit system acts as an effective holder.*

Wichtige Einsatzkriterien zu Karnasch VHM-Bohrern:

Wahl der geeigneten Spannmittel: Die erforderliche Spannung der Bohrer ist die Zylinderschaftaufnahme nach DIN 6535 Form HAK/HA. Hohe Rundlaufgüten und kraftschlüssige Spannungen weisen außerdem Dehn-spannfutter sowie Schrumpfspannfutter auf. Bei optimaler Spannung der Werkzeuge sind hohe Fluchtungsgenauigkeiten und Oberflächengüten erziel-bar. In vielen Fällen kann deshalb auf Reiboperationen verzichtet werden. Der **Rundlauffehler beim rotierenden Werkzeug** sollte **0,015 mm nicht überschreiten**. Die **Werkzeuge** sind aufgrund ihrer geometrischen Auslegung und Eigensteifigkeit **zum Bohren ins Volle geeignet**. Arbeitsgänge wie **Anzentrieren, Vorbohren und Aufbohren sollten entfallen**, um beim Ansetzen der Werkzeuge eine Verlagerung der Rotationsachse zur Vorbohroperation auszuschließen. Ferner wird ein ungünstiger Eingriff der Bohrerspitze bei abweichendem Spitzenwinkel zum Vorbohrwerkzeug vermieden. Ist eine Anfasung erforderlich, sollte das Anfasen **nach der Bohroperation erfolgen**. Die in der **Schnittwerttabelle** angegebenen **Vorschubwerte sollten nicht unterschritten** werden, um einen kontrollierten Spanbruch(Kommaspan) zu erhalten. Bei zu kleinem Spanmittenquerschnitt (Vorschub zu gering) wird zu wenig Wärme über den Span abgeführt, die Temperatur geht vermehrt in das Werkzeug über; dies führt zu Standzeitverlust.

Bei **unterbrochenem Schnitt**, z. B. Eintritt- und Austrittschrägen oder Quer-bohrungen, sollte in diesem Bereich mit **reduzierten Vorschubwerten gefahren werden**. Die Bohrer sind mit ausreichender **Kühlschmierung einzusetzen**. Zur Erzielung guter Bearbeitungsergebnisse sollten hochwertige halb-synthetische oder Emulsions Kühlschmierstoffe (min. 10% Öl) und EP-Zusätze verwendet werden. **Dadurch lassen sich längere Standzeiten sowie höhere Toleranzgenauigkeiten und Oberflächengüten erzielen**. Über 5 x D Bohrtiefe ist unter ungünstigen Gegebenheiten ein- oder mehrmaliges Ausspanen erforderlich. **Ab 8 x D sollte beim Anbohren der Vorschub um 50% verringert werden**. Bei **VHM-Bohrern mit Innenkühlung sind 40 - 50 bar Kühlmitteldruck notwendig um den optimalen Spänefluß zu gewährleisten!**

Important criteria for the use of Karnasch VHM drills

*Selection of the appropriate means to achieve tension: The tension the drill requires is the cylinder shank seat in accordance with DIN 6535 Form HAK/HA. In addition to that high-precision true running and non-positive tensions show stress chuck and contraction chuck. With the tools having an optimum tension both high-precision true alignment and high quality surfaces can be achieved. In many cases there is therefore no need of friction operations. **The eccentricity of revolving tools should not exceed 0,015 mm.** Due to their geometrical layout and inherent stiffness the tools are qualified for drilling at maximum power. Working cycles such as precentring, pilot-drilling and boring open should not be carried out to avoid the rotational axis shifting to the pilot-drilling operation when the tools are put on. **Furthermore, an unfavourable intervention of this bits with the point angle deviating to the pilot-drilling tool is avoided.** Should chamfering be required, the chamfering is to be carried out after the drilling operation.*

*The advance values should not be lower than those specified in the cut value chart to achieve a controlled chip breakage. When the chip centre cross-section is too small (advance is insufficient) an insufficient quantity of heat is carried off trough the chip. The temperature penetrates more and more into the tool, resulting in loss of toll life. In case of an interrupted cut, e.g. approach inclinations and emersion inclinations of transverse drillings reduced advance values should be applied in this area. The drills are to be operated with sufficient cooling lubrication. To achieve good working results, high-quality half synthetic or emulsion cooling lubricants (min. 10 oil) and EP additives are to be used. **By that means a longer tool life as well as higher tolerance precisions and surface qualities can be achieved.** Given more than 5 x D drilling depth chamfering is required once or repeatedly under unfavourable conditions. **From 8 x D onwards the advance should be reduced by 50% when spot-drilling.** Solid carbide drills with interior cooling require 40 - 50 bar cooling agent pressure to ensure an optimum of chip flow.*

|      |         |         |
|------|---------|---------|
| Art. | 22.0402 | 22.0403 |
|      | 22.0419 | 22.0471 |

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer ohne Innenkühlung  
Recommended cutting data for solid carbide twist drill, without interior cooling supply

Die rechts angegebenen Richtwerte für die Schnittgeschwindigkeit Vc sind je nach Bohrtiefe bezogen auf den Durchmesser mit den untenstehenden Korrekturfaktoren Kfv zu multiplizieren.

|     |     |     |     |     |
|-----|-----|-----|-----|-----|
| Kfv | 1xD | 2xD | 3xD | 5xD |
|     | 1,2 | 1,0 | 0,8 | 0,7 |

Die in den Schnittwerttabellen enthaltenen Richtwerte gelten nur beim Einsatz von Spannfuttern nach DIN 1835 Form E und Hydrodehnspannfuttern.

| Werkstoffgruppe<br>Material group | Werkstoff      | Festigkeit<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Vc (m/min) ±10% | Vorschub pro Umdrehung (mm) bezogen auf<br>Bohrerdurchmesserbereich von - bis |       |        |         |         |
|-----------------------------------|----------------|---------------------------------|------------------------------------------------|-------------------------------------------------------------------------------|-------|--------|---------|---------|
|                                   |                |                                 |                                                | Ø 3-5                                                                         | Ø 5-8 | Ø 8-12 | Ø 12-16 | Ø 16-20 |
| 1.1                               | St 42-8        | < 450                           | 80                                             | 0,18                                                                          | 0,24  | 0,30   | 0,35    | 0,40    |
|                                   | C 50           | < 650                           | 70                                             | 0,18                                                                          | 0,24  | 0,30   | 0,35    | 0,40    |
| 2.1                               | 51 Si 7        | < 600                           | 65                                             | 0,15                                                                          | 0,21  | 0,27   | 0,30    | 0,35    |
| 2.2                               | 26 Cr Mo 4     | < 950                           | 50                                             | 0,15                                                                          | 0,21  | 0,27   | 0,30    | 0,35    |
| 2.3                               | 100 WV4        | < 1100                          | 40                                             | 0,15                                                                          | 0,21  | 0,27   | 0,30    | 0,35    |
| 2.6                               | 31 Cr Mo V9    | < 1200                          | 65                                             | 0,15                                                                          | 0,20  | 0,25   | 0,30    | 0,32    |
| 3.1                               | X 42 Cr 13     | < 700                           | 65                                             | 0,15                                                                          | 0,20  | 0,27   | 0,32    | 0,35    |
| 3.2                               | S 29 28        | < 1400                          | 35                                             | 0,08                                                                          | 0,12  | 0,15   | 0,20    | 0,25    |
| 7.1                               | GG 15          | > 180 HB                        | 75                                             | 0,22                                                                          | 0,30  | 0,40   | 0,50    | 0,58    |
| 7.2                               | GG 30          | > 350 HB                        | 70                                             | 0,22                                                                          | 0,30  | 0,40   | 0,50    | 0,58    |
| 7.7                               | GGG 60         | > 200 HB                        | 70                                             | 0,20                                                                          | 0,25  | 0,35   | 0,40    | 0,45    |
| 7.6                               | GTW 3504       | > 230 HB                        | 70                                             | 0,20                                                                          | 0,25  | 0,35   | 0,40    | 0,45    |
| 8.1                               | Toolox 44      | 45-55 HRC                       | 30                                             | 0,08                                                                          | 0,09  | 0,10   | 0,12    | 0,14    |
| 8.11                              | Toolox 33      | 800-1100 N/mm <sup>2</sup>      | 35                                             | 0,08                                                                          | 0,12  | 0,15   | 0,20    | 0,22    |
| 8.5                               | HARDOX 400     | < 1200                          | 40                                             | 0,03-0,06                                                                     | 0,06  | 0,08   | 0,10    | 0,12    |
|                                   | HARDOX 450     | < 1400                          | 35                                             | 0,03-0,06                                                                     | 0,06  | 0,08   | 0,10    | 0,12    |
|                                   | HARDOX 500     | < 1550                          | 30                                             | 0,02-0,05                                                                     | 0,06  | 0,06   | 0,08    | 0,10    |
| 8.6                               | WELDOX 420/460 | < 550                           | 50                                             | 0,04-0,07                                                                     | 0,08  | 0,10   | 0,12    | 0,15    |
|                                   | WELDOX 500     | < 620                           | 50                                             | 0,04-0,07                                                                     | 0,08  | 0,10   | 0,12    | 0,15    |
|                                   | WELDOX 700     | < 860                           | 50                                             | 0,04-0,07                                                                     | 0,08  | 0,10   | 0,12    | 0,15    |
|                                   | WELDOX 900/960 | < 1040                          | 40                                             | 0,03-0,06                                                                     | 0,08  | 0,10   | 0,12    | 0,13    |
|                                   | WELDOX 1100    | < 1350                          | 30                                             | 0,02-0,06                                                                     | 0,07  | 0,08   | 0,10    | 0,12    |

|      |         |         |
|------|---------|---------|
| Art. | 22.0405 | 22.0406 |
|      | 22.0425 | 22.0473 |

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer mit Innenkühlung  
Recommended cutting data for solid carbide twist drill, with interior cooling supply

Die angegebenen Richtwerte für die Schnittgeschwindigkeit Vc sind je nach Bohrtiefe bezogen auf den Durchmesser mit den untenstehenden Korrekturfaktoren Kfv zu multiplizieren.

|     |     |     |     |     |      |
|-----|-----|-----|-----|-----|------|
| Kfv | 1xD | 3xD | 5xD | 8xD | 12xD |
|     | 1,2 | 0,9 | 0,8 | 0,7 | 0,6  |

Die in den Schnittwerttabellen enthaltenen Richtwerte gelten nur beim Einsatz von Spannfuttern nach DIN 1835 Form E und Hydrodehnspannfuttern.

| Werkstoffgruppe<br>Material group | Werkstoff      | Festigkeit<br>N/mm <sup>2</sup> | Schnittge-<br>schwindigkeit<br>Vc (m/min) ±10% |           |           |        |         |         |
|-----------------------------------|----------------|---------------------------------|------------------------------------------------|-----------|-----------|--------|---------|---------|
|                                   |                |                                 |                                                | Ø 3-5     | Ø 5-8     | Ø 8-12 | Ø 12-16 | Ø 16-20 |
| 1.1                               | St 42-8        | < 450                           | 180                                            | 0,08-0,16 | 0,22      | 0,28   | 0,35    | 0,37    |
|                                   | C 50           | < 650                           | 180                                            | 0,08-0,15 | 0,20      | 0,25   | 0,30    | 0,35    |
| 2.1                               | 51 Si 7        | < 600                           | 70                                             | 0,05-0,08 | 0,12      | 0,15   | 0,20    | 0,25    |
| 2.2                               | 26 Cr Mo 4     | < 950                           | 160                                            | 0,08-0,15 | 0,20      | 0,25   | 0,30    | 0,37    |
| 2.3                               | 100 WV4        | < 1100                          | 130                                            | 0,08-0,15 | 0,20      | 0,25   | 0,30    | 0,37    |
| 2.6                               | 31 Cr Mo V9    | < 1200                          | 160                                            | 0,08-0,15 | 0,20      | 0,26   | 0,32    | 0,37    |
| 3.1                               | X 42 Cr 13     | < 700                           | 130                                            | 0,08-0,15 | 0,20      | 0,26   | 0,32    | 0,37    |
| 3.2                               | S 29 28        | < 1400                          | 90                                             | 0,08-0,10 | 0,12      | 0,15   | 0,20    | 0,25    |
| 7.1                               | GG 15          | > 180 HB                        | 150                                            | 0,14-0,25 | 0,30      | 0,40   | 0,45    | 0,50    |
| 7.2                               | GG 30          | > 350 HB                        | 130                                            | 0,12-0,20 | 0,25      | 0,35   | 0,40    | 0,45    |
| 7.4                               | GGG 60         | > 200 HB                        | 130                                            | 0,12-0,20 | 0,25      | 0,35   | 0,40    | 0,45    |
| 7.6                               | GTW 3504       | > 230 HB                        | 100                                            | 0,04      | 0,06-0,10 | 0,12   | 0,15    | 0,20    |
| 8.1                               | Toolox 44      | 45-55 HRC                       | 50                                             | 0,04-0,08 | 0,09      | 0,11   | 0,14    | 0,15    |
| 8.11                              | Toolox 33      | 800-1100 N/mm <sup>2</sup>      | 60                                             | 0,05-0,10 | 0,12      | 0,15   | 0,20    | 0,22    |
| 8.5                               | HARDOX 400     | < 1200                          | 40                                             | 0,04-0,08 | 0,08      | 0,10   | 0,12    | 0,14    |
|                                   | HARDOX 450     | < 1400                          | 35                                             | 0,04-0,08 | 0,08      | 0,10   | 0,12    | 0,14    |
|                                   | HARDOX 500     | < 1550                          | 30                                             | 0,03-0,06 | 0,08      | 0,08   | 0,10    | 0,12    |
| 8.6                               | WELDOX 420/460 | < 550                           | 60                                             | 0,07-0,09 | 0,10      | 0,12   | 0,15    | 0,18    |
|                                   | WELDOX 500     | < 620                           | 60                                             | 0,07-0,09 | 0,10      | 0,12   | 0,15    | 0,18    |
|                                   | WELDOX 700     | < 860                           | 60                                             | 0,07-0,09 | 0,10      | 0,12   | 0,15    | 0,18    |
|                                   | WELDOX 900/960 | < 1040                          | 45                                             | 0,06-0,08 | 0,10      | 0,12   | 0,15    | 0,16    |
|                                   | WELDOX 1100    | < 1350                          | 35                                             | 0,04-0,08 | 0,08      | 0,10   | 0,12    | 0,14    |



Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer mit Innenkühlung  
Recommended cutting data for solid carbide twist drill, with interior cooling supply

Art. 22.0409

Die angegebenen Richtwerte für die Schnittgeschwindigkeit Vc sind je nach Bohrtiefe bezogen auf den Durchmesser mit den untenstehenden Korrekturfaktoren KfV zu multiplizieren.

|     |     |     |     |     |      |
|-----|-----|-----|-----|-----|------|
| KfV | 1xD | 3xD | 5xD | 8xD | 12xD |
|     | 1,2 | 0,9 | 0,8 | 0,7 | 0,6  |

Die in den Schnittwerttabellen enthaltenen Richtwerte gelten nur beim Einsatz von Schrumpf- und Hydrodehnspannfutter.

| Werkstoffgruppe<br>Material group | Werkstoff             | Festigkeit<br>Härte | Schnittgeschwindigkeit Vc (m/min) | Vorschub pro Umdrehung (mm) bezogen auf Bohrerdurchmesserbereich von - bis |             |             |             |             |
|-----------------------------------|-----------------------|---------------------|-----------------------------------|----------------------------------------------------------------------------|-------------|-------------|-------------|-------------|
|                                   |                       |                     |                                   | 3-5                                                                        | 5-8         | 8-12        | 12-16       | 16-20       |
| 3.1 - 3.2 - 4.1 - 4.2 - 4.3       | X12CrNi18/8           |                     | 25 - 55                           | 0,04 - 0,10                                                                | 0,05 - 0,15 | 0,05 - 0,18 | 0,08 - 0,20 | 0,10 - 0,20 |
|                                   | X10CrNiNb18/9         |                     |                                   |                                                                            |             |             |             |             |
| 6.2 - 6.2                         |                       |                     | 15 - 45                           | 0,02 - 0,07                                                                | 0,04 - 0,10 | 0,06 - 0,12 | 0,08 - 0,15 | 0,08 - 0,15 |
| 7.1 - 7.2 - 7.3                   | GG 20, GGG40 GTS 45   | bis 200 HB          | 80 - 130                          | 0,10 - 0,25                                                                | 0,15 - 0,30 | 0,20 - 0,40 | 0,25 - 0,45 | 0,30 - 0,50 |
| 7.4                               | GG 30 GGG 50 GTW 40   | bis 250 HB          | 70 - 115                          | 0,10 - 0,20                                                                | 0,12 - 0,25 | 0,15 - 0,35 | 0,20 - 0,40 | 0,25 - 0,45 |
| 7.5 - 7.6                         | GG 40 GGG 70 GTS 70   | über 250 HB         | 60 - 100                          | 0,10 - 0,20                                                                | 0,12 - 0,25 | 0,15 - 0,35 | 0,20 - 0,40 | 0,25 - 0,45 |
| 9.3                               | < 10% Si              |                     | 100 - 400                         | 0,10 - 0,25                                                                | 0,15 - 0,35 | 0,25 - 0,45 | 0,30 - 0,50 | 0,35 - 0,55 |
| 9.4 - 9.5                         | > 10% Si              |                     | 90 - 300                          | 0,10 - 0,25                                                                | 0,15 - 0,35 | 0,25 - 0,45 | 0,30 - 0,50 | 0,35 - 0,55 |
| 10.2 10.2.1-                      | Kupfer Messing Bronze |                     | 70 - 300                          | 0,07 - 0,18                                                                | 0,12 - 0,25 | 0,20 - 0,35 | 0,25 - 0,45 | 0,30 - 0,50 |
|                                   | Inconel               |                     | 15 - 35                           | 0,02 - 0,07                                                                | 0,04 - 0,10 | 0,06 - 0,12 | 0,08 - 0,15 | 0,08 - 0,18 |

Richtwerte für den Einsatz der KARNASCH VHM-Hochleistungsbohrer – Typ W ohne Innenkühlung  
Recommended cutting data for solid carbide twist drill Typ W, without interior cooling supply

Art. 22.0360

| Werkstoffgruppe | Werkstoff                              | Festigkeit              | 0,50 - 0,75                                | 0,80 - 0,95                                | 1,00 - 1,15                                | 1,20 - 1,45                                | 1,50 - 1,95                                | 2,00 - 2,50                                |
|-----------------|----------------------------------------|-------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| 9.1 9.2         | ALU ALU-Legierungen Aluminium alloys   | < 350 N/mm <sup>2</sup> | n = 20.000<br>f = 0,05<br>step = 0,5 > 5xD | n = 20.000<br>f = 0,06<br>step = 0,8 > 5xD | n = 20.000<br>f = 0,08<br>step = 1,0 > 5xD | n = 18.000<br>f = 0,10<br>step = 1,2 > 5xD | n = 15.000<br>f = 0,11<br>step = 1,5 > 5xD | n = 12.000<br>f = 0,12<br>step = 2,0 > 5xD |
| 10.1 10.3       | Kupfer Kupferlegierungen Copper alloys | < 350 N/mm <sup>2</sup> | n = 20.000<br>f = 0,05<br>step = 0,5 > 5xD | n = 20.000<br>f = 0,06<br>step = 0,8 > 5xD | n = 20.000<br>f = 0,08<br>step = 1,0 > 5xD | n = 18.000<br>f = 0,10<br>step = 1,2 > 5xD | n = 15.000<br>f = 0,11<br>step = 1,5 > 5xD | n = 12.000<br>f = 0,12<br>step = 2,0 > 5xD |
| 11.1            | Kunststoffe Duroplaste Thermoplaste    | -                       | n = 20.000<br>f = 0,05<br>step = 1,0 > 5xD | n = 20.000<br>f = 0,06<br>step = 1,0 > 5xD | n = 20.000<br>f = 0,08<br>step = 1,5 > 5xD | n = 18.000<br>f = 0,10<br>step = 1,8 > 5xD | n = 15.000<br>f = 0,11<br>step = 2,0 > 5xD | n = 12.000<br>f = 0,12<br>step = 3,0 > 5xD |

Richtwerte für den Einsatz von Karnasch VHM Stack-Drills  
Recommended cutting data for Karnasch solid carbide stack-drills

Art. 29.0200 29.0250 29.0210 29.0260

| Werkstoff<br>Material    |          | Ø3,0 - Ø5,0  | Ø5,1 - Ø8,0 | Ø8,1 - Ø12,0 |
|--------------------------|----------|--------------|-------------|--------------|
| CFK / CFRP<br>GFK / GFRP | Vc m/min | 70 - 160     | 70 - 160    | 70 - 160     |
|                          | f mm/U   | 0,05 - 0,07  | 0,05 - 0,08 | 0,06 - 0,14  |
| Aluminium                | Vc m/min | 50 - 450     | 50 - 450    | 50 - 450     |
|                          | f mm/U   | 0,06 - 0,23  | 0,1 - 0,35  | 0,16 - 0,38  |
| Titan<br>Titanium        | Vc m/min | 10 - 55      | 10 - 55     | 10 - 55      |
|                          | f mm/U   | 0,015 - 0,08 | 0,03 - 0,18 | 0,05 - 0,25  |

Art. 22.0526

Richtwerte für den Einsatz der KARNASCH PKD-Hochleistungs-Vierfasenbohrer mit Innenkühlung  
Recommended cutting data for PKD four-in-one drill, with interior cooling supply

Die angegebenen Richtwerte für die Schnittgeschwindigkeit Vc sind je nach Bohrtiefe bezogen auf den Durchmesser mit den untenstehenden Korrekturfaktoren Kfv zu multiplizieren.

|     |     |     |     |     |      |
|-----|-----|-----|-----|-----|------|
| Kfv | 1xD | 3xD | 5xD | 8xD | 12xD |
|     | 1,2 | 0,9 | 0,8 | 0,7 | 0,6  |

Die in den Schnittwerttabellen enthaltenen Richtwerte gelten nur beim Einsatz von Spannfuttern nach DIN 1835 Form E und Hydrodehnspannfutter.

| Werkstoffgruppe<br>Material group | Werkstoff | Schnittgeschwindigkeit Vc (m/min) | Vorschub pro Umdrehung (mm) bezogen auf Bohrerdurchmesserbereich über - bis |           |           |           |           |
|-----------------------------------|-----------|-----------------------------------|-----------------------------------------------------------------------------|-----------|-----------|-----------|-----------|
|                                   |           |                                   | 3-5                                                                         | 5-8       | 8-12      | 12-16     | 16-20     |
| 9.3 - 9.4 - 9.5                   | < 10% Si  | 200-600                           | 0,10-0,25                                                                   | 0,15-0,35 | 0,25-0,45 | 0,30-0,50 | 0,35-0,55 |
|                                   | > 10% Si  | 150-400                           | 0,10-0,25                                                                   | 0,15-0,35 | 0,25-0,45 | 0,30-0,50 | 0,35-0,55 |
| 10.2<br>10.2.1                    | Kupfer    | 200-400                           | 0,07-0,18                                                                   | 0,12-0,25 | 0,20-0,35 | 0,25-0,45 | 0,30-0,50 |
|                                   | Bronze    | 120-350                           | 0,07-0,18                                                                   | 0,12-0,25 | 0,20-0,35 | 0,25-0,45 | 0,30-0,50 |
|                                   | Messing   | 100-300                           | 0,07-0,18                                                                   | 0,12-0,25 | 0,20-0,35 | 0,25-0,45 | 0,30-0,50 |

Art. 22.0468

Richtwerte für den Einsatz von VHM-Bohren < 70 HRC  
Recommended cutting data for solid carbide twist drill, hardness of work materials >68 HRC

**HINWEIS:**  
Gewindebohrer zur Hartbearbeitung HHC bis 63 HRC  
Art-Nr. 22.2025  
Art-Nr. 22.2215  
Art-Nr. 22.2239

| Werkstoffgruppe<br>Material group | 8.1 50 - 55 HRC       |                      | 8.2 56 - 62 HRC       |                      | 8.3 63 - 70 HRC       |                      |
|-----------------------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|----------------------|
| d1                                | n=U/min.<br>Vc=m/min. | Vf=mm/min.<br>f=mm/U | n=U/min.<br>Vc=m/min. | Vf=mm/min.<br>f=mm/U | n=U/min.<br>Vc=m/min. | Vf=mm/min.<br>f=mm/U |
| d1 = 2,6 mm                       | 2.500<br>15 > 25      | 100<br>0,03 > 0,05   | 1.700<br>10 > 15      | 65<br>0,03 > 0,05    | 1.300<br>7 > 12       | 40<br>0,02 > 0,04    |
| d1 = 3,0 mm                       | 2.100<br>15 > 25      | 85<br>0,03 > 0,05    | 1.400<br>10 > 15      | 55<br>0,03 > 0,05    | 1.050<br>7 > 12       | 30<br>0,02 > 0,04    |
| d1 = 3,5 - 4,2 mm                 | 1.600<br>15 > 25      | 60<br>0,03 > 0,05    | 1.050<br>10 > 15      | 40<br>0,03 > 0,05    | 800<br>7 > 12         | 23<br>0,02 > 0,04    |
| d1 = 4,5 - 5,3 mm                 | 1.300<br>15 > 25      | 60<br>0,04 > 0,06    | 800<br>10 > 15        | 40<br>0,04 > 0,06    | 630<br>7 > 12         | 25<br>0,03 > 0,05    |
| d1 = 5,5 - 6,0 mm                 | 1.050<br>15 > 25      | 75<br>0,06 > 0,08    | 700<br>10 > 15        | 40<br>0,05 > 0,07    | 530<br>7 > 12         | 26<br>0,04 > 0,06    |
| d1 = 7,1 - 7,3 mm                 | 900<br>15 > 25        | 60<br>0,06 > 0,08    | 600<br>10 > 15        | 35<br>0,05 > 0,07    | 460<br>7 > 12         | 22<br>0,04 > 0,06    |
| d1 = 8,0 mm                       | 800<br>15 > 25        | 60<br>0,06 > 0,09    | 520<br>10 > 15        | 33<br>0,05 > 0,08    | 400<br>7 > 12         | 20<br>0,04 > 0,06    |
| d1 = 9,0 mm                       | 700<br>15 > 25        | 50<br>0,06 > 0,09    | 460<br>10 > 15        | 30<br>0,05 > 0,08    | 360<br>7 > 12         | 18<br>0,04 > 0,06    |
| d1 = 10,0 - 10,5 mm               | 640<br>15 > 25        | 50<br>0,06 > 0,1     | 420<br>10 > 15        | 30<br>0,05 > 0,09    | 330<br>7 > 12         | 17<br>0,04 > 0,07    |
| d1 = 11,0 mm                      | 580<br>15 > 25        | 45<br>0,06 > 0,1     | 380<br>10 > 15        | 25<br>0,05 > 0,09    | 300<br>7 > 12         | 15<br>0,04 > 0,07    |
| d1 = 11,9 - 12,0 mm               | 520<br>15 > 25        | 48<br>0,06 > 0,12    | 350<br>10 > 15        | 25<br>0,05 > 0,10    | 270<br>7 > 12         | 15<br>0,04 > 0,08    |

Art. 29.0080

Empfohlene Schnittdaten zu Vollhartmetallbohrer GFK/CFK  
Recommended cutting data for solid carbide twist drills Fiberglas/Carbon

| Werkstoffgruppe<br>Material group | MKD - MCD<br>ND - ND<br>Vc (m/min.) |          | Schruppen<br>Roughing<br>fz (mm) ap / ae |           | Schlichten Spiegelschliff<br>fz (mm) Finishing ap/ae |           |
|-----------------------------------|-------------------------------------|----------|------------------------------------------|-----------|------------------------------------------------------|-----------|
|                                   |                                     |          |                                          |           |                                                      |           |
| 11.1<br>11.2                      | PMMA-Acryl                          | 800-1400 | 0,2-0,4                                  | 1,0-2,0   | 0,05-0,25                                            | 0,04-0,06 |
| 15.0<br>16.0                      | Gold-Silber                         | 400-700  | 0,2-0,4                                  | 0,8-0,15  | 0,05-0,20                                            | 0,04-0,06 |
| 9.1<br>9.2                        | Al 99 - Al Mg 5<br>Al Mg Si Pb      | 600-1000 | 0,1-0,2                                  | 0,8-0,15  | 0,08-0,15                                            | 0,03-0,06 |
| 9.3<br>9.4                        | G Al Mg 5<br>G Al Si 7 Mg           | 800-1600 | 0,1-0,2                                  | 0,05-0,10 | 0,08-0,20                                            | 0,03-0,06 |
| 10.1<br>10.2                      | Cu Zn 36 Pb 1,5<br>Cu Zn 20         | 600-800  | 0,1-0,3                                  | 0,08-0,18 | 0,08-0,25                                            | 0,04-0,08 |



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| STAHL   |         |         |         |
|---------|---------|---------|---------|
| 22.0402 | 22.0403 | 22.0405 | 22.0406 |
| 22.0419 | 22.0425 |         |         |

1 Schneide

140°  
Freiwinkel  
8° ± 2°

2 Ausspitzung

140°  
15° ± 0,02  
40°  
55°  
Ra 2%  
0,00  
Überlappung der Ausspitzung

3 Mass der Restquerschnide

RQ

| Ø           | RQ   |
|-------------|------|
| 3,0 - 8,0   | 0,20 |
| 8,0 - 12,0  | 0,25 |
| 12,0 - 14,0 | 0,30 |
| 14,0 - 16,0 | 0,35 |
| 16,0 - 20,0 | 0,40 |

4 Hauptschneidenverrundung mit 25°  
Guss + Stahl = 0,05 - 0,1

26°

| Ø           | x    |
|-------------|------|
| 3,0 - 6,0   | 0,05 |
| 6,0 - 8,0   | 0,08 |
| 8,0 - 10,0  | 0,10 |
| 10,0 - 14,0 | 0,12 |
| 14,0 - 20,0 | 0,15 |

| INOX    |         |  |  |
|---------|---------|--|--|
| 22.0407 | 22.0409 |  |  |

1 Schneide

140°  
10° = 1. Freiwinkel  
25° = 2. Freiwinkel  
0,05 x D  
4-Flächen-Hinterschliff  
Spitzenwinkel

2 Ausspitzung-Scheibe

15°  
47°  
110°  
R  
Ausspitzung - Scheibe

| Ø           | R   |
|-------------|-----|
| 3,0 - 6,0   | 0,5 |
| 6,0 - 10,0  | 0,8 |
| 10,0 - 12,0 | 1,0 |
| 12,0 - 16,0 | 1,2 |
| 16,0 - 20,0 | 1,4 |

3 Ausspitzungswinkel zur Längsachse

32°  
Ausspitzungswinkel zur Längsachse

4 RQ = Restquerschnide

RQ

| Ø           | RQ   |
|-------------|------|
| 3,0 - 8,0   | 0,20 |
| 8,0 - 12,0  | 0,25 |
| 12,0 - 14,0 | 0,30 |
| 14,0 - 16,0 | 0,35 |
| 16,0 - 20,0 | 0,40 |

RQ=Restquerschnide

5 Hauptschneidenverrundung

25°  
0,03  
Hauptschneidenverrundung

| ALU     |         |  |  |
|---------|---------|--|--|
| 22.0411 | 22.0414 |  |  |

1 Schneide

140°  
10° = 1. Freiwinkel  
25° = 2. Freiwinkel  
0,05 x D  
4-Flächen-Hinterschliff  
Spitzenwinkel

2 Ausspitzung-Scheibe

15°  
47°  
110°  
R  
Ausspitzung - Scheibe

| Ø           | R   |
|-------------|-----|
| 3,0 - 6,0   | 0,5 |
| 6,0 - 10,0  | 0,8 |
| 10,0 - 12,0 | 1,0 |
| 12,0 - 16,0 | 1,2 |
| 16,0 - 20,0 | 1,4 |

3 Ausspitzungswinkel zur Längsachse

32°  
Ausspitzungswinkel zur Längsachse

4 RQ = Restquerschnide

RQ

| Ø           | RQ   |
|-------------|------|
| 3,0 - 8,0   | 0,20 |
| 8,0 - 12,0  | 0,25 |
| 12,0 - 14,0 | 0,30 |
| 14,0 - 16,0 | 0,35 |
| 16,0 - 20,0 | 0,40 |

RQ=Restquerschnide

5 Hauptschneidenverrundung

25°  
0,03  
Hauptschneidenverrundung

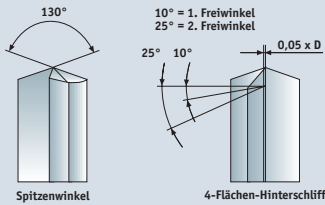


Nachschleifanleitung für Karnasch VHM-Hochleistungsbohrer  
Regrinding informations for Karnasch solid carbide drills

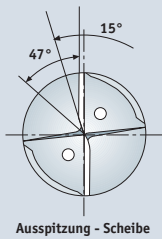
GUSS

22.0418

1 Schneide



2 Ausspitzung-Scheibe



Ausspitzung - Scheibe

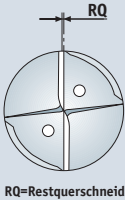
| Ø           | R   |
|-------------|-----|
| 3,0 - 6,0   | 0,5 |
| 6,0 - 10,0  | 0,8 |
| 10,0 - 12,0 | 1,0 |
| 12,0 - 16,0 | 1,2 |
| 16,0 - 20,0 | 1,4 |

3 Ausspitzungswinkel zur Längsachse



Ausspitzungswinkel zur Längsachse

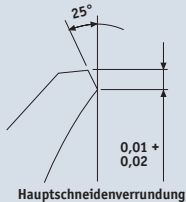
4 RQ = Restquerschnaide



RQ=Restquerschnaide

| Ø           | RQ   |
|-------------|------|
| 3,0 - 8,0   | 0,20 |
| 8,0 - 12,0  | 0,25 |
| 12,0 - 14,0 | 0,30 |
| 14,0 - 16,0 | 0,35 |
| 16,0 - 20,0 | 0,40 |

5 Hauptschneidenverrundung

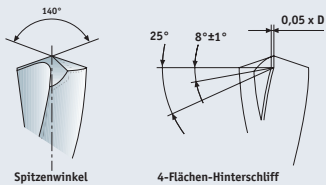


Hauptschneidenverrundung

HHC

22.0468

1 Schneide



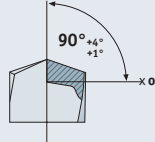
Spitzenwinkel

4-Flächen-Hinterschliff

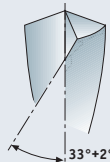
2 Ausspitzung-Scheibe



Ausspitzung - Scheibe

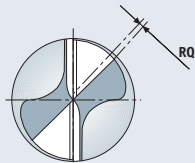


3 Ausspitzungswinkel zur Längsachse



Ausspitzungswinkel zur Längsachse

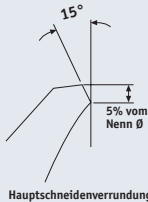
4 RQ = Restquerschnaide



RQ=Restquerschnaide

| Ø           | RQ   |
|-------------|------|
| 3,0 - 8,0   | 0,20 |
| 8,0 - 12,0  | 0,25 |
| 12,0 - 14,0 | 0,30 |
| 14,0 - 16,0 | 0,35 |
| 16,0 - 20,0 | 0,40 |

5 Hauptschneidenverrundung

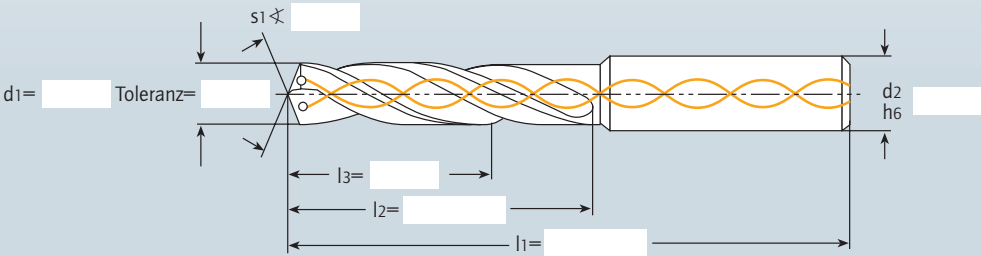


Hauptschneidenverrundung

1. Baumaße

- l1 Gesamtlänge
- l2 Spannnutlänge
- l3 Nutlänge
- d1 Schneidendurchmesser
- d2 Schaftdurchmesser
- S1 Spitzenwinkel

Kopieren und dann gewünschte Maße eintragen:



Bereiche für Zwischenabmessungen

|     | d1          | d2/h6 |
|-----|-------------|-------|
| von | 3,0 - 6,0   | 6     |
|     | 6,0 - 8,0   | 8     |
|     | 8,0 - 10,0  | 10    |
|     | 10,0 - 12,0 | 12    |
|     | 12,0 - 14,0 | 14    |
|     | 14,0 - 16,0 | 16    |
|     | 16,0 - 18,0 | 18    |
|     | 18,0 - 20,0 | 20    |

Ohne nähere Angaben liefern wir Hochleistungsbohrer mit Schneiden Ø d1 - Toleranz m7.

2. Schaftformen DIN 6535

|                                   |                                   |                                   |
|-----------------------------------|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> Form HA  | <input type="checkbox"/> Form HB  | <input type="checkbox"/> Form HE  |
|                                   |                                   |                                   |
| <input type="checkbox"/> Form HAK | <input type="checkbox"/> Form HBK | <input type="checkbox"/> Form HEK |
|                                   |                                   |                                   |

3. Kühlmittelzufuhr

|                                           |                                            |
|-------------------------------------------|--------------------------------------------|
| <input type="checkbox"/> mit Innenkühlung | <input type="checkbox"/> ohne Innenkühlung |
|-------------------------------------------|--------------------------------------------|

4. Beschichtung

|                                |                                                 |                                |
|--------------------------------|-------------------------------------------------|--------------------------------|
| <input type="checkbox"/> keine | <input type="checkbox"/> TIN                    | <input type="checkbox"/> TIALN |
| <input type="checkbox"/> TiCN  | <input type="checkbox"/> andere (bitte angeben) |                                |

5. zu bearbeitender Werkstoff

|  |
|--|
|  |
|  |

6. Mindestbestellung (10 Stück)

|  |       |
|--|-------|
|  | Stück |
|--|-------|

7. Anfrage

|                          |
|--------------------------|
| <input type="checkbox"/> |
|--------------------------|

8. Bestellung

|                          |
|--------------------------|
| <input type="checkbox"/> |
|--------------------------|

SONDERWERKZEUGE

Hochleistungsbohren und Ansenken in einem Arbeitsgang mit Karnasch Hochleistungs-Stufenbohrer

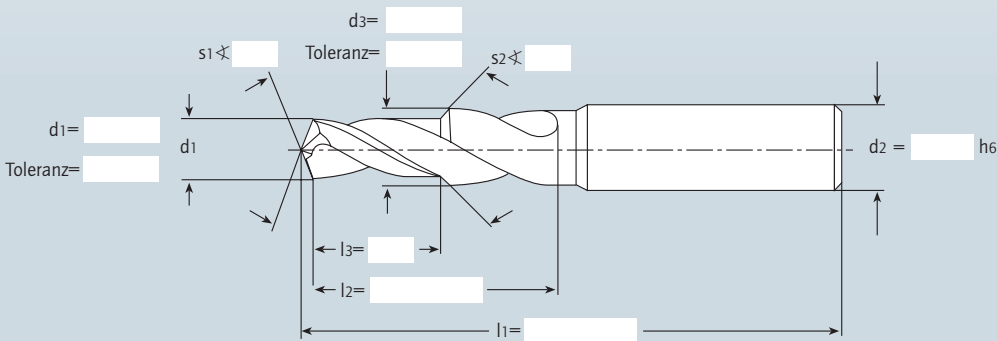
1. Baumaße

- I1 Gesamtlänge
- I2 Spirallänge
- I3 Stufenlänge
- d1 1. Schneidendurchmesser
- d3 2. Stufendurchmesser
- d2 Schaftdurchmesser
- S1 Spitzenwinkel
- S2 Stufenwinkel

Bereiche für Zwischenabmessungen

|     | d1          | d2/h6 |
|-----|-------------|-------|
| von | 3,0 - 6,0   | 6     |
|     | 6,0 - 8,0   | 8     |
|     | 8,0 - 10,0  | 10    |
|     | 10,0 - 12,0 | 12    |
|     | 12,0 - 14,0 | 14    |
|     | 14,0 - 16,0 | 16    |
|     | 16,0 - 18,0 | 18    |
|     | 18,0 - 20,0 | 20    |

Kopieren und dann gewünschte Maße eintragen:



Ohne nähere Angaben liefern wir Stufenbohrer mit Schneiden Ø d1 - Toleranz m7 und Stufendurchmesser d3 - Toleranz ± 0,01.

2. Schaftformen DIN 6535

|                                   |                                   |                                   |
|-----------------------------------|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> Form HA  | <input type="checkbox"/> Form HB  | <input type="checkbox"/> Form HE  |
| <input type="checkbox"/> Form HAK | <input type="checkbox"/> Form HBK | <input type="checkbox"/> Form HEK |

3. Kühlmittelzufuhr

|                                           |                                            |
|-------------------------------------------|--------------------------------------------|
| <input type="checkbox"/> mit Innenkühlung | <input type="checkbox"/> ohne Innenkühlung |
|-------------------------------------------|--------------------------------------------|

4. Beschichtung

|                                |                                                 |                                |
|--------------------------------|-------------------------------------------------|--------------------------------|
| <input type="checkbox"/> keine | <input type="checkbox"/> TIN                    | <input type="checkbox"/> TIALN |
| <input type="checkbox"/> TiCN  | <input type="checkbox"/> andere (bitte angeben) |                                |

5. zu bearbeitender Werkstoff

|  |
|--|
|  |
|  |

6. Bohrertyp

|                                       |                                                |
|---------------------------------------|------------------------------------------------|
| <input type="checkbox"/> Stufenbohrer | <input type="checkbox"/> Mehrfasenstufenbohrer |
|---------------------------------------|------------------------------------------------|

7. Mindestbestellung (10 Stück)

|  |       |
|--|-------|
|  | Stück |
|--|-------|

8. Anfrage

|                          |
|--------------------------|
| <input type="checkbox"/> |
|--------------------------|

9. Bestellung

|                          |
|--------------------------|
| <input type="checkbox"/> |
|--------------------------|

Empfohlene Schnittwerte für Vollhartmetall-Reibahlen / HSR  
Recommended cutting data for micro grain reamers / HSR

| Werkstoffgruppe<br>material group | Festigkeit/Rigidity N/mm <sup>2</sup>                                                                                | Beschichtung / coating                                      |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
|                                   |                                                                                                                      | Schnittgeschwindigkeit Vc in mm / cutting speed Vc in m/min |
|                                   |                                                                                                                      | Werkstoffbeispiel / material example                        |
| 1.1                               | bis 450 N/mm <sup>2</sup> / up to 450 N/mm <sup>2</sup>                                                              | C115, C22, Ck15, St37-3, 9SMn28, 9SMnPb28                   |
| 1.2                               | bis 650 N/mm <sup>2</sup> / up to 650 N/mm <sup>2</sup>                                                              | C35, C45, Ck25, Cf35, Ck45, Cf53,15Mo3,16Mo5                |
| 1.3                               | bis 850 N/mm <sup>2</sup> / up to 850 N/mm <sup>2</sup>                                                              | St50-2, 16CrMo4, 16CrMo4, 16CrMo44, 12CrMo19 5              |
| 1.4                               | bis 950 N/mm <sup>2</sup> / up to 950 N/mm <sup>2</sup>                                                              | St60-2, C55, C60, Ck55, Ck60, C105 W1                       |
| 1.5                               | bis 1100 N/mm <sup>2</sup> / up to 1100 N/mm <sup>2</sup>                                                            | St70-2, 49CrMo4, 42CrV6, 51CrMoV4                           |
| 2.1                               | bis 600 N/mm <sup>2</sup> / up to 600 N/mm <sup>2</sup>                                                              | 100Cr6, 51CrV4, 16MnCr5, 105WCr6, 42Cr4, 50NiCr13           |
| 2.2                               | bis 950 N/mm <sup>2</sup> / up to 950 N/mm <sup>2</sup>                                                              | 100Cr2, 36NiCr6, 31NiCr14, GS-45, CrMoV10 4                 |
| 2.3                               | bis 1100 N/mm <sup>2</sup> / up to 1100 N/mm <sup>2</sup>                                                            | 41CrALMo7, 39CrMoV13 9                                      |
| 2.4                               | bis 1300 N/mm <sup>2</sup> / up to 1300 N/mm <sup>2</sup>                                                            | 40CrMnMo7, X50CrMnNiNbN21 9, 35NiCr18                       |
| 3.1                               | bis 700 N/mm <sup>2</sup> / up to 700 N/mm <sup>2</sup>                                                              | X38CrMoV5 1, X40CrMoV5 1, X155CrVMo12 1                     |
| 3.2                               | bis 1150 N/mm <sup>2</sup> / up to 1150 N/mm <sup>2</sup>                                                            | S 12-1-4-5, S 10-4-3-10, S 6-5-2-5, S 6-5-2                 |
| 4.1                               | ferritisch/martensitisch / ferritic/martensitic                                                                      | X 10 Cr 13 – X 15 Cr Ni Mn 188                              |
| 4.2                               | martensitisch / martensitic                                                                                          | G X 40 Cr Si 17                                             |
| 4.3                               | austenitisch, austenitisch/ferritisch / austenitic, austenitic/ferritic                                              | X 10 Cr Ni Mo Nb 1812                                       |
| 5.1                               | Fe-Basis bis 650 N/mm <sup>2</sup> / Fe-basis up to 650 N/mm <sup>2</sup>                                            | 1.4558, 1.4562, 1.4563, 1.4864, 1.4864                      |
| 5.2                               | Fe-Basis bis 750 N/mm <sup>2</sup> / Fe-basis up to 750 N/mm <sup>2</sup>                                            | X 5 Ni Cr ALTi 3120                                         |
| 5.3                               | Cr-Ni-Basis bis 800 N/mm <sup>2</sup> / Cr-Ni-basis up to 800 N/mm <sup>2</sup>                                      | Monell 400, Hastelloy C-4, Nimonic 75, Inconel 625          |
| 5.4                               | Cr-Ni-Basis bis 950 N/mm <sup>2</sup> / Cr-Ni-basis up to 950 N/mm <sup>2</sup>                                      | Inconel X-750, Hastelloy B, Inconel 751                     |
| 5.5                               | Cr-Ni-Basis bis 1100 N/mm <sup>2</sup> / Cr-Ni-basis up to 1100 N/mm <sup>2</sup>                                    | Monel K-500, Inconel 718                                    |
| 6.1                               | Reintitan/Titanlegierungen bis 850 N/mm <sup>2</sup> / pure titanium and titanium alloys up to 850 N/mm <sup>2</sup> | Ti1, TiCu2, TiAl3V2.5, Ti1Pd                                |
| 6.2                               | Titanlegierungen bis 1200 N/mm <sup>2</sup> / titanium alloys up to 1200 N/mm <sup>2</sup>                           | TiAl5Sn2, TiAl6V4, TiAl6V6Sn2, TiAl4Mo4Sn2                  |
| 7.1                               | Grauguss bis 180 HB / grey cast iron up to 180 HB                                                                    | GG10, GG15                                                  |
| 7.2                               | Grauguss bis 260 HB / grey cast iron up to 260 HB                                                                    | GG20, GG25, GG30, GG35, GG40                                |
| 7.3                               | Kugelgraphitguss bis 160 HB / modular cast iron up to 160 HB                                                         | GGG35, GGG40, GGG50                                         |
| 7.4                               | Kugelgraphitguss bis 250 HB / modular cast iron up to 250 HB                                                         | GGG60, GGG70                                                |
| 7.5                               | Temperguss bis 130 HB / malleable cast iron up to 130 HB                                                             | GTW-04, GTW-45, GTW-55, GTW-65, GTS-35, GTS-45              |
| 7.6                               | Temperguss bis 230 HB / malleable cast iron up to 230 HB                                                             | GTW-35, GTS-55, GTS-65, GTS70                               |
| 8.1                               | 45-55 HRC / steel 45-55 HRC                                                                                          | Toolox 44                                                   |
| 8.2                               | 55-62 HRC / steel 55-62 HRC                                                                                          |                                                             |
| 8.3                               | 60-67-70 HRC / steel 60-67-70 HRC                                                                                    |                                                             |
| 8.4                               | Hartguss bis 48 HRC / hardened cast iron up to 48 HRC                                                                | G-X260NiCr4 2, G-X330NiCr4 2, G-X300CrNi9 5 2               |
| 8.1                               | 45-55 HRC / steel 45-55 HRC                                                                                          | Toolox 44                                                   |
| 8.2                               | 55-60 HRC / steel 55-62 HRC                                                                                          |                                                             |
| 8.3                               | 60-67-70 HRC / steel 60-67-70 HRC                                                                                    |                                                             |
| 8.4                               | Hartguss bis 48 HRC / hardened cast iron up to 48 HRC                                                                |                                                             |
| 9.1                               | Alu Knetlegierungen bis 250 N/mm <sup>2</sup> / malleable alu alloy up 250 N/mm <sup>2</sup>                         | Al99.5, AlMg1                                               |
| 9.2                               | Alu Knetlegierungen bis 350 N/mm <sup>2</sup> / malleable alu alloy up 350 N/mm <sup>2</sup>                         | AlCuSiPb, G-AlCu5Ni1,5, AlZnMgCu0,5                         |
| 9.3                               | Alu-Gusslegierungen <= 12% Si bis 250 N/mm <sup>2</sup> / cast alu alloy <= 12% Si up to 250 N/mm <sup>2</sup>       | G-AlSi9Mg, G-AlSi10Mg, G-AlSi10Mg(Cu), G-AlSi12             |
| 9.4                               | Alu-Gusslegierungen <= 12% Si bis 300 N/mm <sup>2</sup> / cast alu alloy <= 12% Si up to 300 N/mm <sup>2</sup>       | G-AlCu4TiMg, G-AlSi7Mg                                      |
| 9.5                               | Alu-Gusslegierungen <= 12% Si bis 450 N/mm <sup>2</sup> / cast alu alloy <= 12% Si up to 450 N/mm <sup>2</sup>       | G-AlSi18Cu4, G-AlSi21CuNiMg                                 |
| 9.6                               | Magnesium / magnesium                                                                                                | MgMn2, CrMgAl8Zn1                                           |
| 10.1                              | Kupfer - Automatenlegierung, Blei > 1% / copper machining alloys, Pb > 1                                             | G-CuSn7ZnPb, G-CuSn5ZnPb, G-CuPb10Sn                        |
| 10.2                              | Bronze, Messing / bronze, brass                                                                                      | CuZn15, CuZn30, G-CuZn34Al2, CuCrZr, G-CuPb20Sn             |
| 10.3                              | Kupfer, Bleifreies Kupfer, Elektrolytkupfer / copper, lead-free copper, electrolytic copper                          | CuAl10Ni5Fe4, G-CuAl10Ni, G-CuSn10, G-CuSn12                |
| 11.1                              | Thermoplaste / thermoplastics                                                                                        | Bakelit, Responal, Novodur, Pertinax                        |
| 11.2                              | Duroplaste / duroplastics                                                                                            |                                                             |
| 11.3                              | Faserverstärkte Kunststoffe / fibrous-reinforced plastics                                                            | CFK, GFK, AFK                                               |

Reibzugabe in mm  
Reaming allowance mm



|                               |                        |                           |                           |               | Art.                                                                                                                                                                                                                               |                                                | 22.1450                                        |                                                | 22.1452                                        |                                                                            | 22.1490                       |                        |
|-------------------------------|------------------------|---------------------------|---------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------|-------------------------------|------------------------|
|                               |                        | 22.1450                   | 22.1452                   | 22.1490       | Vorschubgeschwindigkeit mm/U · Vorschubwerte sind Mittelwerte und können um ca. 35% nach oben und unten korrigiert werden<br>Feed rate per revolution mm/rev · feed rates are average valve and can be increased or reduced by 35% |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               |                        | unbeschichtet<br>uncoated | unbeschichtet<br>uncoated | FX-70         |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               |                        | Vc                        | Vc                        | Vc            | Ø 0,200 -<br>0,599                                                                                                                                                                                                                 | Ø 0,600 -<br>0,396                             | Ø 3,97 -<br>4,96                               | Ø 4,97 -<br>7,96                               | Ø 7,97 -<br>9,96                               | Ø 9,97 -<br>12,03                                                          | Kühlschmierstoff<br>Lubricant | Kühlmitteldruck<br>bar |
|                               | 100 - 130              | 70 - 90                   | --                        | 0,003 - 0,008 | 0,10 - 0,15<br>0,10 - 0,15<br>0,10 - 0,15<br>0,10 - 0,15<br>0,10 - 0,15                                                                                                                                                            | 0,30 - 0,40                                    | 0,40 - 0,60                                    | 0,50 - 0,65                                    | 0,60 - 0,90                                    | Schneidöl / oil<br>Emulsion / emulsion<br>mind. 12% /<br>min. 12%          | 30 - 60                       |                        |
|                               | 90 - 120               | 60 - 80                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 80 - 110               | 50 - 60                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 70 - 90                | 40 - 70                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 70 - 85                | 40 - 70                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 70 - 80                | 50 - 60                   | --                        | 0,003 - 0,008 | 0,10 - 0,15                                                                                                                                                                                                                        | 0,30 - 0,40                                    | 0,40 - 0,60                                    | 0,50 - 0,65                                    | 0,60 - 0,90                                    | Schneidöl / oil<br>Emulsion / emulsion<br>mind. 12% /<br>min. 12%          | 30 - 60                       |                        |
|                               | 70 - 80                | 50 - 60                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 60 - 80                | 40 - 60                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 60 - 80                | 40 - 60                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 30 - 40                | 20 - 30                   | --                        | 0,003 - 0,008 | 010 - 0,15                                                                                                                                                                                                                         | 0,30 - 0,40<br>0,25 - 0,35                     | 0,40 - 0,60<br>0,30 - 0,45                     | 0,50 - 0,65<br>0,40 - 0,50                     | 0,60 - 0,90<br>0,45 - 0,60                     | Schneidöl / oil<br>Schneidöl / oil                                         | 40 - 70<br>40 - 70            |                        |
|                               | 30 - 40                | 20 - 30                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 20 - 30                | 20 - 30                   | --                        | 0,002 - 0,006 | 0,10 - 0,12                                                                                                                                                                                                                        | 0,25 - 0,35                                    | 0,30 - 0,45                                    | 0,40 - 0,50                                    | 0,45 - 0,60                                    | Schneidöl / oil                                                            | 30 - 60                       |                        |
|                               | 20 - 30                | 20 - 30                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 10 - 20                | 10 - 20                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 20 - 30                | 20 - 30                   | --                        | 0,002 - 0,005 | 0,06 - 0,08                                                                                                                                                                                                                        | 0,20 - 0,30                                    | 0,25 - 0,35                                    | 0,30 - 0,40                                    | 0,35 - 0,45                                    | Schneidöl / oil                                                            | 30 - 60                       |                        |
|                               | 20 - 30                | 20 - 30                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 20 - 30                | 20 - 30                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 20 - 30                | 20 - 30                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 20 - 30                | 20 - 30                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 10 - 20                | 10 - 20                   | --                        | 0,002 - 0,004 | 0,04 - 0,06                                                                                                                                                                                                                        | 0,20 - 0,35                                    | 0,30 - 0,45                                    | 0,40 - 0,50                                    | 0,45 - 0,60                                    | Schneidöl / oil                                                            | 40 - 70                       |                        |
|                               | --                     | --                        | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 40 - 70                | 30 - 50                   | --                        | 0,005 - 0,01  | 0,08 - 0,15                                                                                                                                                                                                                        | 0,50 - 0,65                                    | 0,60 - 0,75                                    | 0,70 - 0,85                                    | 0,80 - 0,95                                    | Schneidöl / oil<br>Luft / air<br>Emulsion / emulsion<br>mind. 12%/min. 12% | 40 - 80                       |                        |
|                               | 40 - 70                | 30 - 50                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 40 - 70                | 30 - 50                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 40 - 70                | 30 - 50                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 40 - 70                | 30 - 50                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 70 - 60                | 40 - 50                   | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        | -             | -                                                                                                                                                                                                                                  | 0,02 - 0,06<br>0,02 - 0,06<br>-<br>0,05 - 0,10 | 0,06 - 0,10<br>0,06 - 0,10<br>-<br>0,08 - 0,15 | 0,10 - 0,15<br>0,10 - 0,15<br>-<br>0,15 - 0,20 | 0,15 - 0,20<br>0,15 - 0,20<br>-<br>0,20 - 0,25 | 20%<br>Emulsion / emulsion                                                 | 60 - 80                       |                        |
|                               | --                     | --                        | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | 25                        | -             | -                                                                                                                                                                                                                                  | 0,03<br>0,03<br>0,03<br>0,05                   | 0,05<br>0,05<br>0,05<br>0,08                   | 0,10<br>0,10<br>0,10<br>0,15                   | 0,15<br>0,15<br>0,15<br>0,20                   | 12% Emulsion<br>12% Emulsion<br>12% Emulsion<br>12% Emulsion               |                               |                        |
|                               | --                     | --                        | 18                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | 12                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | 30                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        | 0,004 - 0,012 | 0,12 - 0,16                                                                                                                                                                                                                        | 0,50 - 0,65                                    | 0,60 - 0,75                                    | 0,70 - 0,85                                    | 0,80 - 0,95                                    | Petroleum/<br>Terpentinölersatz<br>Schneidöl / oil<br>Luft / air           | 40 - 80                       |                        |
|                               | 180 - 250              | 100 - 120                 | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 180 - 250              | 100 - 120                 | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 180 - 250              | 100 - 120                 | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | 180 - 250              | 100 - 120                 | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        | 0,005 - 0,012 | 0,12 - 0,16                                                                                                                                                                                                                        | 0,50 - 0,65                                    | 0,60 - 0,75                                    | 0,70 - 0,85                                    | 0,80 - 0,95                                    | Schneidöl / oil<br>Emulsion 12%                                            | 40 - 80                       |                        |
|                               | 180 - 260<br>200 - 300 | 100 - 120<br>160 - 200    | --<br>--                  |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        | 0,008 - 0,015 | 0,12 - 0,16                                                                                                                                                                                                                        | 0,50 - 0,65                                    | 0,60 - 0,75                                    | 0,70 - 0,85                                    | 0,80 - 0,95                                    | Luft/air                                                                   | 40 - 80                       |                        |
|                               | --                     | --                        | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
|                               | --                     | --                        | --                        |               |                                                                                                                                                                                                                                    |                                                |                                                |                                                |                                                |                                                                            |                               |                        |
| min.<br>mittel/middle<br>max. |                        |                           |                           |               |                                                                                                                                                                                                                                    | 0,08<br>0,10<br>0,15                           | 0,08<br>0,12<br>0,20                           | 0,10<br>0,15<br>0,25                           | 0,10<br>0,20<br>0,30                           | 0,15<br>0,20<br>0,30                                                       |                               |                        |

Problembehebung bei VHM-Reibahlen  
Practical solutions for carbide reaming problems

Wichtige Einsatzkriterien zu Karnasch Hochleistungsreibahlen mit Innenkühlung

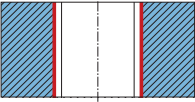
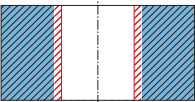
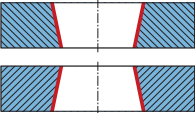
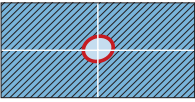
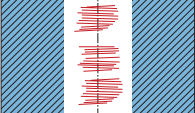
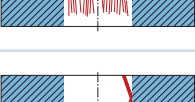
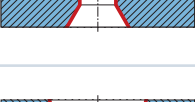
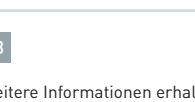
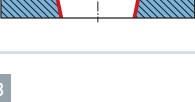
Karnasch Hochleistungsreibahlen mit Innenkühlung sind Werkzeuge für die Feinstbearbeitung und sollten daher in Hydrodehnspannfuttern, Hochgenauigkeitsspannzangen oder im Schrumpffutter aufgenommen werden. Die enorm hohe Rundlaufgenauigkeit, welche mit diesen Werkzeugaufnahmen erreicht werden, kommen dem Bearbeitungsergebnis wesentlich zugute. Karnasch Hochleistungsreibahlen mit Innenkühlung können nach Erreichen des Standzeitendes in der Regel mehrfach nachgeschliffen werden.

Es ist wichtig, die Hochleistungsreibahlen rechtzeitig nach- zuschleifen um den Verschleiß zu minimieren und die Produktionssicherheit zu optimieren. Nutzen Sie unser Know-How für Ihre Fertigung. Sollte sich widererwartend ein Bearbeitungsproblem ergeben, haben wir Ihnen einige Punkte zur Problembehebung aufgezeichnet.

Important criteria for the operational application of Karnasch high-performance reamers with internal cooling

Karnasch high-performance reamers with internal cooling are tools for precision finishing and therefore should be received in hydro strain chucks, high-precision collet chucks, or in shrink chucks. The extremely high true-running accuracy which is reached with these tool-receiving sockets is of considerable benefit for the processing result.

Karnasch high-performance reamers with internal cooling can usually be resharpened several times after reaching the end of the dwell time. It is important to resharpen the high-performance reamers in good time in order to minimize the wear and to optimize the production process. Take advantage of our know-how for your production. If, contrary to expectation, there should be processing problems we have listed several steps for the solution of these problems.

| Problem:                                                                                                                                                                                    | Ursache:                                                                                                                                                                                                                                                                                                                                                                      | Lösung:                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>A.</b> Bohrung ist zu gross<br/><i>Bore too large</i></p>                                            | <ol style="list-style-type: none"><li>1. Werkzeug-Ø zu gross – <i>Reamer too big</i></li><li>2. Fluchtung Werkzeug zu Maschine ungenau – <i>Alignment reamer to machine not precise</i></li><li>3. Aufbauschneide – <i>Built up edge</i></li><li>4. Schmierung ungeeignet – <i>Unsuitable coolant</i></li><li>5. Zu wenig Spantiefe – <i>Depth of cut too small</i></li></ol> | <ol style="list-style-type: none"><li>1. Ausgleichhalter einsetzen – <i>Use compensation chuck</i></li><li>2. Flucht korrigieren bzw. Ausgleichs- oder Pendelhalter einsetzen – <i>Correct alignment or insert compensation or floating chuck</i></li><li>3/4. Anderen Kühlschmierstoff wählen – <i>Select a different coolant</i></li><li>5. Kleine Reibahle, eventl. im Ø kleiner läppen – <i>Small reamer, lapping with smaller Ø if necessary</i></li></ol> |
|  <p><b>B.</b> Bohrung zu klein<br/><i>Bore too small</i></p>                                                | <ol style="list-style-type: none"><li>1. Werkzeug verschlissen – <i>Worn reamer</i></li><li>2. Kühlschmiermittel ungeeignet – <i>Wrong coolant</i></li><li>3. Zu geringe Spantiefe – <i>Depth of cut too small</i></li><li>4. Werkstück verspannt – <i>Deformation through fixation of the work piece</i></li></ol>                                                           | <ol style="list-style-type: none"><li>1. Neues Werkzeug verwenden – <i>Use new reamer</i></li><li>2. Kühlschmiermittel wechseln – <i>Change coolant</i></li><li>3. Reibzugabe ändern – <i>Change reaming allowance</i></li><li>4. Spannsystem überprüfen – <i>Check the clamping system</i></li></ol>                                                                                                                                                           |
|  <p><b>C.</b> Bohrung ist konisch<br/><i>Tapered bore</i></p>                                              | <ol style="list-style-type: none"><li>1. Ungenau Fluchtung – <i>Faulty alignment</i></li><li>2. Aufbauschneide – <i>Built up edge</i></li></ol>                                                                                                                                                                                                                               | <ol style="list-style-type: none"><li>1. Achsfehler auf max. 0,005 mm verringern oder wenn nicht möglich, achsparallelen Ausgleich verwenden<br/><i>Reduce axis error to max. 0.005 mm or if that is not possible, use axis-parallel compensation</i></li><li>2. Anderen Kühlschmierstoff wählen<br/><i>Select a different coolant</i></li></ol>                                                                                                                |
|  <p><b>D.</b> Bohrung ist unrund und zeigt Rattermarken<br/><i>Bore not true, shows chatter marks</i></p> | <ol style="list-style-type: none"><li>1. Zu grosser Rundlauf- und Fluchtungsfehler<br/><i>Concentricity a. alignment error too large</i></li><li>2. Schräge Anschnittfläche – <i>Wrong cutting geometry</i></li><li>3. Werkstück ist verspannt – <i>Deformation through fixation of the work piece</i></li></ol>                                                              | <ol style="list-style-type: none"><li>1. Spanndruck verringern od. Spannart ändern – <i>Reduce clamping pressure or change clamping type</i></li><li>2. Flucht korrigieren od. Ausgleichs- u. Pendelhalter einsetzen – <i>Correct alignment or insert compensation or floating chuck</i></li><li>3. Bohrung ansenken – <i>Countersink bore</i></li></ol>                                                                                                        |
|  <p><b>E.</b> Oberflächengüte ungenügend<br/><i>Surface quality unsatisfactory</i></p>                    | <ol style="list-style-type: none"><li>1. Schneiden verschlissen – <i>Cutting edges blunt</i></li><li>2. Werkzeug läuft nicht rund – <i>Reamers does not run true</i></li><li>3. Falsche Schnittdaten – <i>Wrong machining data</i></li><li>4. Spänefluss wird behindert/Kühlmitteldruck nicht ausreichend<br/><i>Bad chip flow (insufficient coolant)</i></li></ol>           | <ol style="list-style-type: none"><li>1. Vorschub verringern – <i>Reduce feed</i></li><li>2. Kühlschmierstoff anreichern – <i>Concentrate the coolant</i></li><li>3. Vc und f verändern ± 25%<br/><i>Change Vc and f ± 25%</i></li><li>4. Reibahle neu schärfen bzw. neue Reibahle<br/><i>Resharpen reamer or replace with new one</i></li></ol>                                                                                                                |
|  <p><b>F.</b> Vorschubmarken in der Bohrung<br/><i>Feed marks in bore</i></p>                             | <ol style="list-style-type: none"><li>1. Exzentrische Spindel oder Werkzeug<br/><i>Eccentric spindle or reamer</i></li></ol>                                                                                                                                                                                                                                                  | <ol style="list-style-type: none"><li>1. Achsfehler auf max. 0,005 mm verringern oder wenn nicht möglich, achsparallelen Ausgleich verwenden<br/><i>Reduce axis error to max. 0.005 mm or, if that is not possible, use axis-parallel compensation</i></li></ol>                                                                                                                                                                                                |
|  <p><b>M.</b> Werkzeug klemmt<br/><i>Reamers jams</i></p>                                                 | <ol style="list-style-type: none"><li>1. Zu geringe Konizität – <i>Reamers taper too slight because of wear relieving</i></li></ol>                                                                                                                                                                                                                                           | <ol style="list-style-type: none"><li>1. Verjüngung vergrößern, schärfen der Reibahle<br/><i>Increase taper, sharpen reamer</i></li></ol>                                                                                                                                                                                                                                                                                                                       |
|  <p><b>G.</b> Bohrung bauchig<br/><i>Bore bulges</i></p>                                                  | <ol style="list-style-type: none"><li>1. Verspannung des Werkstückes auch bei großen Wandstärken möglich.<br/><i>Workpiece may be distorted even with large wall thicknesses</i></li></ol>                                                                                                                                                                                    | <ol style="list-style-type: none"><li>1. Spannkraft verringern bzw. Spannkrafteinwirkungsrichtung ändern<br/><i>Reduce clamping force or change direction of clamping force</i></li></ol>                                                                                                                                                                                                                                                                       |
|  <p><b>H.</b> Konischer Einlauf<br/>Konischer Auslauf<br/><i>Conical run-in<br/>Conical run-out</i></p>   | <ol style="list-style-type: none"><li>1. Flucht ungenau – <i>Imprecise alignment</i></li><li>2. Differenz zwischen Spindel und Werkzeugachse<br/><i>Difference between spindle and tool axis</i></li><li>3. Reibahle schneidet hinten nach<br/><i>Reamer is cutting back</i></li></ol>                                                                                        | <ol style="list-style-type: none"><li>1. Flucht korrigieren – <i>Correct alignment</i></li><li>2. Werkzeugachse/Achsfluchtung korrigieren – <i>Correct tool axis/axis alignment</i></li><li>3. Schneiden-Verjüngung kontrollieren – <i>Check cutting taper</i></li></ol>                                                                                                                                                                                        |
|  <p><b>K.</b> Bohrung verläuft<br/><i>Bore drifts</i></p>                                                 | <ol style="list-style-type: none"><li>1. Vorbearbeitungszugabe zu gering – <i>Not enough preprocessing allowance</i></li><li>2. Mangelhafte Vorbearbeitung – <i>Faulty preprocessing</i></li></ol>                                                                                                                                                                            | <ol style="list-style-type: none"><li>1. Reibzugabe erhöhen – <i>Increase reaming allowance</i></li><li>2. Vorbearbeitung prüfen – <i>Check preprocessing</i></li></ol>                                                                                                                                                                                                                                                                                         |

Reibahlen – Herstellungstoleranzen Auszug aus DIN 1420  
Reamers – manufacturing tolerances Excerpt from DIN 1420

1. Grundsätzliches zur Festlegung der Herstellungstoleranz

Die in dieser Norm angegebenen Herstellungstoleranzen sind bestimmten Toleranzfeldern der zu reibenden Löchern zugeordnet. Sie gewährleisten im allgemeinen, dass das geriebene Loch innerhalb des zugehörigen Toleranzfeldes liegt und das gleichzeitig die Reibahle wirtschaftlich ausgenutzt werden kann.  
Es ist jedoch zu berücksichtigen, dass die Größe des geriebenen Loches außer von der Herstellungstoleranz der Reibahle noch von anderen Faktoren abhängt, z.B. von den Winkeln an der Schneide, vom Anschnitt der Reibahle, von der Aufspannung des Werkstückes, von der Werkzeugaufnahme, vom Zustand der Werkzeugmaschine, von der Schmierung und vom Werkstoff des Werkstückes, in dem gerieben wird. Demzufolge können Sonderfälle auftreten, in denen andere Herstellungstoleranzen günstiger sind.  
Mit Rücksicht auf eine wirtschaftliche Herstellung und Lagerhaltung sowie auf die Austauschbarkeit von Reibahlen verschiedener Hersteller sollten jedoch nur in wirklich begründeten Sonderfällen andere Herstellungstoleranzen gefordert werden.

2. Ermittlung der zulässigen Größt- und Kleinstmaße von Reibahlen

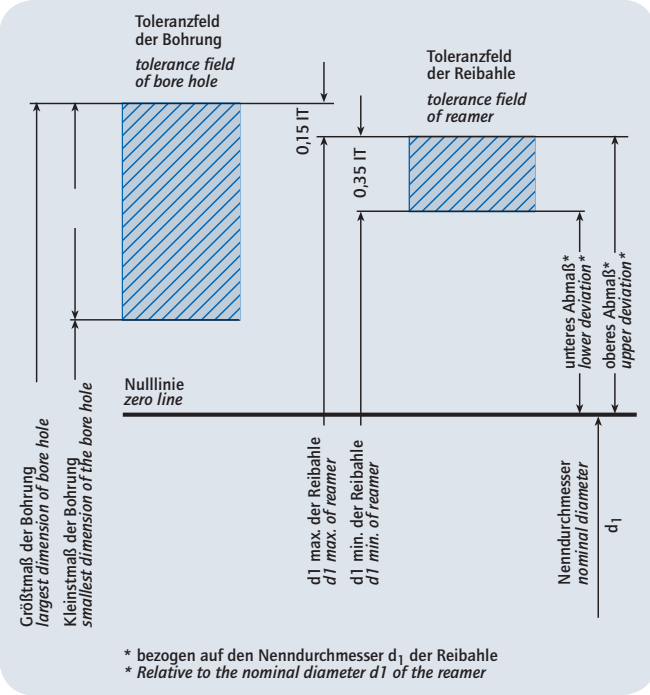
Der zulässige größte Durchmesser  $d_1$  max. der Reibahle liegt um 15% der jeweiligen Bohrungs-Toleranz (0,15 IT) unter dem zulässigen Größtmaß der Bohrung (siehe Bild). Hierbei wird der Wert 0,15 IT auf dem nächst größeren ganzzahligen oder halben  $\mu\text{m}$ -Wert gerundet, so dass für  $d_1$  max. glatte  $\mu\text{m}$ -Werte entstehen. Der zulässige kleinste Durchmesser  $d_1$  min. der Reibahle liegt bei 35% der jeweiligen Bohrungs-Toleranz (0,35 IT) unter dem zulässig größten Reibahldurchmesser  $d_1$  max.

3. Vereinfachte Ermittlung der zulässigen Größt- und Kleinstmaße von Reibahlen

Um das Rechnen zu vereinfachen, sind für die gebräuchlichsten Toleranzfelder die oberen und unteren Abmaße vom Nenndurchmesser  $d_1$  der Reibahle in den Tabellen auf der folgenden Seiten aufgeführt. Mit Hilfe dieser Abmaße können die zulässigen Größt- und Kleinstmaße der Reibahlen auf einfachste Weise errechnet werden.

4. Bezeichnung (Auszug)

Werden in Sonderfällen Reibahlen mit von dieser Norm abweichenden Größt- und Kleinstmaßen bestellt, so ist in der Bezeichnung an Stelle des ISO-Kurzzeichens für das Bohrungstoleranzfeld das obere und untere Abmaß der Reibahle in  $\mu\text{m}$  anzugeben, z.B. für eine Reibahle mit Nenndurchmesser 20 mm, oberes Abmaß = + 15  $\mu\text{m}$ : Reibahle 20p 25 p 15 p DIN...  
In der Bezeichnung wird an Stelle des Pluszeichens ein p und an Stelle des Minuszeichens ein m gesetzt, weil die Zeichen "+" und "-" sich nicht auf allen Maschinen, insbesondere der Daten verarbeitenden Maschinen, schreiben lassen.



1. Basic principles for determining manufacturing tolerance

The manufacturing tolerances specified in this standard are assigned to specific tolerance fields of the holes to be reamed. These tolerances ensure in general that the reamed hole will be within the relevant tolerance field while also guaranteeing economical use of the reamer.  
It must be considered, however, that the size of the reamed hole could still be outside the manufacturing tolerance of the reamer because of other factors, for example the angles on the cutting edges, the cut of the reamer, the way the workpiece is clamped, the tool receiving socket, condition of the tool machine, lubrication, or the material of the workpiece being reamed.  
Because of this, special cases may arise where other manufacturing tolerances are more favorable.  
In consideration of economical production and storage as well as replaceability of reamers made by different manufacturers, however, other manufacturing tolerances should only be used in special cases with real justification.

2. Determining the largest and smallest permissible dimensions of reamers

The largest permissible diameter  $d_1$  max. of the reamer is 15% of the corresponding bore hole tolerance (0.15 IT), taking into account the largest permissible dimension of the bore hole (see picture).  
The value of 0.15 IT is rounded up to the next greater whole-number or half  $\mu\text{m}$  value. This results in a smooth series of  $\mu\text{m}$  values for  $d_1$ . The smallest permissible diameter  $d_1$  min. of the reamer is 35% of the relevant bore hole tolerance (0.35 IT) below the largest permissible reamer diameter  $d_1$  max.

3. Simplified determination of the largest and smallest permissible dimensions of reamers

To simplify calculations, the upper and lower deviations from the nominal diameter  $d_1$  of the reamer for the most commonly used tolerance fields is shown in the tables on the following pages. Using these dimensional deviations, you can calculate the largest and smallest permissible dimensions of reamers quickly and easily.

4. Designation (excerpt)

If reamers are ordered in special cases with largest and smallest dimensions that deviate from this standard, the upper and lower deviations of the reamer must be indicated in the designation in  $\mu\text{m}$  instead of the ISO abbreviation for the bore hole tolerance field. For example, for a reamer with a nominal diameter of 20 mm, upper deviation = + 15  $\mu\text{m}$ : Reamer 20p 25 p 15 p DIN...  
A p is used in the designation instead of the plus sign and an m instead of the minus sign. This is because the symbols "+" and "-" cannot be written on all machines, especially the data for processing machines.

Einsatz von Kühlschmierstoffen

Beim Reiben sollte – wenn möglich – immer ein Kühlschmierstoff eingesetzt werden. Dieser erfüllt zugleich Kühl- und Schmierfunktionen, wobei beim Reiben bei niedrigen Schnittgeschwindigkeiten die Schmierung die wichtigste Funktion einnimmt.

Die Anforderungen, die an Kühlschmierstoffe gestellt werden:

- Die Reduktion der Reibung zwischen Span und Werkzeug, sowie zwischen Rundschliff-Fase und Bohrungswand
- Wegspülen von Spänen und Abriebteilchen
- Abführen von Wärme

Für das Reiben gelangen vorwiegend wassermischbare Kühlschmierstoffe, materialbedingt auch Luft, Öl und Petroleum zum Einsatz.

Insertion of Coolant

A cooling lubricant should always be used when cutting. This fulfils a cooling and lubricating function at the same time, when lubrication being the most important function when cutting at low cutting speeds.

The demands made on cooling lubricants:

- Reduction of the friction between metal chips and tool and between the cylindrical prindling bevel and bore-hole wall
- Washing away chippings and filings
- Dissipation of heat

Water miscible cooling lubricants are used primarily for cutting although cutting oils can also be used in exceptional cases.

Reibahlen-Herstellungstoleranzen in  $\mu = 0,001\text{ mm}$     Auszug aus DIN 1420  
Fabrication tolerances for reamers in  $\mu = 0,001\text{ mm}$     Excerpt from DIN 1420

| Neendurchmesser<br>der Reibahle<br>Nominal diameter<br>for reamers<br><br>d1 in mm |    | Zulässiges oberes und unteres Abmaß vom Nenndurchmesser d1 der Reibahle in µm für Bohrungs-Toleranzfeld<br>Acceptable up and down allowance from nominal diameter d1 for reamer in µm for the tolerance zone of the drilling |       |       |       |       |       |       |       |       |       |
|------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                                                                    |    | A                                                                                                                                                                                                                            |       | B     |       |       |       | C     |       |       |       |
|                                                                                    |    | 9                                                                                                                                                                                                                            | 11    | 8     | 9     | 10    | 11    | 8     | 9     | 10    | 11    |
| über                                                                               | 1  | + 291                                                                                                                                                                                                                        | + 321 | + 151 | + 161 | + 174 | + 191 | + 71  | + 81  | + 94  | + 111 |
| bis                                                                                | 3  | + 282                                                                                                                                                                                                                        | + 300 | + 146 | +152  | + 160 | + 170 | + 66  | +72   | + 80  | + 90  |
| über                                                                               | 3  | + 295                                                                                                                                                                                                                        | + 333 | + 155 | + 165 | + 180 | + 203 | + 85  | + 95  | + 110 | + 133 |
| bis                                                                                | 6  | + 284                                                                                                                                                                                                                        | + 306 | +148  | + 154 | + 163 | + 176 | + 78  | + 84  | + 93  | + 106 |
| über                                                                               | 6  | + 310                                                                                                                                                                                                                        | + 356 | + 168 | + 180 | + 199 | + 226 | + 98  | + 110 | + 129 | + 156 |
| bis                                                                                | 10 | + 297                                                                                                                                                                                                                        | + 324 | + 160 | + 167 | + 178 | + 194 | + 90  | + 97  | + 108 | + 124 |
| über                                                                               | 10 | + 326                                                                                                                                                                                                                        | + 383 | + 172 | + 186 | + 209 | + 243 | + 117 | + 131 | + 154 | + 188 |
| bis                                                                                | 18 | + 310                                                                                                                                                                                                                        | + 344 | + 162 | + 170 | + 184 | + 204 | + 107 | + 115 | + 129 | + 149 |
| über                                                                               | 18 | + 344                                                                                                                                                                                                                        | + 410 | + 188 | + 204 | + 231 | + 270 | + 138 | + 154 | + 181 | + 220 |
| bis                                                                                | 30 | + 325                                                                                                                                                                                                                        | + 364 | + 176 | + 185 | + 201 | + 224 | + 126 | + 135 | + 151 | + 174 |

| Neendurchmesser<br>der Reibahle<br>Nominal diameter<br>for reamers<br><br>d1 in mm |    | Zulässiges oberes und unteres Abmaß vom Nenndurchmesser d1 der Reibahle in µm für Bohrungs-Toleranzfeld<br>Acceptable up and down allowance from nominal diameter d1 for reamer in µm for the tolerance zone of the drilling |      |      |      |      |      |      |       |       |     |     |      |
|------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|-------|-------|-----|-----|------|
|                                                                                    |    | G                                                                                                                                                                                                                            |      | H    |      |      |      |      |       | J     |     |     |      |
|                                                                                    |    | 6                                                                                                                                                                                                                            | 7    | 6    | 7    | 8    | 9    | 10   | 11    | 12    | 6   | 7   | 8    |
| über                                                                               | 1  | + 7                                                                                                                                                                                                                          | + 10 | + 5  | + 8  | + 11 | + 21 | + 34 | + 51  | +85   | +1  | + 2 | + 3  |
| bis                                                                                | 3  | + 4                                                                                                                                                                                                                          | + 6  | +2   | + 4  | + 6  | + 12 | + 20 | + 30  | + 50  | - 2 | - 2 | - 2  |
| über                                                                               | 3  | + 10                                                                                                                                                                                                                         | + 14 | + 6  | + 10 | + 15 | + 25 | + 40 | + 63  | + 102 | + 3 | + 4 | + 7  |
| bis                                                                                | 6  | + 7                                                                                                                                                                                                                          | + 9  | + 3  | + 5  | + 8  | + 14 | + 23 | + 36  | + 60  | 0   | - 1 | 0    |
| über                                                                               | 6  | + 12                                                                                                                                                                                                                         | + 17 | + 7  | + 12 | + 18 | + 30 | + 49 | + 76  | + 127 | + 3 | + 5 | + 8  |
| bis                                                                                | 10 | + 8                                                                                                                                                                                                                          | + 11 | + 3  | + 6  | + 10 | + 17 | + 28 | + 44  | + 74  | - 1 | - 1 | 0    |
| über                                                                               | 10 | + 15                                                                                                                                                                                                                         | + 21 | + 9  | + 15 | + 22 | + 36 | + 59 | + 93  | + 153 | + 4 | + 7 | + 10 |
| bis                                                                                | 18 | + 11                                                                                                                                                                                                                         | + 14 | + 5  | + 8  | + 12 | + 20 | + 34 | + 54  | + 90  | 0   | 0   | 0    |
| über                                                                               | 18 | + 18                                                                                                                                                                                                                         | + 24 | + 11 | + 17 | + 28 | + 44 | + 71 | + 110 | + 178 | + 6 | + 8 | + 15 |
| bis                                                                                | 30 | + 13                                                                                                                                                                                                                         | + 16 | + 6  | + 9  | + 16 | + 25 | + 41 | + 64  | + 104 | + 1 | 0   | + 3  |

| Neendurchmesser<br>der Reibahle<br>Nominal diameter<br>for reamers<br><br>d1 in mm |    | Zulässiges oberes und unteres Abmaß vom Nenndurchmesser d1 der Reibahle in µm für Bohrungs-Toleranzfeld<br>Acceptable up and down allowance from nominal diameter d1 for reamer in µm for the tolerance zone of the drilling |     |      |      |     |     |     |      |      |      |
|------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|-----|-----|-----|------|------|------|
|                                                                                    |    | JS                                                                                                                                                                                                                           |     |      |      | K   |     |     | M    |      |      |
|                                                                                    |    | 6                                                                                                                                                                                                                            | 7   | 8    | 9    | 6   | 7   | 8   | 6    | 7    | 8    |
| über                                                                               | 1  | + 2                                                                                                                                                                                                                          | + 3 | + 4  | + 8  | - 1 | - 2 | - 3 | - 3  | - 4  | - 5  |
| bis                                                                                | 3  | - 1                                                                                                                                                                                                                          | - 1 | - 1  | - 1  | - 4 | - 6 | - 8 | - 6  | - 8  | - 10 |
| über                                                                               | 3  | + 2                                                                                                                                                                                                                          | + 4 | + 6  | + 10 | 0   | + 1 | + 2 | - 3  | - 2  | - 1  |
| bis                                                                                | 6  | - 1                                                                                                                                                                                                                          | - 1 | - 1  | - 1  | - 3 | - 4 | - 5 | - 6  | - 7  | - 8  |
| über                                                                               | 6  | + 3                                                                                                                                                                                                                          | + 5 | + 7  | + 12 | 0   | + 2 | + 2 | - 5  | - 3  | - 3  |
| bis                                                                                | 10 | -1                                                                                                                                                                                                                           | - 1 | - 1  | - 1  | - 4 | - 4 | - 6 | - 9  | - 9  | - 11 |
| über                                                                               | 10 | + 3                                                                                                                                                                                                                          | + 6 | + 9  | + 15 | 0   | + 3 | + 3 | - 6  | - 3  | - 3  |
| bis                                                                                | 18 | - 1                                                                                                                                                                                                                          | - 1 | - 1  | - 1  | - 4 | - 4 | - 7 | - 10 | - 10 | - 13 |
| über                                                                               | 18 | + 4                                                                                                                                                                                                                          | + 7 | + 11 | +18  | 0   | + 2 | + 5 | - 6  | - 4  | - 1  |
| bis                                                                                | 30 | - 1                                                                                                                                                                                                                          | - 1 | - 1  | - 1  | - 5 | - 6 | - 7 | - 11 | - 12 | - 13 |

| Neendurchmesser<br>der Reibahle<br>Nominal diameter<br>for reamers<br><br>d1 in mm |    | Zulässiges oberes und unteres Abmaß vom Nenndurchmesser d1 der Reibahle in µm für Bohrungs-Toleranzfeld<br>Acceptable up and down allowance from nominal diameter d1 for reamer in µm for the tolerance zone of the drilling |      |      |      |      |      |      |      |      |      |
|------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|
|                                                                                    |    | N                                                                                                                                                                                                                            |      |      |      | P    |      | R    |      |      |      |
|                                                                                    |    | 6                                                                                                                                                                                                                            | 7    | 8    | 9    | 10   | 11   | 66   | 7    | 6    | 7    |
| über                                                                               | 1  | - 5                                                                                                                                                                                                                          | - 6  | - 7  | - 8  | - 10 | - 13 | - 7  | - 8  | - 11 | - 12 |
| bis                                                                                | 3  | - 8                                                                                                                                                                                                                          | - 10 | - 12 | - 17 | - 24 | - 34 | - 10 | - 12 | - 14 | - 16 |
| über                                                                               | 3  | - 7                                                                                                                                                                                                                          | - 6  | - 5  | - 5  | - 8  | - 12 | - 11 | - 10 | - 14 | - 13 |
| bis                                                                                | 6  | - 10                                                                                                                                                                                                                         | -11  | - 12 | - 16 | - 25 | - 39 | - 14 | - 15 | - 17 | - 18 |
| über                                                                               | 6  | - 9                                                                                                                                                                                                                          | - 7  | - 7  | - 6  | - 9  | - 14 | - 14 | - 12 | - 18 | - 16 |
| bis                                                                                | 10 | - 13                                                                                                                                                                                                                         | - 13 | - 15 | - 19 | - 30 | - 46 | - 18 | - 18 | - 22 | - 22 |
| über                                                                               | 10 | - 11                                                                                                                                                                                                                         | - 8  | - 8  | - 7  | - 11 | - 17 | - 17 | - 14 | - 22 | - 19 |
| bis                                                                                | 18 | - 15                                                                                                                                                                                                                         | - 15 | - 18 | - 23 | - 36 | - 56 | - 21 | - 21 | - 26 | - 26 |
| über                                                                               | 18 | - 13                                                                                                                                                                                                                         | - 11 | - 8  | - 8  | - 13 | - 20 | - 20 | - 18 | - 26 | - 24 |
| bis                                                                                | 30 | - 18                                                                                                                                                                                                                         | - 19 | - 20 | - 27 | - 43 | - 66 | - 25 | - 26 | - 31 | - 32 |

| Neendurchmesser<br>der Reibahle<br>Nominal diameter<br>for reamers<br><br>d1 in mm |    | Zulässiges oberes und unteres Abmaß vom Nenndurchmesser d1 der Reibahle in µm für Bohrungs-Toleranzfeld<br>Acceptable up and down allowance from nominal diameter d1 for reamer in µm for the tolerance zone of the drilling |      |      |      |      |      |       |    |       |       |
|------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|-------|----|-------|-------|
|                                                                                    |    | S                                                                                                                                                                                                                            |      | T    | U    |      |      | X     |    | Z     |       |
|                                                                                    |    | 6                                                                                                                                                                                                                            | 7    | 6    | 6    | 7    | 10   | 10    | 11 | 10    | 11    |
| über                                                                               | 1  | - 15                                                                                                                                                                                                                         | - 16 | -    | - 19 | - 20 | - 24 | -     | -  | - 32  | -     |
| bis                                                                                | 3  | - 18                                                                                                                                                                                                                         | - 20 | -    | - 22 | - 24 | - 38 | -     | -  | - 46  | -     |
| über                                                                               | 3  | - 18                                                                                                                                                                                                                         | - 17 | -    | - 22 | - 21 | - 31 | -     | -  | - 43  | -     |
| bis                                                                                | 6  | - 21                                                                                                                                                                                                                         | - 22 | -    | - 25 | - 26 | - 48 | -     | -  | - 60  | -     |
| über                                                                               | 6  | - 22                                                                                                                                                                                                                         | - 20 | -    | - 27 | - 25 | - 37 | -     | -  | - 51  | -     |
| bis                                                                                | 10 | - 26                                                                                                                                                                                                                         | - 26 | -    | - 31 | - 31 | - 58 | -     | -  | - 72  | -     |
| über                                                                               | 10 | -                                                                                                                                                                                                                            | -    | -    | -    | -    | -    | -     | -  | - 61  | -     |
| bis                                                                                | 14 | - 27                                                                                                                                                                                                                         | - 24 | -    | - 32 | - 29 | - 44 | -     | -  | - 86  | -     |
| über                                                                               | 14 | - 31                                                                                                                                                                                                                         | - 31 | -    | - 36 | - 36 | - 69 | - 56  | -  | - 71  | -     |
| bis                                                                                | 18 | -                                                                                                                                                                                                                            | -    | -    | -    | -    | -    | - 81  | -  | - 96  | -     |
| über                                                                               | 18 | -                                                                                                                                                                                                                            | -    | -    | - 39 | - 37 | -    | - 67  | -  | - 86  | -     |
| bis                                                                                | 24 | - 33                                                                                                                                                                                                                         | - 31 | -    | - 44 | - 45 | -    | - 97  | -  | - 116 | -     |
| über                                                                               | 24 | - 38                                                                                                                                                                                                                         | - 39 | - 39 | - 46 | - 44 | -    | - 77  | -  | - 101 | - 108 |
| bis                                                                                | 30 | -                                                                                                                                                                                                                            | -    | - 44 | - 51 | - 52 | -    | - 107 | -  | - 131 | - 154 |



Rautiefen nach DIN  
Roughness depth according to DIN

| $R_{max.} \pm 0,001$ | $R_{max.}$ Angabe | entspricht $R_a$ -Wert | Rauheitskennzahl |
|----------------------|-------------------|------------------------|------------------|
| 71 - 100             | 100               | 17 - 26                | N11              |
| 50 - 71              | 71                | 12 - 18                |                  |
| 40 - 50              | 50                | 9 - 13                 | N10              |
| 31,5 - 40            | 40                | 6,3 - 10               |                  |
| 25 - 31,5            | 31,5              | 5,2 - 7,6              | N9               |
| 18 - 25              | 25                | 3,5 - 6                |                  |
| 12,5 - 18            | 18                | 2,5 - 4                | N8               |
| 8 - 12,5             | 12,5              | 1,5 - 2,8              |                  |
| 5 - 8                | 8                 | 0,8 - 1,8              | N7               |
| 2,5 - 5              | 5                 | 0,4 - 1                | N6               |
| 1,4 - 2,5            | 2,5               | 0,2 - 0,47             | N5               |
| 0,14 - 1,4           | 1,4               | 0,025 - 0,25           | N1-N4            |

Ungleiche Teilung und extrem-ungleich Teilung für Karnasch Reibahlen  
Uneven spacing and extremely uneven spacing for Karnasch reamers

Standard Ungleich-Teilung / Unequal graduation

Standard-Reibahlen werden in normaler Ungleich-Teilung geliefert.  
*Unequal graduation and extreme unequal graduation.*

| Nenn Ø-Bereich<br>Nom. range of dia. | Z | Teilung<br>graduation |
|--------------------------------------|---|-----------------------|
| 0,5 - 1,9                            | 3 | 120°/120°/120         |
| 1,9 - 2,65                           | 4 | 93°/87°               |
| 2,65 - 13,2                          | 6 | 63°/60°/57°           |
| 13,2 - 20,3                          | 8 | 47°/43°/47°/43°       |

Extrem Ungleich-Teilung / Extreme unequal graduation

Extrem ungleiche Teilungen ermöglichen die Fertigung von Bohrungen hoher Kreisformgenauigkeit, mit einem maximalen Kreisformfehler von 1-3 µm und eine ISO-Passungsgenauigkeit von nahezu IT 05.  
*Extremely unequal graduation make it possible to make boreholes of high circularity precision with a maximum circularity deviation of 1-3 µm and an ISO fitting exactness of almost IT 0,5.*

| Nenn Ø-Bereich<br>Nom. range of dia. | Z | Teilung<br>graduation |
|--------------------------------------|---|-----------------------|
| 3,0 - 20,0                           | 6 | 75°/60°/45°           |

Empfohlene Bohrdurchmesser zum Reiben, Richtwerte in mm  
Recommended drill hole diameters for reaming. Standard value in mm

| Werkstoff<br>material              | Ø bis 6 mm<br>dia to 6 mm | Ø bis 10 mm<br>dia to 10 mm | Ø bis 16 mm<br>dia to 16 mm | Ø bis 25 mm<br>dia to 25 mm | Ø über 25 mm<br>dia over 25 mm |
|------------------------------------|---------------------------|-----------------------------|-----------------------------|-----------------------------|--------------------------------|
| Stahl ≤ 800 / steel ≤ 800          | 0,1 - 0,2                 | 0,2                         | 0,2 - 0,3                   | 0,3 - 0,4                   | 0,4 - 0,5                      |
| Stahlguss / steel casting          | 0,1 - 0,2                 | 0,2                         | 0,2                         | 0,2 - 0,3                   | 0,3 - 0,4                      |
| Grauguss / cast iron               | 0,1 - 0,2                 | 0,2                         | 0,2 - 0,3                   | 0,3 - 0,4                   | 0,4 - 0,5                      |
| Temperguss / mailable cast iron    | 0,1 - 0,2                 | 0,2                         | 0,3                         | 0,4                         | 0,5                            |
| Kupfer / copper                    | 0,1 - 0,2                 | 0,2 - 0,3                   | 0,3 - 0,4                   | 0,4 - 0,5                   | 0,5                            |
| Messing, Bronze / brass, bronze    | 0,1 - 0,2                 | 0,2                         | 0,2 - 0,3                   | 0,3                         | 0,3 - 0,4                      |
| Aluminium / aluminium              | 0,1 - 0,2                 | 0,2 - 0,3                   | 0,3 - 0,4                   | 0,4 - 0,5                   | 0,5                            |
| Kunststoffe, hart / hard plastic   | 0,1 - 0,2                 | 0,3                         | 0,4                         | 0,4 - 0,5                   | 0,5                            |
| Kunststoffe, weich / thermoplastic | 0,1 - 0,2                 | 0,2                         | 0,2                         | 0,3                         | 0,3 - 0,4                      |

| Art.                              | 29.1783                                   | 29.1784                                                   | 29.1790A                   | 29.1790C      | Empfohlene Schnittdaten für Karnasch-Router<br>Recommended cutting data for Karnasch Router |               |               |                |                |                |                |
|-----------------------------------|-------------------------------------------|-----------------------------------------------------------|----------------------------|---------------|---------------------------------------------------------------------------------------------|---------------|---------------|----------------|----------------|----------------|----------------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                     | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min. | ae<br>ap                   | Ø4<br>f= mm/U | Ø5<br>f= mm/U                                                                               | Ø6<br>f= mm/U | Ø8<br>f= mm/U | Ø10<br>f= mm/U | Ø12<br>f= mm/U | Ø16<br>f= mm/U | Ø20<br>f= mm/U |
| 8.3                               | PEEK<br><> CF 30<br><br>PTFE<br><> CF25   | 130                                                       | ap= 0,1 x d<br>ae= 0,5 x d | 0,06-0,08     | 0,08-0,09                                                                                   | 0,11-0,13     | 0,15-0,17     | 0,18-0,22      | 0,22-0,26      | 0,26-0,28      | 0,28-0,32      |
|                                   | PEEK<br><> GF 30<br><br>PA 66<br><> GF 30 | 100                                                       | ap= 0,1 d<br>ae= 0,5 x d   | 0,06-0,08     | 0,08-0,09                                                                                   | 0,11-0,13     | 0,15-0,17     | 0,18-0,22      | 0,22-0,26      | 0,26-0,28      | 0,28-0,32      |
|                                   | POM<br><> GF 25<br><br>PVDF<br><> GF 20   | 120                                                       | ap= 0,1 x d<br>ae= 0,5 x d | 0,10-0,12     | 0,12-0,14                                                                                   | 0,16-0,18     | 0,22-0,24     | 0,28-0,32      | 0,38-0,40      | 0,42-0,46      | 0,48-0,55      |
|                                   | CFK                                       | 130                                                       | ap= 0,1 x d<br>ae= 0,5 x d | 0,08          | 0,09                                                                                        | 0,10          | 0,13          | 0,15           | 0,20           | 0,25           | 0,28           |
|                                   |                                           |                                                           |                            |               |                                                                                             |               |               |                |                |                |                |

| Art. | 29.6521 | 29.6522 | 29.6523 | 29.6524 | 29.6525 | 29.6526 | Empfohlene Schnittdaten für CVD-Fräser<br>Recommended cutting data for CVD mills |  |  |  |  |
|------|---------|---------|---------|---------|---------|---------|----------------------------------------------------------------------------------|--|--|--|--|
|      | 29.6553 | 29.6562 | 29.6572 | 29.6573 | 29.6574 | 29.6510 |                                                                                  |  |  |  |  |

| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                     | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min. | ae: minimum<br>ap: minimum              | Ø4<br>fz | Ø5<br>fz | Ø6<br>fz | Ø8<br>fz | Ø10<br>fz | Ø12<br>fz | Ø16<br>fz | Ø20<br>fz |
|-----------------------------------|-------------------------------------------|-----------------------------------------------------------|-----------------------------------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| 8.3                               | PEEK<br><> CF 30<br><br>PTFE<br><> CF25   | 900                                                       | ap= 0,5 x d.mi<br>ae= 0,2 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04     | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | PEEK<br><> GF 30<br><br>PA 66<br><> GF 30 | 1100                                                      | ap= 0,5 x d.mi<br>ae= 0,2 x d.mi        | 0,01     | 0,015    | 0,025    | 0,03     | 0,05      | 0,07      | 0,08      | 0,10      |
|                                   | POM<br><> GF 25<br><br>PVDF<br><> GF 20   | 1200                                                      | ap= 0,5 x d.mi<br>ae= 0,5 x 0,2<br>d.mi | 0,015    | 0,018    | 0,03     | 0,04     | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | CFK                                       | 600                                                       | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,016    | 0,020    | 0,03     | 0,05     | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   |                                           |                                                           |                                         |          |          |          |          |           |           |           |           |
| 8.1                               | Acryl                                     | 1100                                                      | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04     | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | PA 66<br>PE-HD                            | 1000                                                      | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04     | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | PEEK                                      | 900                                                       | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04     | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | ALSI 18<br>CnNiMg                         | 600                                                       | ap= 0,5 x d.mi<br>ae= 0,2 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04     | 0,06      | 0,08      | 0,10      | 0,15      |

Empfohlene Schnittdaten für Einzahnfräser  
Recommended cutting data for one-tooth end mills

Art. 29.1652 29.1654 29.1658 29.1661

| Werkstoffgruppe<br>Material group | WERKSTOFF<br>WORKPIECE MATERIAL | UNBESCHICHTET<br>UNCOATED - Vc |  | Fräserdurchmesser / Dimension (mm)<br>VORSCHUB fz (mm/Zahn) |       |        |        |
|-----------------------------------|---------------------------------|--------------------------------|--|-------------------------------------------------------------|-------|--------|--------|
|                                   |                                 |                                |  | Ø < 2                                                       | Ø < 5 | Ø < 10 | Ø < 20 |
| 11.1                              | Polyamid                        | 350 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyolefine                     | 350 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyacetale                     | 300                            |  | 0,15                                                        | 0,3   | 0,4    | 0,5    |
|                                   | Polyester                       | 300                            |  | 0,15                                                        | 0,3   | 0,4    | 0,5    |
|                                   | Polycarbonat                    | 300                            |  | 0,15                                                        | 0,3   | 0,4    | 0,5    |
|                                   | Polyphenylenether               | 300                            |  | 0,15                                                        | 0,3   | 0,4    | 0,5    |
|                                   | Aromat. Polyamid                | 300                            |  | 0,15                                                        | 0,3   | 0,4    | 0,5    |
|                                   | ABS                             | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Fluorpolymere                   | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polysulfon                      | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyphenylsulfon                | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyethersulfon                 | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyetherimid                   | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyphenylsulfid                | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyetherkethon                 | 400 - 500                      |  | 0,1                                                         | 0,2   | 0,35   | 0,45   |
|                                   | Polyimid                        | 80 - 100                       |  | 0,05                                                        | 0,1   | 0,2    | 0,35   |

Testergebnisse: CVD-Fräser mit sehr guten Ergebnissen. Wir lösen Ihre Probleme bei Composites!  
Test result: Very good test results with our CVD-end mills. We solve your Composites machining problems !

CVD-Fräser Art. 29.6526

Ø 8,0 x SL = 20

Material/Werkstoff = Dispal 20 / 20% Silizium  
U/min. = 14.000  
Vf = 2.000  
ae = 0,5 mm  
ap = 10 mm

CVD-Fräser Art. 29.6522

Ø 6 r 3,0

Material/Werkstoff = FS2 ALU Hochfest  
U/min. = 14.000  
Vf = 3.000  
ae = 2,0 mm  
ap = 2,0 mm

CVD-Fräser Art. 29.6526

Ø 8,0 x SL = 20

Material/Werkstoff = CFK mit Kevlar  
U/min. = 14.000  
Vf = 1.200  
ae = 3,00 mm

CVD-Fräser Art. 29.6526

Ø 8,0 x SL = 20

Material/Werkstoff = PA6 mit 30% Glasanteil  
U/min. = 14.000  
Vf = 2.500  
ae = 4,0 mm  
ap = 4,0 mm

CVD-Fräser Art. 29.6526

Ø 8,0 x SL = 20

Material/Werkstoff = CFK  
U/min. = 14.000  
Vf = 3.000  
ae = 5,0 mm  
ap = 4,0 mm

CVD-Fräser Art. 29.6526

Ø 8,0 x SL = 20

Material/Werkstoff = Al Si 05  
U/min. = 14.000  
Vf = 2.500  
ae = 4,0 mm  
ap = 4,0 mm



SPIEGELBEARBEITUNG  
MIRROR FINISH TOOLS

→ ND – MCD Tools

Karnasch™  
PROFESSIONAL TOOLS



|      |         |         |         |
|------|---------|---------|---------|
| Art. | 29.6811 | 29.6837 | 29.6838 |
|      | 29.6839 | 29.6840 | 29.6843 |

Empfohlene Schnittdaten zu MKD/ND Schaftfräser - Fasenfräser für Spiegelschliff  
Recommended cutting data for MCD/ND milling/beveling mill

Bearbeitungshinweise:

- 1. Vorausgesetzt, es werden stabile Maschinenverhältnisse und einwandfreie Werkzeugaufnahmen verwendet (Schrumpffutter)
- 2. Um optimale Schnittbedingungen zu erreichen sind die Einsatzbedingungen vor Ort zu berücksichtigen.

Processing instruction:

- 1. Assumed there are rugged machine conditions and faultless die holder in use.
- 2. To reach optimal cut conditions, the insert terms on location are to consider.

| Werkstoffgruppe<br>Material group |                                | MKD - MCD<br>ND - ND<br>Vc (m/min.) | fz (mm) | Schruppen<br>Roughing<br>ap / ae | Schlichten Spiegelschliff<br>fz (mm) Finishing ap/ae |           |
|-----------------------------------|--------------------------------|-------------------------------------|---------|----------------------------------|------------------------------------------------------|-----------|
| 11.1<br>11.2                      | PMMA-Acryl                     | 800-1400                            | 0,2-0,4 | 1,0-2,0                          | 0,05-0,25                                            | 0,04-0,06 |
| 15.0<br>16.0                      | Gold-Silber                    | 400-700                             | 0,2-0,4 | 0,8-0,15                         | 0,05-0,20                                            | 0,04-0,06 |
| 9.1<br>9.2                        | Al 99 - Al Mg 5<br>Al Mg Si Pb | 600-1000                            | 0,1-0,2 | 0,8-0,15                         | 0,08-0,15                                            | 0,03-0,06 |
| 9.3<br>9.4                        | G Al Mg 5<br>G Al Si 7 Mg      | 800-1600                            | 0,1-0,2 | 0,05-0,10                        | 0,08-0,20                                            | 0,03-0,06 |
| 10.1<br>10.2                      | Cu Zn 36 Pb 1,5<br>Cu Zn 20    | 600-800                             | 0,1-0,3 | 0,08-0,18                        | 0,08-0,25                                            | 0,04-0,08 |

Art. 29.0080

Empfohlene Schnittdaten zu Vollhartmetallbohrer GFK/CFK  
Recommended cutting data for solid carbide twist drills Fiberglass/Carbon

| Werkstoffgruppe | Werkstoff      | E-Modul N/mm <sup>2</sup> · DIN 53457 | n/Vf                  | Ø 1,0 - 3,0 | Ø 3,2 - 7,0 | Ø 8,0 - 11,0 | Ø 12,0 - 14,0 |
|-----------------|----------------|---------------------------------------|-----------------------|-------------|-------------|--------------|---------------|
| 11.1            | PVC - Hart     | 800 - 3.200                           | n (min <sup>1</sup> ) | 18.000      | 10.000      | 6.000        | 5.000         |
| Thermoplaste    | PVC- Weich     |                                       | Vf (mm/min)           | 2.200       | 2.000       | 1.900        | 1.600         |
| 11.2            | PUR 5220       | < 10.000                              | n (min <sup>1</sup> ) | 18.000      | 10.000      | 6.000        | 5.000         |
| Duroplaste      | PF 31 / MP 183 |                                       | Vf (mm/min)           | 2.200       | 2.000       | 1.900        | 1.600         |
| 11.3            | GFK            | < 10.000                              | n (min <sup>1</sup> ) | 20.000      | 10.000      | 6.000        | 5.000         |
|                 | PA66 - GF30    |                                       | Vf (mm/min)           | 4.000       | 2.400       | 1.800        | 1.500         |
|                 | CFK            | < 10.000                              | n (min <sup>1</sup> ) | 20.000      | 10.000      | 6.000        | 5.000         |
|                 | PEEK - CF30    |                                       | Vf (mm/min)           | 1.600       | 1.000       | 720          | 800           |



Werkstoffe / DIN – AFNOR – AlSi – BS – SS – CMC Code  
Material / DIN – AFNOR – AlSi – BS – SS – CMC Code

8.1 Kunststoffe / Thermoplaste

| Werkstoff / Material | DIN                   | Handelsbez.      | AFNOR                   | AlSi | BS                  | SS | CMC-Code |
|----------------------|-----------------------|------------------|-------------------------|------|---------------------|----|----------|
| -                    | ABS                   | ABS              | -                       | -    | -                   | -  | 40.1     |
| -                    | Epoxide               | Araldit          | Epoxy                   | -    | -                   | -  | -        |
| -                    | Polyvinylchlorid      | Polyvenylchlorid | Chlornrede Polyvinyle   | -    | -                   | -  | -        |
| -                    | EP                    | Epoxid           | -                       | -    | -                   | -  | -        |
| -                    | Polyterafluoräthylen  | Hastaflon TF     | Polytetrafluore Thylene | -    | Tetrafluore-Thylene | -  | -        |
| -                    | Polypropylen          | Hostalen PP      | Polypropylene           | -    | -                   | -  | -        |
| -                    | Polyimid              | Kapton           | -                       | -    | -                   | -  | -        |
| -                    | Polyäthylen           | Lupolen          | Polyethynele            | -    | -                   | -  | -        |
| -                    | Polycarbonat          | Makrolon         | Polycarbonate           | -    | -                   | -  | -        |
| -                    | PA                    | Polyamid         | -                       | -    | -                   | -  | -        |
| -                    | PC                    | Polycarbonat     | -                       | -    | -                   | -  | -        |
| -                    | PE                    | PE               | -                       | -    | -                   | -  | -        |
| -                    | PI                    | PI               | -                       | -    | -                   | -  | -        |
| -                    | PMMA                  | Plexiglas        | Plexiglas               | -    | -                   | -  | -        |
| -                    | Polystrol             | Polysterol       | Polystyrene             | -    | Styrene             | -  | -        |
| -                    | PUR-Elastomer         | Polymethan       | -                       | -    | -                   | -  | -        |
| -                    | Polyurethan-Elastomer | Vulkollan        | Polyurethane            | -    | -                   | -  | -        |
| -                    | PS                    | -                | -                       | -    | -                   | -  | -        |
| -                    | PTFE                  | Teflon           | -                       | -    | TFE                 | -  | -        |
| -                    | PVC                   | PVC              | PVC                     | -    | -                   | -  | -        |
| -                    | Styrol-Polymerisate   | Trolitul         | -                       | -    | -                   | -  | -        |
| -                    | Polyamid              | Ultramid         | Polyamide               | -    | -                   | -  | -        |

8.2 Kunststoffe / Duroplaste-Preßstoffe

| Werkstoff / Material | DIN                  | Handelsbez. | AFNOR             | AlSi     | BS       | SS | CMC-Code    |
|----------------------|----------------------|-------------|-------------------|----------|----------|----|-------------|
| Werkstoff            | DIN                  | Handelsbez. | AFNOR             | Alsi     | BS       | SS | CMC-Code    |
| -                    | Harnstoffformaldehyd | Bakelite    | -                 | -        | -        | -  | 40.2 - 40.3 |
| -                    | Polysulfon           | Bakelite P  | -                 | -        | -        | -  | -           |
| -                    | Resopal              | Resopal     | Resopal-Formica   | -        | Formica  | -  | -           |
| -                    | Melaminformaldehyd   | -           | Melamine-Bakelite | -        | Melamine | -  | -           |
| -                    | MF                   | -           | -                 | -        | -        | -  | -           |
| -                    | Pertinax             | Pertinax    | -                 | -        | -        | -  | -           |
| -                    | Phenolformaldehyd    | -           | -                 | -        | Phenolic | -  | -           |
| -                    | Resitex              | Resitex     | -                 | -        | -        | -  | -           |
| -                    | -                    | Toufnell    | Toufnell          | Toufnell | Toufnell | -  | -           |

8.3 Kunststoffe Faserverstärkt

| Werkstoff / Material | DIN | Handelsbez. | AFNOR            | AlSi | BS          | SS | CMC-Code |
|----------------------|-----|-------------|------------------|------|-------------|----|----------|
| -                    | AFK | AFK         | -                | -    | -           | -  | 40.4     |
| -                    | CFK | CFK         | fibre de Carbone | -    | Carbonfibre | -  | -        |
| -                    | GFK | GFK         | fibre de Verre   | -    | Fibreglass  | -  | -        |

| Art.                              | 30.6522                               | 30.6523                                                   | 30.6524                                 | 30.6526  | 30.6528  | 30.6534  | Empfohlene Schnittdaten für PCD-Fräser<br>Recommended cutting data for PCD mills |           |           |           |           |
|-----------------------------------|---------------------------------------|-----------------------------------------------------------|-----------------------------------------|----------|----------|----------|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|
| Werkstoffgruppe<br>Material group | Werkstoff<br>Material                 | Schnittge-<br>schwindigkeit<br>Cutting speed<br>Vc m/min. | ae: minimum<br>ap: minimum              | Ø4<br>fz | Ø5<br>fz | Ø6<br>fz | Ø8<br>fz                                                                         | Ø10<br>fz | Ø12<br>fz | Ø16<br>fz | Ø20<br>fz |
| 8.3                               | PEEK<br><> CF 30<br>PTFE<br><> CF25   | 900                                                       | ap= 0,5 x d.mi<br>ae= 0,2 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | PEEK<br><> GF 30<br>PA 66<br><> GF 30 | 1100                                                      | ap= 0,5 x d.mi<br>ae= 0,2 x d.mi        | 0,01     | 0,015    | 0,025    | 0,03                                                                             | 0,05      | 0,07      | 0,08      | 0,10      |
|                                   | POM<br><> GF 25<br>PVDF<br><> GF 20   | 1200                                                      | ap= 0,5 x d.mi<br>ae= 0,5 x 0,2<br>d.mi | 0,015    | 0,018    | 0,03     | 0,04                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | CFK                                   | 600                                                       | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,016    | 0,020    | 0,03     | 0,05                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |
| 8.1                               | Acryl                                 | 1100                                                      | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | PA 66<br>PE-HD                        | 1000                                                      | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | PEEK                                  | 900                                                       | ap= 0,5 x d.mi<br>ae= 0,3 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |
|                                   | ALSI 18<br>CnNiMg                     | 600                                                       | ap= 0,5 x d.mi<br>ae= 0,2 x d.mi        | 0,015    | 0,018    | 0,03     | 0,04                                                                             | 0,06      | 0,08      | 0,10      | 0,15      |

| Art.                              | 29.0412                   | 29.0416               | 29.0417              |                      |                      |                      |
|-----------------------------------|---------------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|
| Werkstoffgruppe<br>Material group | Werkstoff                 |                       | 6 Ø                  | 8 Ø                  | 10 Ø                 | 12 Ø                 |
| 8.3<br>CFK                        | PVDF - POM<br>PA66 - PEEK | ae + ap<br>fz<br>vc = | 1 x D<br>0,06<br>190 | 1 x D<br>0,07<br>190 | 1 x D<br>0,08<br>190 | 1 x D<br>0,10<br>190 |
| CFK                               | CF 30<br>PTFE - PEEK      | ae + ap<br>fz<br>vc = | 1 x D<br>0,06<br>180 | 1 x D<br>0,07<br>180 | 1 x D<br>0,08<br>180 | 1 x D<br>0,10<br>180 |
| GFK                               | GF 30 - PA<br>Homeycomb   | ae + ap<br>fz<br>vc = | 2 x D<br>0,06<br>380 | 2 x D<br>0,07<br>380 | 2 x D<br>0,08<br>380 | 2 x D<br>0,10<br>380 |

|                                   |                           |                       | Art.                        | 29.1751              | 29.1752              | 29.1753              | 29.1761              | 29.1762              | 29.1763              |
|-----------------------------------|---------------------------|-----------------------|-----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Werkstoffgruppe<br>Material group | Werkstoff                 |                       | 3-5 Ø                       | 6 Ø                  | 8 Ø                  | 10 Ø                 | 12 Ø                 | 16 Ø                 | 20 Ø                 |
| 8.3<br>CFK                        | PVDF - POM<br>PA66 - PEEK | ae + ap<br>fz<br>vc = | 1 x D<br>0,03 - 0,04<br>190 | 1 x D<br>0,05<br>190 | 1 x D<br>0,06<br>190 | 1 x D<br>0,07<br>190 | 1 x D<br>0,08<br>190 | 1 x D<br>0,08<br>190 | 1 x D<br>0,08<br>190 |
| CFK                               | CF 30<br>PTFE - PEEK      | ae + ap<br>fz<br>vc = | 1 x D<br>0,03 - 0,04<br>180 | 1 x D<br>0,05<br>180 | 1 x D<br>0,06<br>180 | 1 x D<br>0,07<br>180 | 1 x D<br>0,08<br>180 | 1 x D<br>0,08<br>180 | 1 x D<br>0,08<br>180 |
| GFK                               | GF 30 - PA<br>Homeycomb   | ae + ap<br>fz<br>vc = | 2 x D<br>0,03 - 0,04<br>380 | 2 x D<br>0,05<br>380 | 2 x D<br>0,06<br>380 | 2 x D<br>0,07<br>380 | 2 x D<br>0,08<br>380 | 2 x D<br>0,08<br>380 | 2 x D<br>0,08<br>380 |

| Schnittdaten Empfehlung / Recommended Cutting Parameters |                                          |                                              |                               |                                              |                              |                                              | Art.                         | 29.6600 |
|----------------------------------------------------------|------------------------------------------|----------------------------------------------|-------------------------------|----------------------------------------------|------------------------------|----------------------------------------------|------------------------------|---------|
| Werkstoffgruppe<br>Material group                        | MATERIAL                                 | Maximum<br>Schnittgeschw.<br>/ Cutting Speed | Maximum<br>Vorschub /<br>Feed | Maximum<br>Schnittgeschw.<br>/ Cutting Speed | Maximum<br>Vorschub/<br>Feed | Maximum<br>Schnittgeschw.<br>/ Cutting Speed | Maximum<br>Vorschub/<br>Feed |         |
|                                                          |                                          | Vc<br>(m/min)                                | fz<br>(mm/Zahn/teeth)         | Vc<br>(m/min)                                | fz<br>(mm/Zahn/teeth)        | Vc<br>(m/min)                                | fz<br>(mm/Zahn/teeth)        |         |
|                                                          |                                          | ap / doc bis / up to 0,5 mm                  |                               | ap / doc bis / up to 2,0 mm                  |                              | ap / doc bis / up to 5,0 mm                  |                              |         |
| 9.1                                                      | Aluminium Legierungen / Alloys Si < 1 %  | 4000                                         | 0,30                          | 3800                                         | 0,25                         | 3500                                         | 0,20                         |         |
| 9.5                                                      | Aluminium Legierungen / Alloys Si < 12 % | 3000                                         | 0,25                          | 2800                                         | 0,20                         | 2500                                         | 0,18                         |         |
| 9.7                                                      | Aluminium Legierungen / Alloys Si < 12 % | 2000                                         | 0,20                          | 1800                                         | 0,18                         | 1500                                         | 0,15                         |         |
| 10.1-<br>10.8                                            | Magnesium / Magnesium Alloys             | 4000                                         | 0,30                          | 3800                                         | 0,25                         | 3500                                         | 0,20                         |         |
|                                                          | Kupfer Legierungen / Copper Alloys       | 2500                                         | 0,15                          | 2000                                         | 0,12                         | 1500                                         | 0,10                         |         |
| 12.2                                                     | Messing Legierungen / Brass Alloys       | 1500                                         | 0,20                          | 1200                                         | 0,15                         | 1000                                         | 0,12                         |         |
| 14                                                       | Graphit / Graphite                       | 2500                                         | 0,20                          | 2500                                         | 0,18                         | 2500                                         | 0,16                         |         |
| 8.3                                                      | GFK / Glass fibre reinforced             | 2000                                         | 0,30                          | 2000                                         | 0,25                         | 2000                                         | 0,20                         |         |
|                                                          | CFK / Carbon fibre reinforced            | 2000                                         | 0,30                          | 2000                                         | 0,25                         | 2000                                         | 0,20                         |         |

Titanlegierungen  
Titanium alloys

| Werkstoffgruppe<br>Material group<br><br>Legierung<br>Alloy | Legierungsbestandteile (in%) |                    |     |     |      |      |     |      |         |
|-------------------------------------------------------------|------------------------------|--------------------|-----|-----|------|------|-----|------|---------|
|                                                             | Bezeichnung / Name           | DIN                | Al  | Sn  | Mo   | V    | Zr  | Si   | Andere  |
| Alpha-Ti-Legierungen                                        | Ti-5Al-2.55N                 | TiAl55n2           | 5,0 | 2,5 |      |      |     |      |         |
|                                                             | Ti-7Al-4Mo                   | TiAl7Mo4           | 7,0 |     | 4,0  |      |     |      |         |
|                                                             | Ti-8Al-1Mo-1V                | TiAl8Mo1V1         | 8,0 |     | 1,0  | 1,0  |     |      |         |
|                                                             | Ti-6Al-4Zr-2Mo-2Sn           | TiAl6Zr4Mo2Sn2     | 6,0 | 2,0 | 2,0  |      | 4,0 |      |         |
| Alpha-Beta-Ti-Legierungen                                   | Ti-6Al-4V                    | TiAl6V4            | 6,0 |     |      | 4,0  |     |      |         |
|                                                             | Ti-6Al-6V-2Sn                | TiAl6V6Sn2         | 5,5 | 2,0 |      | 5,5  |     |      |         |
|                                                             | Ti-6Al-6V-2Sn                | TiAl4Mo4Sn2Si0.5   | 4,0 | 2,0 | 4,0  |      |     | 0,55 |         |
|                                                             | Ti-4Al-4Mo-4Sn-0.5Si         | TiAl4Mo4Sn4Si0.5   | 4,0 | 4,0 | 4,0  |      |     | 0,5  |         |
|                                                             | Ti-7Al-4Mo                   | TiAl7Mo4           | 7,0 |     | 4,0  |      |     |      | Fe 0,3  |
|                                                             | Ti-6Al-5Zr-0.5Mo-0.25Si      | TiA6Zr5Mo0.5Si0.25 | 6,0 |     | 0,5  |      | 5,0 | 0,25 |         |
|                                                             | Ti-6Al-5Zr-4Mo-Cu-0.2Si      | TiAl6Zr5Mo4CuSi0.2 | 6,0 |     | 4,0  |      | 5,0 | 0,2  | Cu 1,0  |
|                                                             | Allvac 3-2.5                 |                    | 3,0 |     |      | 2,5  |     |      | Fe 0,13 |
|                                                             | Allvac 6-4Eli                |                    | 6,0 |     |      |      |     |      | Fe 0,2  |
|                                                             | Allvac 6-2-4-6               |                    | 6,0 | 2,0 | 6,0  |      | 4,0 |      | Fe 0,10 |
| Beta-Ti-Legierung                                           | Allvac Ti-17                 |                    | 5,0 | 2,0 | 4,0  |      | 2,0 |      | Cr 4,0  |
|                                                             | Ti-13V-11Cr-3Al              | TiV13Cr11Al3       | 3,0 |     |      | 13,0 |     |      | Cr 11,0 |
|                                                             | Ti-8Mo-8V-2Fe-3Al            |                    | 3,0 |     | 8,0  | 8,0  |     |      |         |
|                                                             | Ti-3Al-8V-6Cr-4Mo-4Zr        |                    | 3,0 |     | 4,0  | 8,0  | 4,0 |      | Cr 6,0  |
| Rein-Titan                                                  | Ti-11.5Mo-6Zr-4.5Sn          |                    |     | 4,5 | 11,5 |      | 6,0 |      |         |
|                                                             | Ti 99.5                      | Ti 99.5            |     |     |      |      |     |      |         |
|                                                             | Ti 99.6                      | Ti 99.6            |     |     |      |      |     |      |         |
|                                                             | Ti 99.7                      | Ti 99.7            |     |     |      |      |     |      |         |
|                                                             | Ti 99.8                      | Ti 99.8            |     |     |      |      |     |      |         |

Art. 23.1764

Empfohlene Richtwerte für VHM-Gewindewirbler, LogTop Stahl  
Recommended cutting data for solid carbide whirling thread cutter, LogTop steel

| Gewindegröße<br>Thread Size | Gewindeschneidgröße<br>Thread cutting side | 1.1-1.2-1.3-1.4-1.5<br>unlegierter Stahl<br>Carbon Steels<br><800 N/mm² |                | 4.1-4.2-4.3<br>Rostfreier Stahl<br>Stainless Steels |                | Titanlegierung<br>Titanium Alloy<br>TiAl 6V4 |                | 8.1<br>gehärteter Stahl<br>Hardened Steels<br>45-55 HRC |                | gehärteter Stahl<br>Hardened Steels<br>55-70 HRC |                |
|-----------------------------|--------------------------------------------|-------------------------------------------------------------------------|----------------|-----------------------------------------------------|----------------|----------------------------------------------|----------------|---------------------------------------------------------|----------------|--------------------------------------------------|----------------|
|                             |                                            | n<br>min <sup>-1</sup>                                                  | fz<br>mm/tooth | n<br>min <sup>-1</sup>                              | fz<br>mm/tooth | n<br>min <sup>-1</sup>                       | fz<br>mm/tooth | n<br>min <sup>-1</sup>                                  | fz<br>mm/tooth | n<br>min <sup>-1</sup>                           | fz<br>mm/tooth |
| M 1                         | M 1 M 1,1                                  | 30.000-40.000                                                           | 0,004          | 30.000-40.000                                       | 0,004          | 16.000-20.000                                | 0,002          | 20.000-25.000                                           | 0,004          | 20.000-24.000                                    | 0,003          |
| M 1,2                       | M 1,2                                      | 25.000-30.000                                                           | 0,005          | 25.000-30.000                                       | 0,005          | 10.000-18.000                                | 0,003          | 20.000-23.000                                           | 0,004          | 18.000-21.000                                    | 0,003          |
| M 1,4                       | M 1,4                                      | 20.000-28.000                                                           | 0,006          | 20.000-28.000                                       | 0,006          | 10.000-14.000                                | 0,004          | 15.000-18.000                                           | 0,005          | 13.000-17.000                                    | 0,004          |
| M 1,6                       | M 1,6                                      | 18.000-24.000                                                           | 0,007          | 18.000-24.000                                       | 0,007          | 5.000-15.000                                 | 0,006          | 13.000-15.000                                           | 0,005          | 12.000-14.000                                    | 0,004          |
| M 1,7                       | M 1,7 M 1,8                                | 15.000-25.000                                                           | 0,007          | 15.000-25.000                                       | 0,007          | 5.000-15.000                                 | 0,006          | 12.000-14.000                                           | 0,006          | 11.000-13.000                                    | 0,005          |
| M 2,0                       | M 2 M 2,3                                  | 10.000-14.000                                                           | 0,008          | 10.000-14.000                                       | 0,008          | 5.000-15.000                                 | 0,008          | 8.000-10.000                                            | 0,006          | 8.000-10.000                                     | 0,005          |
| M 2,5                       | M 2,5 M2,6                                 | 10.000-14.000                                                           | 0,008          | 10.000-14.000                                       | 0,008          | 5.000-15.000                                 | 0,008          | 8.000-10.000                                            | 0,007          | 8.000-10.000                                     | 0,006          |
| M 3,0                       | M3                                         | 6.000-10.000                                                            | 0,012          | 5.000-10.000                                        | 0,012          | 6.000-10.000                                 | 0,010          | 6.000-8.000                                             | 0,010          | 5.000-8.000                                      | 0,008          |

Art. 23.1760

Empfohlene Richtwerte für VHM-Gewindewirbler, LogTop poliert  
Recommended cutting data for solid carbide whirling thread cutters, LogTop polished

| Gewindegröße<br>Thread Size | Gewindeschneidgröße<br>Thread cutting side | Kunststoff<br>Plastic  |                | Aluminium-Kupfer-Messing<br>Aluminium-Copper-Brass |                | 14<br>CFK / GFK-Graphit<br>CRFP / GFRP-Graphite |                |
|-----------------------------|--------------------------------------------|------------------------|----------------|----------------------------------------------------|----------------|-------------------------------------------------|----------------|
|                             |                                            | n<br>min <sup>-1</sup> | fz<br>mm/tooth | n<br>min <sup>-1</sup>                             | fz<br>mm/tooth | n<br>min <sup>-1</sup>                          | fz<br>mm/tooth |
| M 1                         | M 1 M 1,1                                  | 30.000-40.000          | 0,005          | 40.000-50.000                                      | 0,006          | 30.000-40.000                                   | 0,005          |
| M 1,2                       | M 1,2                                      | 28.000-35.000          | 0,006          | 30.000-40.000                                      | 0,007          | 26.000-32.000                                   | 0,006          |
| M 1,4                       | M 1,4                                      | 25.000-30.000          | 0,008          | 25.000-35.000                                      | 0,008          | 25.000-30.000                                   | 0,008          |
| M 1,6                       | M 1,6                                      | 20.000-25.000          | 0,009          | 22.000-30.000                                      | 0,010          | 20.000-25.000                                   | 0,009          |
| M 1,7                       | M 1,7 M 1,8                                | 18.000-28.000          | 0,009          | 20.000-28.000                                      | 0,010          | 18.000-23.000                                   | 0,009          |
| M 2,0                       | M 2 M 2,3                                  | 12.000-16.000          | 0,010          | 15.000-25.000                                      | 0,010          | 15.000-20.000                                   | 0,011          |
| M 2,5                       | M 2,5 M2,6                                 | 12.000-16.000          | 0,012          | 12.000-20.000                                      | 0,012          | 12.000-16.000                                   | 0,012          |
| M 3,0                       | M3                                         | 8.000-13.000           | 0,016          | 8.000-15.000                                       | 0,020          | 10.000-15.000                                   | 0,015          |

Art. 23.1768

Empfohlene Richtwerte für VHM-Gewindewirbler, LogTop Dia  
Recommended cutting data for solid carbide whirling thread cutters, LogTop Dia

| Gewindegröße<br>Thread Size | Gewindeschneidgröße<br>Thread cutting side | 14<br>CFK / GFK-Graphit<br>CRFP / GFRP-Graphite |                |
|-----------------------------|--------------------------------------------|-------------------------------------------------|----------------|
|                             |                                            | n<br>min <sup>-1</sup>                          | fz<br>mm/tooth |
| M 1                         | M 1 M 1,1                                  | 30.000-40.000                                   | 0,005          |
| M 1,2                       | M 1,2                                      | 26.000-32.000                                   | 0,006          |
| M 1,4                       | M 1,4                                      | 25.000-30.000                                   | 0,008          |
| M 1,6                       | M 1,6                                      | 20.000-25.000                                   | 0,009          |
| M 1,7                       | M 1,7 M 1,8                                | 18.000-23.000                                   | 0,009          |
| M 2,0                       | M 2 M 2,3                                  | 15.000-20.000                                   | 0,011          |
| M 2,5                       | M 2,5 M2,6                                 | 12.000-16.000                                   | 0,012          |
| M 3,0                       | M3                                         | 10.000-15.000                                   | 0,015          |



Co-Basislegierungen  
Co- based alloys

| Werkstoffgruppe<br>Material group<br><br>Handelsbezeichnung /<br>Trade name | Legierungsbestandteile in % / Alloy component in % |                  |      |      |      |     |     |      |      |      |      |      |    |   |                 |
|-----------------------------------------------------------------------------|----------------------------------------------------|------------------|------|------|------|-----|-----|------|------|------|------|------|----|---|-----------------|
|                                                                             | Werkstoff<br>Material                              | DIN              | Fe   | Ni   | Co   | Cr  | Mo  | W    | Si   | Mn   | C    | Al   | Ti | P | S               |
| MP35N                                                                       |                                                    |                  | 35   |      | 20   | 9,8 |     |      |      | 0,01 |      |      |    |   |                 |
| L 605                                                                       |                                                    | CoCr20W15Ni      | 10   | 0,5  | 20   |     | 15  |      | 1,7  | 0,1  |      |      |    |   |                 |
| Nickelvac TJA-1537                                                          |                                                    |                  | 0,2  | 0,25 | 28   | 6   |     | 0,5  | 0,5  | 0,06 |      |      |    |   | N 0,2           |
| Altemp S 816                                                                |                                                    | CoCr20Ni20W      | 20   | 4    | 20   | 4   | 4   | 0,4  | 1,2  |      |      | 0,38 |    |   |                 |
| HS 21                                                                       |                                                    | CoCr28Mo         | 3    | 1    | 27   | 5   |     | 0,6  | 0,6  |      |      | 0,25 |    |   |                 |
| HS 25                                                                       |                                                    | CoCr20W15Ni      | 10   | 3    | 20   |     | 15  | 2    | 1,5  |      |      | 0,1  |    |   |                 |
| HS 30                                                                       |                                                    | CoCr26Ni14Mo     | 16   | 1    | 24   | 6   |     | 0,6  | 0,6  |      |      | 0,4  |    |   |                 |
| HS 31                                                                       | 2.4670                                             | CoCr25NiW        | 10   | 1,5  | 25   |     | 8   | 0,75 | 0,6  |      |      | 0,4  |    |   |                 |
| HS 36                                                                       |                                                    | CoCr19W14NiB     | 10   | 2    | 18   |     | 15  |      | 1,5  |      |      | 0,4  |    |   |                 |
| Jetalloy 209                                                                |                                                    |                  | 10   | 1    | 20   |     | 15  |      |      |      | 2,0  | 0,02 |    |   |                 |
| L 251                                                                       |                                                    |                  | 10   | 1    | 19   |     | 14  |      |      |      |      | 0,4  |    |   |                 |
| M 203                                                                       |                                                    |                  | 24,5 | 1    | 19,5 |     | 12  | 1,0  | 0,8  | 2,15 | 24,5 | 0,07 |    |   |                 |
| M 204                                                                       |                                                    |                  | 24,5 |      | 18,5 |     | 12  | 1,0  | 1,0  |      |      | 0,07 |    |   |                 |
| M 205                                                                       |                                                    |                  | 24,5 |      | 18,5 |     | 12  |      |      | 2,8  |      | 0,07 |    |   |                 |
| MAR-M 302                                                                   |                                                    | CoCrW10TaZrB     |      |      | 21,5 |     | 10  |      |      |      |      | 0,85 |    |   | Ta 9,0          |
| MAR-M 322                                                                   |                                                    | CoCr22W9TaZrNb   |      |      | 21,5 |     | 9   | 0,1  | 0,1  |      | 0,75 | 1,0  |    |   | Ta 4,5, Zr 2,25 |
| MAR-M 509                                                                   |                                                    | CoCr24Ni10WtaZrB | 10   | 1    | 23,5 |     | 7   | 0,1  | 0,1  |      | 0,2  | 0,6  |    |   | Ta 3,5, Zr 0,5  |
| MAR-M 905                                                                   |                                                    |                  | 20   |      | 20,0 |     |     |      |      |      | 0,5  | 0,05 |    |   | Ta 7,5, Zr 0,1  |
| MAR-M 918                                                                   |                                                    | CoCr20Ni20Ta     | 20   | 0,4  | 20,0 |     |     | 0,1  | 0,1  |      |      | 0,05 |    |   | Ta 7,5, Zr 0,1  |
| Stellite 1                                                                  |                                                    |                  |      |      | 33,0 |     | 13  |      |      | 2,5  |      |      |    |   |                 |
| Stellite 6                                                                  |                                                    |                  |      |      | 26,0 |     | 5   |      |      | 1,0  |      |      |    |   | Nb 6,0          |
| Stellite 12                                                                 |                                                    |                  |      |      | 29   |     | 9   |      |      | 1,8  |      |      |    |   |                 |
| V-36                                                                        |                                                    | CoCr25Ni20MoWNB  | 20   | 3    | 25   | 4   | 2   | 0,4  | 1,0  |      |      | 0,3  |    |   | Nb 2,0          |
| WI-52                                                                       |                                                    | CoCr21Mo11W      | 1    | 2    | 21   |     | 11  | 0,25 |      |      |      | 0,45 |    |   | Nb 2,0          |
| X 40                                                                        |                                                    | CoCr25NiW        | 10,5 | 1,5  | 25,5 |     | 7,5 | 0,75 | 0,75 |      |      | 0,5  |    |   |                 |
| X 45                                                                        |                                                    |                  | 10,5 | 2    | 25,5 |     | 7   |      | 0,7  |      |      | 0,25 |    |   | B 0,01          |
| X 50                                                                        |                                                    |                  | 20,5 | 4    | 22,5 |     | 12  |      |      |      |      | 0,75 |    |   |                 |

Fe-Basislegierungen  
Fe- based alloys

| Werkstoffgruppe<br>Material group<br><br>Handelsbezeichnung /<br>Trade name | Legierungsbestandteile in % / Alloy component in % |                 |      |      |      |      |      |     |      |      |      |      |      |       |       |
|-----------------------------------------------------------------------------|----------------------------------------------------|-----------------|------|------|------|------|------|-----|------|------|------|------|------|-------|-------|
|                                                                             | Werkstoff<br>Material                              | DIN             | Fe   | Ni   | Co   | Cr   | Mo   | W   | Si   | Mn   | C    | Al   | Ti   | P     | S     |
| VascoMax C-250                                                              |                                                    |                 |      | 18,5 | 78   |      | 4,8  |     | 0,05 | 0,05 | 0,02 | 0,1  | 0,4  | 0,005 | 0,005 |
| VascoMax C-350                                                              |                                                    |                 |      | 18,5 | 12   |      | 4,8  |     | 0,05 | 0,05 | 0,02 | 0,1  | 1,4  | 0,005 | 0,005 |
| VascoMax C-200                                                              |                                                    |                 |      | 18,5 | 8,5  |      | 3,25 |     | 0,05 | 0,05 | 0,01 |      | 0,2  | 0,005 | 0,005 |
| VascoMax C-300                                                              |                                                    |                 |      | 18,5 | 8,8  |      | 4,8  |     | 0,05 | 0,05 | 0,02 | 0,1  | 0,73 | 0,005 | 0,005 |
| VascoMax T-200                                                              |                                                    |                 |      | 18,5 |      |      | 3    |     | 0,05 | 0,05 | 0,01 |      | 0,7  | 0,005 | 0,005 |
| VascoMax T-250                                                              |                                                    |                 |      | 18,5 |      |      | 3    |     | 0,03 | 0,05 | 0,02 | 0,01 | 1,4  | 0,005 | 0,005 |
| Greek Ascology                                                              |                                                    |                 |      | 2    |      | 12   |      | 2,5 |      |      | 0,19 |      |      |       |       |
| Jethete M-152                                                               |                                                    |                 |      | 2,5  |      | 12   | 1,7  |     |      |      | 0,15 |      |      |       |       |
| Haynes 556                                                                  |                                                    | X12CrCoNi2120   | 31   | 20   | 20   | 21   | 3    | 2,5 |      |      | 0,1  |      |      |       |       |
| N 155                                                                       |                                                    |                 |      | 20   | 20   | 21   | 3    | 2,5 | 0,5  | 1,5  | 0,15 |      |      |       |       |
| S590                                                                        |                                                    | X40CoCrNi2020   |      | 20   | 20   | 21   | 4    | 4   |      |      | 0,43 |      |      |       |       |
| Crucible A286                                                               | 1.4980                                             |                 |      | 25   |      | 14   | 1,3  |     | 0,5  | 1,3  | 0,05 | 0,2  | 2,1  |       |       |
| Discaloy 16/25/6                                                            |                                                    |                 |      | 25   |      | 16   | 6    |     | 0,7  | 1,35 | 0,12 |      | 0,3  |       |       |
| AL-6XN Alloy                                                                |                                                    |                 |      | 25   |      | 20,5 | 6,5  |     |      |      | 0,02 |      |      |       |       |
| Discaloy 24                                                                 |                                                    |                 |      | 26   |      | 13,5 | 2,7  |     | 0,8  | 0,9  | 0,04 | 0,1  | 1,7  |       |       |
| Armco 18                                                                    |                                                    |                 |      | 3,7  |      | 17,2 |      |     | 0,47 | 12,5 | 0,06 |      |      |       |       |
| Incoloy 801                                                                 |                                                    | G-X50CrNi3030   |      | 32   | 20,5 |      |      |     | 0,5  | 0,8  | 0,05 |      | 1,1  |       |       |
| Incoloy 800                                                                 |                                                    | X10NiCrAlTi3220 | 39,5 | 32,5 |      | 21   |      |     | 0,5  | 0,75 | 0,05 | 0,37 | 0,37 |       | 0,007 |
| Incoloy A 286                                                               |                                                    |                 | 56,5 | 26   |      | 15   | 1,2  |     | 0,4  | 0,8  | 0,4  |      | 2    |       |       |
| N156                                                                        |                                                    |                 |      | 33   | 24   | 17   | 3    | 2   |      |      | 0,33 |      |      |       |       |
| 20CB-3                                                                      |                                                    |                 |      | 33   |      | 20   | 2,2  |     |      |      |      |      |      |       |       |
| Sanicro 30                                                                  | 1.4558                                             | X2NiCrAlTi3220  |      | 34   |      | 22   |      |     | 0,55 | 0,55 | 0,03 | 0,3  | 0,5  |       |       |
| Sanicro 28                                                                  | 1.4563                                             |                 | 63   | 37   |      | 27   | 3,5  |     | 0,6  | 2    | 0,02 |      |      | 0,025 | 0,015 |
| Sanicro 31HT                                                                | 1.4876                                             |                 | 46   | 30,5 |      | 20,5 |      |     | 0,6  | 0,6  | 0,07 | 0,5  | 0,5  | 0,015 | 0,01  |
| Incoloy 803                                                                 |                                                    |                 |      | 35   |      | 25   |      |     |      |      | 0,08 | 0,15 | 0,15 |       |       |
| Allvac 330                                                                  |                                                    |                 |      | 35,5 |      | 18,5 |      |     | 1,13 | 1    | 0,04 |      |      | 0,01  | 0,01  |
| Al 36                                                                       |                                                    |                 |      | 36   |      |      |      |     |      |      |      |      |      |       |       |
| Incoloy DS                                                                  |                                                    | X12NiCrSi3616   |      | 37   |      | 18   |      |     | 2,3  | 1    | 0,06 |      |      |       |       |
| AL 42                                                                       |                                                    |                 |      | 41   |      |      |      |     |      |      |      |      |      |       |       |
| Armco 20-45-5                                                               |                                                    |                 |      | 46   |      | 20   | 2,3  |     | 1    | 5    | 0,08 |      |      |       |       |
| AL 4750                                                                     |                                                    |                 |      | 49   |      |      |      |     |      |      |      |      |      |       |       |
| ALLOY 21-6-9                                                                |                                                    |                 |      | 6,5  |      | 21   |      |     |      | 6    |      |      |      |       |       |
| Vasco 13-8 Mo                                                               | MF                                                 |                 |      | 8    |      | 12,8 | 2,3  |     | 0,05 | 0,1  | 0,03 | 1,05 |      | 0,005 | 0,004 |

Ni-Basislegierung  
Ni-Based alloys

| Werkstoffgruppe<br>Material group<br><br>Handelsbezeichnung /<br>Trade name | Legierungsbestandteile in % / Alloy component in % |                    |     |      |      |       |      |      |      |      |       |      |      |       |       |
|-----------------------------------------------------------------------------|----------------------------------------------------|--------------------|-----|------|------|-------|------|------|------|------|-------|------|------|-------|-------|
|                                                                             | Werkstoff<br>Material                              | DIN                | Ni  | Fe   | Co   | Cr    | Mo   | W    | Si   | Mn   | C     | Al   | Ti   | P     | S     |
| AL 22                                                                       |                                                    |                    | 56  | 2,5  |      | 20,6  | 13,9 | 2,65 |      |      |       |      |      |       |       |
| Allcor                                                                      |                                                    |                    |     |      |      | 31,0  | 10,0 | 2,0  |      |      | 0,02  | 0,25 | 0,25 |       |       |
| Astroloy                                                                    |                                                    |                    |     |      | 17,0 | 15,0  | 5,0  |      |      |      | 0,04  | 4,0  | 3,5  |       |       |
| Duranickel 310                                                              |                                                    |                    |     | 0,6  |      |       | 0,5  |      | 1,0  | 0,5  |       | 4,4  | 0,6  |       |       |
| GMR 235                                                                     |                                                    |                    |     | 10,0 |      | 15,5  | 5,2  |      | 0,4  | 0,2  | 0,15  | 3,0  | 2,0  |       |       |
| GMR 235-D                                                                   |                                                    | NiCr16MoAl         |     | 4,5  |      | 15,5  | 5,0  |      |      |      | 0,15  | 3,5  | 2,5  |       |       |
| Hastelloy B                                                                 |                                                    | S-NiMo30           | 65  | 5,0  | 2,0  | 1,5   | 28,0 |      | 0,05 | 0,5  | 0,02  |      |      |       |       |
| Hastelloy B-2                                                               |                                                    |                    | 69  | 1,0  | 0,5  | 0,5   | 16,0 |      | 0,05 | 0,5  | 0,01  |      |      | 0,02  | 0,015 |
| Hastelloy C                                                                 | 2.4602                                             | NiCr17Mo17FeW      | 65  | 6,0  | 2,0  | 15,0  | 17,0 | 5    |      |      | 0,04  |      |      |       |       |
| Hastelloy D                                                                 |                                                    |                    |     | 2,0  |      | 1,0   |      |      | 9,0  | 1,0  | 0,1   |      |      |       |       |
| Hastelloy N                                                                 |                                                    |                    |     | 4,0  |      | 7,0   | 16,5 |      |      |      | 0,02  |      |      |       |       |
| Hastelloy R235                                                              |                                                    |                    |     | 10,0 | 2,5  | 15,5  | 5,5  |      |      |      | 0,15  | 2    | 2,5  |       |       |
| Hastelloy W                                                                 |                                                    |                    |     | 4,0  |      | 5,0   | 24,5 |      |      |      | 0,02  |      |      |       |       |
| Hastelloy X                                                                 | 2.4665                                             | NiCr22FeMo         | 47  | 18   | 1,5  | 22    | 9,0  | 0,6  |      |      | 0,1   |      |      |       |       |
| Haynes 75                                                                   |                                                    |                    | 10  | 5,0  |      | 20,0  |      |      |      |      | 0,12  | 0,25 | 0,4  |       |       |
| HS 27                                                                       |                                                    | Nico32Cr26Mo       |     | 2,0  | 31,5 | 26,0  | 6,0  |      |      |      | 0,4   |      |      |       |       |
| IN 100                                                                      | 2.4674                                             | NiCo15Cr10MoAlTi   |     |      | 15,0 | 10,0  | 3,0  |      |      |      | 0,18  | 5,5  | 4,7  |       |       |
| IN 713                                                                      |                                                    |                    |     | 2,5  |      | 13,0  | 4,6  |      | 0,4  | 0,2  | 0,18  | 6,0  | 0,8  |       |       |
| Incoloy 020                                                                 | 2.4660                                             |                    | 46  | 37   | 20   | 2,5   |      |      |      |      |       |      |      |       |       |
| Incoloy 804                                                                 |                                                    |                    | 46  | 25,4 |      | 29,5  |      |      | 0,5  | 0,75 | 0,06  | 0,25 | 0,6  |       |       |
| Incoloy 825                                                                 | 2.4858                                             | NiCr21Mo           | 46  | 30   |      | 21,5  |      | 3,0  | 0,5  | 0,65 | 0,03  | 0,2  | 0,9  |       |       |
| Incoloy 901                                                                 | 2.4662                                             | NiFe35Cr14MoTi     | 45  | 35,3 |      | 13,45 | 6,20 |      | 0,22 | 0,48 | 0,05  |      | 2,5  |       |       |
| Incoloy 903                                                                 |                                                    |                    | 40  |      | 15,0 |       |      |      |      |      |       | 0,7  | 1,4  |       |       |
| Incoloy 925                                                                 |                                                    |                    | 44  | 22   |      | 21    | 3    |      |      |      |       | 0,3  | 2,1  |       |       |
| Inconel® 600                                                                | 2.4816                                             | NiCr15Fe           | 75  | 8,0  |      | 15,5  |      |      |      |      | 0,075 |      |      |       |       |
| Inconel® 601                                                                | 2.4851                                             |                    | 61  | 14,0 |      | 23,0  |      |      | 0,2  | 0,5  | 0,05  | 1,3  |      |       | 0,008 |
| Inconel® 617                                                                | 2.4663                                             |                    | 55  |      | 12,5 | 22    | 9,0  |      |      |      | 0,07  | 1,0  |      |       |       |
| Inconel® 622                                                                | 2.4602                                             |                    |     | 2,3  |      | 20,5  | 14,2 | 3,2  |      |      |       |      |      |       |       |
| Inconel® 625                                                                | 2.4856                                             | NiCr22Mo9Nb        | 62  | 2,5  |      | 21,5  | 9,0  |      |      |      | 0,05  | 0,3  | 0,3  |       |       |
| Inconel® 690                                                                | 2.4642                                             |                    | 58  | 9,0  |      | 29,0  |      |      | 0,2  | 0,2  | 0,25  |      |      |       | 0,007 |
| Inconel® 700                                                                |                                                    | NiCo28Cr15MoAlTi   |     | 0,7  | 28,5 | 15    | 3,7  |      | 0,3  | 0,1  | 0,12  | 3,0  | 2,2  |       |       |
| Inconel® 702                                                                |                                                    |                    |     | 0,4  |      | 15,6  |      |      | 0,2  | 0,05 | 0,04  | 3,4  | 0,7  |       |       |
| Inconel® 706                                                                |                                                    |                    |     |      |      | 16,0  |      |      |      |      | 0,03  |      | 1,8  |       |       |
| Inconel® 713                                                                | 2.4670                                             | G-NiCr13Al16MoNb   |     |      |      | 12    | 4,5  |      |      |      | 0,13  | 6    | 0,6  |       |       |
| Inconel® 718                                                                | 2.4668                                             | NiCr19Fe19NbMo     | 55  |      |      | 19,0  | 3,1  |      |      |      | 0,02  | 0,5  | 0,9  |       |       |
| Inconel® 718-OP                                                             |                                                    |                    | 55  |      |      | 19,0  | 3,1  |      |      |      | 0,02  | 0,5  | 0,9  |       |       |
| Inconel® 720                                                                |                                                    |                    |     |      | 14,7 | 18    | 3    | 1,25 |      |      |       | 2,5  | 5    |       |       |
| Inconel® 721                                                                |                                                    |                    |     | 8,0  |      | 16    |      |      | 0,15 | 2,25 | 0,07  | 0,1  | 3,0  |       |       |
| Inconel® 722                                                                |                                                    | NiCr16FeTi         |     | 7,0  |      | 15,5  |      |      |      |      | 0,04  | 0,7  | 2,4  |       |       |
| Inconel® 725                                                                |                                                    |                    |     | 7,5  |      | 21    | 8    |      |      |      |       | 0,3  | 1,5  |       |       |
| Inconel® 751                                                                | 2.4694                                             |                    |     | 7,0  |      | 15,5  |      |      | 0,2  | 0,5  | 0,05  | 1,2  | 2,3  |       | 0,005 |
| Inconel® X-750                                                              | 2.4669                                             | NiCr16FeTi         | 70  | 7,0  |      | 15,5  |      |      |      |      | 0,04  | 0,7  | 2,5  |       |       |
| Inconel® 783                                                                |                                                    | Ni27Co34Fe25Nb3Cr3 | 28  | 25   | 34   | 3     |      |      | 0,5  | 0,5  | 0,1   | 5,5  | 0,2  | 0,015 | 0,005 |
| Jessop G 81                                                                 |                                                    | NiCr20Co18Ti       |     | 0,5  | 16,9 | 20,6  |      |      | 0,2  | 0,5  | 0,08  | 1,5  | 2,5  |       |       |
| Jessop X-40                                                                 | 2.4670                                             | G-NiCr13Al6MoNb    |     |      |      | 12    | 4,5  |      |      |      | 0,13  | 6    | 0,6  |       |       |
| Jethete M-252                                                               |                                                    | G-NiCr19Co         |     | 2,5  | 10,0 | 19,0  | 9,75 |      |      |      | 0,15  | 1,0  | 2,5  |       |       |
| MAR-M 200                                                                   |                                                    | NW13Co10Cr9AlTi    |     |      | 10,0 | 9,0   |      | 12,5 |      |      | 0,15  | 5,0  | 2,0  |       |       |
| MAR-M 246                                                                   | 2.4676                                             | NiCo10W10Cr9AlTi   |     |      | 10,0 | 9,0   | 2,5  | 10,0 |      |      | 0,15  | 5,5  | 1,5  |       |       |
| MAR-M 421                                                                   |                                                    | NiCr16Co10WAlTi    |     |      | 10,0 | 15,5  | 1,7  | 3,5  |      |      | 0,15  | 4,25 | 1,75 |       |       |
| MAR-M 432                                                                   |                                                    | NiCo20Cr16WAlTi    |     |      | 20,0 | 15,5  |      | 3    |      |      | 0,15  | 2,5  | 4,3  |       |       |
| Monel 400                                                                   | 2.4360                                             | NiCu30Fe           | 63  | 1,2  |      |       |      |      | 0,25 |      | 0,15  |      |      |       | 0,01  |
| Monel K 500                                                                 | 2.4375                                             | NiCu30Al           | 63  | 1,0  |      |       |      |      | 0,25 | 0,7  | 0,1   | 2,7  | 0,6  |       | 0,01  |
| Monel R 405                                                                 |                                                    |                    |     | 1,25 |      |       |      |      | 0,25 | 1,0  | 0,15  |      |      |       |       |
| Nimocast 713                                                                | 2.4670                                             | G-NiCr13Al16MoNb   |     |      |      | 13,5  | 4,5  |      |      |      | 0,12  | 6,0  | 0,9  |       |       |
| Nimocast PD 16                                                              |                                                    | NiFe33Cr17Mo       |     | 34,0 |      | 16,5  | 3,3  |      |      |      | 0,06  | 1,2  | 1,2  |       |       |
| Nimocast PE 10                                                              |                                                    |                    |     | 3,0  |      | 20,0  | 6,0  | 2,5  |      |      | 0,03  |      |      |       |       |
| Nimocast PK 24                                                              | 2.4674                                             | NiCo15Cr10MoAlTi   |     |      | 15,0 | 10,0  | 3,0  |      |      |      | 0,18  | 5,5  | 4,7  |       |       |
| Nimonic 105                                                                 | 2.4634                                             | NiCo20Cr15MoAlTi   |     | 0,5  | 20   | 14,75 | 5    |      | 0,5  | 0,5  | 0,1   | 4,7  | 1,2  |       |       |
| Nimonic 115                                                                 | 2.4636                                             | NiCo15Cr15MoAlTi   |     |      | 13,2 | 14,2  | 4    |      |      |      | 0,16  | 5    | 4    |       |       |
| Nimonic 75                                                                  | 2.4630                                             | NiCr20Ti           | 0,3 | 4    |      | 20    |      |      | 0,45 | 0,45 | 0,45  | 0,1  | 0,35 |       |       |
| Nimonic 80A                                                                 | 2.4631                                             | NiCr20TiAl         |     | 0,55 |      | 19,5  |      |      | 0,2  | 0,55 | 0,08  | 1,4  | 2,4  |       |       |
| Nimonic 86                                                                  |                                                    |                    |     |      |      | 25    | 10   |      |      |      |       |      |      |       |       |
| Nimonic 90                                                                  | 2.4632                                             | NiCr20Co18Ti       | 0,3 | 1,5  | 18,0 | 19,5  |      |      |      |      | 0,065 | 1,4  | 2,4  |       |       |
| Nimonic 901                                                                 | 2.4662                                             | NiCr15MoTi         |     | 35,0 |      | 12,5  | 6,0  |      |      |      | 0,05  |      | 2,8  |       |       |
| Nimonic 95                                                                  |                                                    |                    |     | 5,0  | 18,0 | 19,5  |      |      | 1,0  | 1,0  | 0,1   | 2,0  | 3,5  |       |       |
| Nimonic C-22                                                                |                                                    |                    |     | 4,0  | 1,2  | 21,2  | 13,5 | 3,0  | 0,04 | 0,2  | 0,07  |      |      | 0,01  |       |
| Nimonic C-263                                                               | 2.4650                                             | NiCr20CoMoTi       |     |      | 20,0 | 20,0  | 5,85 |      |      |      | 0,06  | 0,45 | 2,15 |       |       |
| Nimonic C-276                                                               | 2.4819                                             |                    |     | 5,0  | 0,5  | 15,5  | 16,0 | 3,5  |      |      | 0,01  |      |      |       |       |
| Nimonic PE 13                                                               | 2.4665                                             | NiCr22Fe18Mo       |     | 18,5 | 1,5  | 21,75 | 9    | 0,6  | 0,5  | 0,5  | 0,01  |      |      |       |       |
| Nimonic PE 16                                                               |                                                    | NiFe33Cr17Mo       |     | 1,2  |      | 16,5  | 3,5  |      |      |      | 0,05  | 1,2  | 1,2  |       |       |
| Nimonic PK 25                                                               |                                                    |                    |     |      | 19,5 | 19    | 4    |      | 0,75 | 0,75 | 0,08  | 2,9  | 2,9  |       |       |
| Nimonic PK 31                                                               |                                                    |                    |     |      | 14   | 20    | 4,5  |      |      |      |       | 0,4  | 2,3  |       |       |
| Nimonic PK 33                                                               |                                                    | NiCr20Co16MoTi     |     | 0,5  | 14   | 18    | 7    |      | 0,25 | 0,25 | 0,05  | 2,1  | 2    |       |       |
| R-235                                                                       |                                                    |                    |     | 10,0 | 1,15 | 15,0  | 5,5  |      | 0,3  | 0,1  | 0,12  | 20   | 2,5  |       |       |
| Refractaloy 26                                                              |                                                    |                    |     | 16,0 | 20,0 | 18,0  | 3,2  |      | 1,0  | 0,8  | 0,03  | 0,2  | 2,8  |       |       |
| René 100                                                                    |                                                    | NiCo15Cr10MoAlTi   |     |      | 15,0 | 10,0  | 3,0  |      |      |      | 0,18  | 5,5  | 4,7  |       |       |
| René 125                                                                    |                                                    |                    |     |      | 10,0 | 8,9   | 2,0  | 7,0  |      |      | 0,1   | 4,7  | 2,5  |       |       |
| René 41                                                                     | 2.4973                                             | NiCr19Co11MoTi     | 20  | 3,0  | 11,0 | 19,0  | 9,75 |      |      |      | 0,06  | 1,6  | 2,5  |       |       |
| René 63                                                                     |                                                    |                    |     | 3,5  | 15,0 | 14,0  | 6,0  | 3,5  | 0,2  | 0,1  | 0,05  | 3,8  | 2,5  |       |       |
| René 77                                                                     |                                                    |                    |     | 0,4  | 15,0 | 15,0  | 4,2  |      | 0,1  | 0,1  | 0,07  | 4,3  | 3,3  |       |       |
| René 80                                                                     |                                                    |                    |     |      | 9,5  | 14,0  | 4,0  | 4,0  |      |      | 0,17  | 3,0  | 5,0  |       |       |
| René 95                                                                     |                                                    |                    |     |      | 8,0  | 14,0  | 3,5  | 3,5  |      |      | 0,15  | 3,5  | 2,5  |       |       |
| Sanicro 41                                                                  | 2.4858                                             |                    | 46  | 30   |      | 21,5  |      | 3,0  | 0,5  | 0,65 | 0,03  | 0,2  | 0,9  |       |       |
| Sanicro 69                                                                  | 2.4642                                             |                    | 58  | 9,0  |      | 29,0  |      |      | 0,2  | 0,2  | 0,25  |      |      |       | 0,007 |
| Sanicro 70                                                                  | 2.4816                                             |                    | 75  | 8,0  |      | 15,5  |      |      |      |      | 0,075 |      |      |       |       |
| TRW VIA                                                                     |                                                    | NiTa9Co8W6CrAl     |     |      | 7,5  | 6,0   | 2,0  | 5,8  |      |      | 0,13  | 5,4  | 1,0  |       |       |
| Udimet 500                                                                  | 2.4983                                             | NiCr18CoMoAlTi     |     |      | 19,0 |       | 4,0  |      | 0,1  | 0,1  | 0,07  | 3,0  | 3,0  |       |       |
| Udimet 520                                                                  |                                                    |                    |     |      | 12   | 19    | 6    | 1    |      |      |       | 2    | 3    |       |       |
| Udimet 630                                                                  | 2.4668                                             | NiCr19NbMo         |     | 18,0 | 18,0 |       | 3,0  |      |      |      | 0,03  | 0,5  | 1,0  |       |       |
| Udimet 700                                                                  | 2.4636                                             | NiCo15Cr15MoAlTi   |     |      | 16,5 | 15,0  | 5,0  |      |      |      | 0,07  | 4,4  | 3,4  |       |       |
| Udimet 710                                                                  |                                                    |                    |     |      | 15,0 | 18,0  | 3,0  | 1,5  |      |      | 0,07  | 2,5  | 5,0  |       |       |
| Udimet 718                                                                  |                                                    | NiCr19Fe19NbMo     |     | 18,0 |      | 18,0  | 3,0  |      |      |      | 0,05  | 0,6  | 1,0  |       |       |
| Waspaloy                                                                    | 2.4654                                             | NiCr20Co14MoTi     | 0,3 | 2    | 13,0 | 19,5  | 4,3  |      |      |      | 0,05  | 1,40 | 3,0  |       |       |

Internationaler Normenvergleich  
International comparison of standards

Werkstoffgruppe / material group

1. Unlegierte Stähle – Automatenstähle / *Unalloyed steels – machining steels*

| Werkstoff<br>Nr.:<br>material<br>No.:                         | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|---------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 1.1 bis 450 N/ mm <sup>2</sup> / up to 450 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.0432                                                        | C21                           |                        |                               |                                       |                         |                           |                         |                    |
| 1.0498                                                        | St42.8                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.0044                                                        | St442                         |                        | E 28-2                        | 4360-43 B                             | Fe 430 BFN              | 1412                      | AE 275-B                | A 570 Gr. 40       |
| 1.0401                                                        | C15                           |                        | CC12                          | 080 M 15                              | C 15                    | 1350                      | F.111                   | 1015               |
| 1.0420                                                        | GS38                          | GE 200                 | 230-400M                      |                                       |                         | 1306                      |                         |                    |
| 1.0446                                                        | GS45                          | GE 230                 | E23-45M                       | A1                                    |                         | 1305                      | F.221                   |                    |
| 1.1120                                                        | GS20Mn5                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.1121                                                        | Ck10                          | 2 C 10                 | XC 10                         | 040 A 10                              | C 10                    | 1265                      | C 10 k                  | 1010               |
| 1.1131                                                        | GS16Mn5                       | GE 17 Mn 5             |                               |                                       |                         |                           |                         |                    |
| 1.1141                                                        | Ck15                          | 2 C 15                 | XC 15                         | 080 M 15                              | C 15                    | 1370                      | C 16 k                  | 1015               |
| 1.1151                                                        | Ck22                          | 2 C 22                 | XC 25                         | 050 A 20                              | C 20                    |                           | C 25 k                  | 1023               |
| 1.5523                                                        | 19MnB4                        |                        |                               | 170 H 20                              |                         |                           | 20 MnB 4 DF             |                    |
| 1.8961                                                        | WTSt373                       |                        |                               |                                       | Fe 360 D FF             |                           |                         |                    |
| 1.0035                                                        | St33                          |                        | A 33                          |                                       | Fe 320                  |                           | AE 235-B                |                    |
| 1.0037                                                        | St372                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.0710                                                        | 15S10                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.0711                                                        | 9S20                          |                        |                               | 220 M 07                              | CF 9 S 22               |                           |                         | 1212               |
| 1.0715                                                        | 9SMn28                        | 11 SMn 28              | S 250                         | 230 M 07                              | CF 9 SMn 28             | 1912                      | 11 SMn 28               | 1213               |
| 1.0718                                                        | 9SMnPb28                      | 11 SMnPb 28            | S 250 Pb                      |                                       | CF 9 SMnPb 28           | 1914                      | 11 SMnPb 28             | 12 L 13            |
| 1.0721                                                        | 10S20                         | 10 S 20                | 10 F 1                        | 210 M 15                              | CF 10 S 20              |                           | 10 S 20                 | 1108               |
| 1.0722                                                        | 10SPb20                       | 10 SPb 20              | 10 Pb F 2                     |                                       | CF 10 SPb 20            |                           | 10 SPb 20               | 11 L 08            |
| 1.0736                                                        | 9SMn36                        |                        | S 300                         | 240 M 07                              | CF 9 SMn 36             |                           | 12 SMn 35               | 1215               |
| 1.0737                                                        | 9SMnPb36                      |                        | S 300 Pb                      |                                       | CF 9 SMnPb 36           | 1926                      | 12 SMnPb 35             | 12 L 14            |
| 1.1127                                                        | 36Mn6                         |                        |                               | 212 M 36                              |                         |                           |                         | 1141               |
| 1.1133                                                        | 20Mn5                         |                        |                               | 120 M 19                              | G 22 Mn 3               |                           | 20 Mn 6                 | 1022               |
| 1.1273                                                        | 90Mn4                         |                        |                               | 060 A 96                              |                         |                           |                         | 1090               |
| 1.2 bis 650 N/ mm <sup>2</sup> / up to 650 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.0136                                                        | St423                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.0254                                                        | St37.0                        | P235T1                 |                               |                                       |                         |                           |                         |                    |
| 1.0553                                                        | S355J0                        | S355J0                 | S355J0; E 36-3                | En 50 C; S355J0                       | S355J0; Fe 510 C FN     |                           | S355J0                  |                    |
| 1.0581                                                        | St52.4                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.1140                                                        | C15R                          | C15R                   | C15R                          | C15R                                  |                         |                           | C15R; C 16 k-1; F.1513  |                    |
| 1.1190                                                        | S355G15                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.0116                                                        | St373                         |                        | E 24-3                        | 4360-40 C                             | Fe 37-3                 | 1312                      | A 360 C                 | A 570 Gr. 36       |
| 1.0144                                                        | St443                         |                        | E 28-3                        | 4360-43 C                             | Fe 430 D FF             | 1414                      | AE 275-D                | A 573 Gr. 70       |
| 1.0406                                                        | C25                           | 1 C 25                 | CC 25                         | 070 M 26                              | C 25                    |                           | C 25 k                  | 1025               |
| 1.0461                                                        | StE255                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.0482                                                        | 19Mn5                         |                        | A 52 CP; AP; FP               | 224-460                               |                         |                           |                         |                    |
| 1.0486                                                        | StE285                        |                        |                               |                                       | Fe E 285 KG             |                           | AE 285 KG               |                    |
| 1.0501                                                        | C35                           | 1 C 35                 | CC 35                         | 060 A 35                              | C 35                    | 1550                      | F.113                   | 1035               |
| 1.0503                                                        | C45                           | 1 C 45                 | CC 45                         | 080 M 46                              | C 45                    | 1650                      | C 45 k                  | 1045               |
| 1.0505                                                        | StE315                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.0511                                                        | C40                           | 1 C 40                 |                               | 080 M 40                              |                         |                           | F.114.A                 | 1040               |
| 1.0528                                                        | C30                           | 1 C 30                 | CC 32                         | 080 M 30                              | C 30                    |                           |                         | 1030               |
| 1.0540                                                        | C50                           | 1 C 50                 |                               | 080 M 50                              |                         | 1674                      |                         | 1050               |
| 1.0552                                                        | GS52                          | GE 260                 |                               |                                       |                         |                           |                         |                    |
| 1.0558                                                        | GS60                          | GE 300                 | 320-560M                      | A3                                    | C 45                    | 1606                      |                         |                    |
| 1.0562                                                        | StE355                        |                        | E 355 R/ FP                   |                                       | Fe E 355 KG             | 2132                      | AE 355 KG               | A 633 Gr. C        |
| 1.0970                                                        | 38Si7                         |                        | 41 S 7                        |                                       |                         |                           |                         |                    |
| 1.1106                                                        | ESStE355                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.1157                                                        | 40Mn4                         |                        | 35 M 5                        | 150 M 36                              |                         |                           |                         | 1039               |
| 1.1169                                                        | 20Mn6                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.1520                                                        | C70W1                         |                        |                               |                                       | C 70 KU                 |                           |                         |                    |
| 1.2002                                                        | 125Cr1                        |                        | Y2 120 C                      |                                       |                         |                           |                         |                    |
| 1.2003                                                        | 75Cr1                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.2008                                                        | 140Cr3                        |                        | Y2 140 C                      |                                       |                         |                           |                         |                    |
| 1.2056                                                        | 90Cr3                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.2057                                                        | 105Cr4                        |                        |                               |                                       |                         |                           | F.120.J                 |                    |
| 1.5637                                                        | 10Ni14                        |                        |                               | 503                                   | 18 Ni 14 KT             |                           |                         | A 350-LF 5         |
| 1.8962                                                        | 9CrNiCuP324                   |                        |                               | WR 50 A                               |                         |                           |                         |                    |
| 1.0726                                                        | 35S20                         | 35 S 20                | 35 MF 4                       | 212 M 36                              |                         | 1957                      | F.210G                  | 1140               |
| 1.0760                                                        | 38SMn28                       | 38SMn28                | 38SMn28                       | 38SMn28                               |                         |                           | 38SMn28                 |                    |
| 1.1158                                                        | Ck25                          | 2 C 25                 | XC 25                         | 070 M 26                              | C 25                    |                           | C 25 k                  | 1025               |
| 1.1167                                                        | 36Mn5                         |                        | 40 M 5                        | 150 M 36                              |                         | 2120                      | 36 Mn 5                 | 1335               |
| 1.1170                                                        | 28Mn6                         | 28 Mn 6                | 35 M 5                        | 150 M 28                              | C 28 Mn                 |                           | 36 Mn 6                 | 1330               |
| 1.1178                                                        | Ck30                          | 2 C 30                 | XC 32                         | 080 M 30                              | C 30                    |                           |                         | 1030               |
| 1.1181                                                        | Ck35                          | 2 C 35                 | XC 38 H1                      | 080 M 36                              | C 35                    | 1572                      | C 35 k                  | 1034               |
| 1.1183                                                        | Cf35                          |                        | XC 38 TS                      | 060 A 35                              | C 35                    | 1572                      |                         | 1035               |
| 1.1191                                                        | Ck45                          | 2 C 45                 | XC 42                         | 080 M 46                              | C 40                    |                           | C 45 k                  | 1045               |
| 1.1206                                                        | Ck50                          | 2 C 50                 |                               | 080 M 50                              | C 50                    | 1674                      |                         | 1050               |
| 1.1730                                                        | C45W                          | C 45 U                 | Y3 42                         |                                       |                         |                           |                         |                    |
| 1.5423                                                        | 16Mo5                         |                        |                               | 1503-245-420                          | 16 Mo 5                 |                           | 16 Mo 5                 | 4520               |

Internationaler Normenvergleich  
International comparison of standards

Werkstoffgruppe / material group

1. Unlegierte Stähle – Automatenstähle / *Unalloyed steels – machining steels*

| Werkstoff<br>Nr.:<br>material<br>No.:                         | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|---------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 1.3 bis 850 N/mm <sup>2</sup> / up to 850 N/mm <sup>2</sup>   |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.1165                                                        | GS30Mn5                       |                        |                               |                                       |                         |                           | 30 Mn 5                 | 1330               |
| 1.1744                                                        | C67W                          |                        | Y1 70                         |                                       |                         |                           | F.512                   |                    |
| 1.1750                                                        | C75W                          |                        |                               | BW 1A                                 |                         |                           |                         | W 1                |
| 1.2004                                                        | 85Cr1                         |                        | Y1 100 C 2                    |                                       |                         |                           |                         |                    |
| 1.5029                                                        | 71Si7                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.5404                                                        | 21MoV53                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.5406                                                        | 17MoV84                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.5633                                                        | 24Ni8                         |                        | 22 N 8                        |                                       |                         |                           |                         |                    |
| 1.6311                                                        | 20MnMoNi45                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.7242                                                        | 16CrMo4                       |                        | 15 CD 3.5                     |                                       | 18 CrMo 4               |                           | 18 CrMo 4               |                    |
| 1.7258                                                        | 24CrMo5                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.7259                                                        | 26CrMo7                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.7273                                                        | 24CrMo10                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.7337                                                        | 16CrMo44                      |                        |                               |                                       | A 18 CrMo 4 5 KW        |                           |                         | A 387 Gr. 12 Cl. 2 |
| 1.7350                                                        | 22CrMo44                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.7362                                                        | 12CrMo195                     |                        | Z 10 CD 5.05                  | 3606-625                              | 16 CrMo 20 5            |                           |                         |                    |
| 1.7709                                                        | 21CrMoV57                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.7766                                                        | 17CrMoV10                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.7779                                                        | 20CrMoV135                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4 bis 950 N/mm <sup>2</sup> / up to 950 N/mm <sup>2</sup>   |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.0062                                                        | St601                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.0532                                                        | St522                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.0535                                                        | C55                           | 1 C 55                 |                               | 070 M 55                              | C 55                    | 1655                      |                         | 1055               |
| 1.0570                                                        | St523                         | S 355 J 2 G 3          | E 36-3                        | 4360-50 B                             | Fe 510 B                | 2132                      | A 510 C                 |                    |
| 1.0601                                                        | C60                           | 1 C 60                 | AF 70 C 55                    | 080 A 62                              | C 60                    |                           |                         | 1060               |
| 1.0728                                                        | 60S20                         | 60 S 20                | 60 MF 4                       |                                       |                         |                           |                         |                    |
| 1.1203                                                        | Ck55                          | 2 C 55                 | XC 55 H1                      | 070 M 55                              | C 55                    |                           | C 55 k                  | 1055               |
| 1.1221                                                        | Ck60                          | 2 C 60                 | XC 60                         | 060 A 62                              | C 60                    | 1678                      |                         | 1060               |
| 1.1223                                                        | Cm60                          | 3 C 60                 |                               | 080 A 67                              |                         |                           |                         |                    |
| 1.1525                                                        | C80W1                         | C 80 U                 | Y1 90                         |                                       | C 80 KU                 |                           | F.513                   | W 108              |
| 1.1545                                                        | C105W1                        | C105 U                 | Y1 105                        |                                       | C 100 KU                | 1880                      | F.515                   | W 110              |
| 1.1620                                                        | C70W2                         | C 70 U                 |                               |                                       |                         |                           |                         |                    |
| 1.1625                                                        | C80W2                         |                        | Y1 90                         | BW 1B                                 |                         |                           | C 80                    | W 1                |
| 1.1645                                                        | C105W2                        |                        |                               |                                       |                         |                           | C 102                   |                    |
| 1.1663                                                        | C125W                         | C 120 U                | Y2 120                        |                                       | C 120 KU                |                           | C 120                   | W 112              |
| 1.1673                                                        | C135W                         |                        | Y2 140                        |                                       | C 140 KU                |                           |                         |                    |
| 1.1740                                                        | C60W                          |                        | Y3 55                         |                                       |                         |                           |                         |                    |
| 1.1820                                                        | C55W                          |                        |                               |                                       |                         |                           |                         |                    |
| 1.1830                                                        | C85W                          | C 90 U                 | Y3 90                         |                                       |                         |                           |                         |                    |
| 1.3561                                                        | 44Cr2                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.3563                                                        | 43CrMo4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.5131                                                        | 50MnSi4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.5141                                                        | 53MnSi4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.7276                                                        | 10CrMo11                      |                        | 12 CD 10                      |                                       |                         |                           |                         |                    |
| 1.7281                                                        | 16CrMo93                      |                        | 20 CD 8                       |                                       |                         |                           |                         |                    |
| 1.5 bis 1100 N/mm <sup>2</sup> / up to 1100 N/mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.0070                                                        | St702                         |                        | A 70-2                        |                                       | Fe 70-2                 |                           | A 690-2                 |                    |
| 1.0603                                                        | C67                           |                        |                               |                                       |                         |                           |                         |                    |
| 1.7238                                                        | 49CrMo4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.7561                                                        | 42CrV6                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.7701                                                        | 51CrMoV4                      |                        | 51 CDV 4                      |                                       | 51 CrMoV 4              |                           |                         |                    |

Werkstoffgruppe / material group

2. Vergütungsstähle / *Alloy steels*

|                                                             |               |            |           |          |               |      |            |      |
|-------------------------------------------------------------|---------------|------------|-----------|----------|---------------|------|------------|------|
| 2.1 bis 600 N/mm <sup>2</sup> / up to 600 N/mm <sup>2</sup> |               |            |           |          |               |      |            |      |
| 1.0902                                                      | 46Si7         |            | 45 S 7    |          |               |      | 46 Si 7    |      |
| 1.0961                                                      | 60SiCr7       |            | 60 SC 7   | 250 A 61 | 60 SiCr 8     |      | 60 SiCr 8  | 9262 |
| 1.0985                                                      | QStE500N      |            |           |          |               |      |            |      |
| 1.2101                                                      | 62SiMnCr4     |            |           |          |               |      |            |      |
| 1.2162                                                      | 21MnCr5       | 21 MnCr 5  | 20 NC 5   |          |               |      |            |      |
| 1.2208                                                      | 31CrV3        |            |           |          |               |      |            |      |
| 1.2210                                                      | 115CrV3       |            |           |          | 107 CrV 3 KU  |      | F.520.L    | 12   |
| 1.2235                                                      | 80CrV2        |            |           |          |               |      | F.520.J    |      |
| 1.2241                                                      | 51CrV4        | 51 CrMnV 4 |           |          | 51 CrMnV 4 KU |      |            |      |
| 1.2307                                                      | 29CrMoV9      |            |           |          |               |      |            |      |
| 1.2323                                                      | 48CrMoV67     |            | 45 CDV 6  |          |               |      |            |      |
| 1.2382                                                      | GX155CrVMo121 |            |           |          |               |      |            |      |
| 1.2414                                                      | 120W4         |            |           |          |               |      | F.532      |      |
| 1.2419                                                      | 105WCr6       | 105 WCr 5  | 105 WC 13 |          | 107 WCr 5 KU  | 2140 | 105 WCr 5  |      |
| 1.2519                                                      | 110WCrV5      |            |           |          |               |      | 102 WCrV 5 |      |
| 1.2542                                                      | 45WCrV7       | 45 WCrV 8  |           | BS 1     | 45 WCrV 8 KU  | 2710 | 45 WCrSi 8 | S1   |
| 1.2552                                                      | 80WCrV8       |            |           |          |               |      | 60 WCrSi 8 |      |
| 1.2710                                                      | 45NiCr6       |            |           |          |               |      |            |      |
| 1.2726                                                      | 26NiCrMoV5    |            |           |          |               |      |            |      |
| 1.2737                                                      | 28NiCrV5      |            |           |          |               |      |            |      |



Internationaler Normenvergleich  
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Werkstoffgruppe / material group  
2. Vergütungsstähle / Alloy steels

| Werkstoff<br>Nr.:<br>material<br>No.:                         | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|---------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 2.1 bis 600 N/ mm <sup>2</sup> / up to 600 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.2738                                                        | 40CrMnNiMo864                 | 40CrMnNiMo8-6-4        |                               |                                       |                         |                           |                         |                    |
| 1.2740                                                        | 28NiCrMoV10                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.2743                                                        | 60NiCrMoV124                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.2762                                                        | 75CrMoNiW67                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.2826                                                        | 60MnSi4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.2838                                                        | 145V33                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.2842                                                        | 90MnCrV8                      |                        | 90 MV 8                       | BO 2                                  | 90 MnVCr 8 KU           |                           |                         | O 2                |
| 1.2851                                                        | 34CrAl6                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.3505                                                        | 100Cr6                        | 100 Cr 6               | 100 C 6                       | 535 A 99                              | 100 Cr 6                | 2258                      | 100 Cr 6                | E 52100            |
| 1.3520                                                        | 100CrMn6                      | 100 CrMn 6             | 100 CM 6                      |                                       |                         |                           | 100 CrMn 6              |                    |
| 1.3565                                                        | 48CrMo4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.5023                                                        | 38Si7                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.5025                                                        | 51Si7                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.5085                                                        | 51Mn7                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.5142                                                        | 60SiMn5                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.5213                                                        | 15MnV5                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.5223                                                        | 42MnV7                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.5225                                                        | 51MnV7                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.5752                                                        | 14NiCr14                      |                        | 16 NC 12                      | 655 M 13                              |                         |                           |                         | E3310              |
| 1.5919                                                        | 15CrNi6                       |                        | 16 NC 6                       | S 107                                 | 16 CrNi 4               |                           |                         |                    |
| 1.6511                                                        | 36CrNiMo4                     | 36 CrNiMo 4            | 40 NCD 3                      | 816 M 40                              | 38 NiCrMo 4 KB          |                           | 35 NiCrMo 4             | 9840               |
| 1.6582                                                        | 34CrNiMo6                     | 34 CrNiMo 6            | 35 NCD 6                      | 817 M 40                              | 35 NiCrMo 6 KB          | 2541                      | 40 NiCrMo 7             | 4340               |
| 1.6587                                                        | 17CrNiMo6                     |                        | 18 NCD 6                      | 820 A 16                              | 18 NiCrMo 7             |                           | 14 NiCrMo 13            |                    |
| 1.7003                                                        | 38Cr2                         | 38 Cr 2 KD             | 38 C 2                        |                                       | 38 Cr 3                 |                           | 38 Cr 3                 |                    |
| 1.7012                                                        | 13Cr2                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.7045                                                        | 42Cr4                         |                        | 42 C 4 TS                     | 530 A 40                              | 41 Cr 4                 | 2245                      | 42 Cr 4                 | 5140               |
| 1.7103                                                        | 67SiCr5                       |                        |                               |                                       | 67 SiCr 5               |                           |                         |                    |
| 1.7131                                                        | 16MnCr5                       | 16 MnCr 5 KD           | 16 MC 5                       | 527 M 17                              | 16 MnCr 5               | 2173                      | 16 MnCr 5               | 5115               |
| 1.7226                                                        | 34CrMoS4                      | 34 CrMoS 4             |                               |                                       |                         |                           | 35 CrMo 4-1             |                    |
| 1.7227                                                        | 42CrMoS4                      | 42 CrMoS 4             |                               | 708 H 42                              |                         |                           | 40 CrMo 4               |                    |
| 1.7271                                                        | 23CrMoB33                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.7707                                                        | 30CrMoV9                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.7715                                                        | 14MoV63                       |                        |                               | 1503-660-440                          |                         |                           | 13 MoCrV 6              |                    |
| 1.7735                                                        | 14CrMoV69                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.8159                                                        | 50CrV4                        | 51 CrV 4               | 50 CV 4                       | 735 A 50                              | 50 CrV 4                | 2230                      | 51 CrV 4                | 6150               |
| 1.8515                                                        | 31CrMo12                      | 31 CrMo 12             |                               | 722 M 24                              | 31 CrMo 12              |                           | 31 CrMo 12              |                    |
| 1.8907                                                        | StE500                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.8911                                                        | ESTE380                       |                        |                               |                                       |                         |                           |                         |                    |
| 2.2 bis 950 N/ mm <sup>2</sup> / up to 950 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.0906                                                        | 65Si7                         |                        |                               | 250 A 61                              |                         |                           |                         |                    |
| 1.1199                                                        | 49MnVS3                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.2108                                                        | 90CrSi5                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.2109                                                        | 125CrSi5                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.2127                                                        | 105MnCr4                      |                        |                               |                                       | 100 CrMn 4 KU           |                           |                         |                    |
| 1.2206                                                        | 140CrV1                       |                        | 130 C 3                       |                                       |                         |                           |                         |                    |
| 1.2242                                                        | 59CrV4                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.2243                                                        | 61CrSiV5                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.2249                                                        | 45SiCrV6                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.2303                                                        | 100CrMo5                      |                        |                               |                                       |                         |                           | F.520.F                 | L 7                |
| 1.2312                                                        | 40CrMnMoS86                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.2562                                                        | 142WV13                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.2747                                                        | 28NiMo17                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.2766                                                        | 35NiCrMo16                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.3501                                                        | 100Cr2                        |                        | 100 C 2                       |                                       |                         |                           |                         | E 50100            |
| 1.3503                                                        | 105Cr4                        |                        |                               |                                       |                         |                           |                         | E 51100            |
| 1.5094                                                        | 38 MnS 6                      | 38MnS6                 |                               |                                       |                         |                           |                         |                    |
| 1.5217                                                        | 20MnV6                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.5231                                                        | 38MnSiV55                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.5232                                                        | 27MnSiV56                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.5233                                                        | 44MnSiV56                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.5403                                                        | 17MnMoV64                     |                        |                               | 1501-261                              |                         |                           |                         |                    |
| 1.5526                                                        | 30MnB4                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.5710                                                        | 36NiCr6                       |                        | 30 NC 6                       | 640 A 35                              |                         |                           |                         | 3135               |
| 1.5736                                                        | 36NiCr10                      |                        | 30 NC 11                      |                                       | 35 NiCr 9               |                           |                         | 3435               |
| 1.5755                                                        | 31NiCr14                      |                        | 18 NC 13                      | 653 M 31                              |                         |                           |                         |                    |
| 1.6225                                                        | 11NiMn54                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.6310                                                        | 20MnMoNi55                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.6368                                                        | 15NiCuMoNb5                   |                        |                               | 3604-591                              |                         |                           |                         |                    |
| 1.6946                                                        | 30CrMoNiV511                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.6948                                                        | 26NiCrMoV115                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.6971                                                        | 79Ni1                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.6972                                                        | 83Ni1                         |                        |                               |                                       |                         |                           |                         |                    |
| 1.7038                                                        | 37CrS4                        | 37 CrS 4               |                               |                                       |                         |                           |                         |                    |
| 1.7214                                                        | 25CrMo4                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.7219                                                        | 26CrMo4                       |                        |                               |                                       |                         |                           |                         |                    |

Internationaler Normenvergleich  
International comparison of standards

Werkstoffgruppe / material group  
2. Vergütungsstähle / Alloy steels

| Werkstoff<br>Nr.:<br>material<br>No.:                                         | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|-------------------------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 2.2 bis 950 N/ mm <sup>2</sup> / up to 950 N/ mm <sup>2</sup>                 |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.7222                                                                        | 42CrMoPb4                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.7225                                                                        | 42CrMo4.M45                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.7389                                                                        | CX12CrMo101                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.7711                                                                        | 40CrMoV47                     |                        |                               | 1506-670-860                          |                         |                           |                         |                    |
| 1.7725                                                                        | GS30CrMoV64                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.7733                                                                        | 24CrMoV55                     |                        | 20 CDV 6                      |                                       | 24 CrMoV 5 5            |                           |                         |                    |
| 1.7741                                                                        | 42CrMoV73                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.7755                                                                        | GS45CrMoV104                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.8070                                                                        | 21CrMoV511                    |                        |                               |                                       | 21 CrMoV 5 11           |                           |                         |                    |
| 1.8212                                                                        | 21CrVMoW12                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.8521                                                                        | 15CrMoV59                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.8550                                                                        | 34CrAlNi7                     |                        |                               |                                       |                         |                           |                         |                    |
| 2.3 bis 1100 N/ mm <sup>2</sup> / up to 1100 N/ mm <sup>2</sup>               |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.2511                                                                        | 80WCrV3                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.2515                                                                        | 100WV4                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.7756                                                                        | GS36CrMoV104                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.8509                                                                        | 41CrAlMo7                     |                        |                               | 905 M 39                              | 41 CrAlMo 7             | 2940                      | 41 CrAlMo 7             | A 355 C1A          |
| 1.8523                                                                        | 39CrMoV139                    |                        |                               | 897 M 39                              |                         |                           |                         |                    |
| 1.8827                                                                        | S460M                         | S460M                  | E 460; S460M                  | S460M                                 | S460M                   |                           | S460M                   |                    |
| 2.4 bis 1300 N/ mm <sup>2</sup> / up to 1300 N/ mm <sup>2</sup>               |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.2311                                                                        | 40CrMnMo7                     |                        |                               |                                       | 35 CrMo 8 KU            |                           |                         |                    |
| 1.5864                                                                        | 35NiCr18                      |                        |                               |                                       |                         |                           |                         |                    |
| 2.5 Nitrierstähle bis 1000 N/ mm <sup>2</sup> / up to 1000 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.8504                                                                        | 34CrAl6                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.8506                                                                        | 34CrAlS5                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.8507                                                                        | 34CrAlMo5                     |                        |                               |                                       |                         |                           |                         |                    |
| 2.6 Nitrierstähle über 1000 N/ mm <sup>2</sup> / over 1000 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.8519                                                                        | 31CrMoV9                      |                        |                               |                                       |                         |                           |                         |                    |

Werkstoffgruppe / material group  
3. Hochlegierte Stähle / High-alloy steels

|                                                               |               |                 |              |       |                          |  |                |       |
|---------------------------------------------------------------|---------------|-----------------|--------------|-------|--------------------------|--|----------------|-------|
| 3.1 bis 700 N/ mm <sup>2</sup> / up to 700 N/ mm <sup>2</sup> |               |                 |              |       |                          |  |                |       |
| 1.2080                                                        | X210Cr12      | X 210 Cr 12     | Z 200 C 12   | BD 3  | X 205 Cr 12 KU           |  | X 210 Cr 12    | D3    |
| 1.2083                                                        | X42Cr13       | X 42 Cr 13      | Z 40 C 14    |       | X 41 CR 13 KU            |  |                |       |
| 1.2316                                                        | X36CrMo17     | X 36 CrMo 17    |              |       | X 38 CrMo 16 1 KU        |  | X 38 CrMo 16   |       |
| 1.2343                                                        | X38CrMoV5H1   | X 38 CrMoV 5 1  | Z 38 CDV 5   | BH 11 | X 37 CrMoV 5 1 KU        |  | X 37 CrMoV 5   | H 11  |
| 1.2344                                                        | X40CrMoV51    | X 40 CrMoV 5 1  | Z 40 CDV 5   | BH 13 | X 40 CrMoV 5 1 1 KU 2242 |  | X 40 CrMoV 5   | H 13  |
| 1.2364                                                        | X63CrMoV51    |                 |              |       |                          |  |                |       |
| 1.2363                                                        | X100CrMoV51   | X 100 CrMoV 5 1 | Z 100 CDV 5  | BA 2  | X 100 CrMoV 5 1 KU 2260  |  | X 100 CrMoV 5  | A 2   |
| 1.2367                                                        | X38CrMoV53    |                 |              |       |                          |  |                |       |
| 1.2376                                                        | X96CrMoV12    |                 |              |       |                          |  |                |       |
| 1.2379                                                        | X155CrVMo121  | X 153 CrMoV 12  | Z 160 CDV 12 | BD 2  | X 155 CrVMo 12 1 KU      |  |                | D 2   |
| 1.2436                                                        | X210CrW12     | X 210 CrW 12    |              |       | X 215 CrW 12 1 KU 2312   |  | X 210 CrW 12   |       |
| 1.2453                                                        | X130W5        |                 |              |       |                          |  |                |       |
| 1.2564                                                        | X30WCrV41     |                 |              |       |                          |  | F.527          |       |
| 1.2567                                                        | X30WCrV53     | X 30 WCrV 5 3   | Z 32 WCV 5   |       | X 30 WCrV 5 3 KU         |  |                |       |
| 1.2581                                                        | X30WCrV93     | X 30 WCrV 9 3   | Z 30 WCV 9   | BH 21 | X 30 WCrV 9 3 KU         |  | X 30 WCrV 9    | H 21  |
| 1.2601                                                        | X165CrMoV12   | X 165 CrMoV 12  |              |       | X 165 CrMoW 12 KU 2310   |  | X 160 CrMoV 12 |       |
| 1.2606                                                        | X37CrMoW51    |                 | Z 35 CWDV 5  | BH 12 | X 35 CrMoW 05 KU         |  | F.537          | H 12  |
| 1.2622                                                        | X60WCrMoV94   |                 |              |       |                          |  |                |       |
| 1.2631                                                        | X50CrMoW911   |                 |              |       |                          |  |                |       |
| 1.2662                                                        | X30WCrCoV93   |                 |              |       |                          |  |                |       |
| 1.2678                                                        | X45CrCoVW555  |                 |              |       |                          |  |                |       |
| 1.2764                                                        | X19NiCrMo4    |                 |              |       |                          |  |                |       |
| 1.2767                                                        | X45NiCrMo4    | 40 NiCrMo 4     | Y35 NCD 16   |       | 42 NiCrMo 15 7 KU        |  |                |       |
| 1.2786                                                        | X13NiCrSi3615 |                 |              |       |                          |  |                |       |
| 1.2889                                                        | X45CoCrMoV553 |                 |              |       |                          |  |                |       |
| 1.3302                                                        | S1214         |                 |              |       | (X 150 WV 1305 KU)       |  |                |       |
| 1.3318                                                        | S1212         |                 |              |       |                          |  |                |       |
| 1.3401                                                        | X120Mn12      |                 | Z 120 M 12   |       | X G 120 Mn 12            |  | AM-X 120 Mn 12 | A 128 |
| 1.3533                                                        | 18NiCrMo146   |                 |              |       |                          |  |                |       |
| 1.3815                                                        | X40MnCr182    |                 |              |       |                          |  |                |       |
| 1.3817                                                        | X40MnCr18     |                 |              |       |                          |  |                |       |
| 1.3941                                                        | X4CrNi1813    |                 |              |       |                          |  |                |       |
| 1.3952                                                        | X4CrNiMoN1814 |                 |              |       |                          |  |                |       |
| 1.3958                                                        | X5CrNi1811    |                 |              |       |                          |  |                |       |
| 1.3962                                                        | X15CrNiMn1210 |                 |              |       |                          |  |                |       |
| 1.3965                                                        | X8CrMnNi188   |                 |              |       |                          |  |                |       |
| 1.3967                                                        | X50CrMnNiN229 |                 |              |       |                          |  |                |       |
| 1.4704                                                        | X45SiCr4      |                 |              |       |                          |  |                | HNv 2 |
| 1.4710                                                        | GX30CrSi6     |                 |              |       |                          |  |                |       |
| 1.4712                                                        | X10CrSi6      |                 |              |       |                          |  |                |       |
| 1.4716                                                        | X8Cr9         |                 |              |       |                          |  |                |       |
| 1.4721                                                        | 215Cr12       |                 |              |       |                          |  |                |       |
| 1.4722                                                        | X10CrSi13     |                 |              |       |                          |  | X 10 CrSi 13   |       |
| 1.4725                                                        | CrAl144       |                 |              |       |                          |  |                |       |

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Werkstoffgruppe / material group  
3. Hochlegierte Stähle / High-alloy steels

| Werkstoff<br>Nr.:<br>material<br>No.:                           | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|-----------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 3.1 bis 700 N/ mm <sup>2</sup> / up to 700 N/ mm <sup>2</sup>   |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4767                                                          | CrAl205                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.4773                                                          | X8Cr30                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.4822                                                          | GX40CrNi245                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.4829                                                          | X12CrNi2212                   |                        |                               |                                       | X 16 CrNi 23 14         |                           |                         |                    |
| 1.4842                                                          | X12CrNi2520                   |                        |                               | 310 S 94                              |                         |                           |                         |                    |
| 1.4846                                                          | X40CrNi2521                   |                        |                               | 310 S 98                              |                         |                           |                         |                    |
| 1.4861                                                          | X10NiCr3220                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.6903                                                          | X10CrNiTi1810                 |                        |                               |                                       |                         |                           |                         |                    |
| 3.2 bis 1400 N/ mm <sup>2</sup> / up to 1400 N/ mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.2709                                                          | X3NiCoMoTi1895                |                        |                               |                                       |                         |                           |                         |                    |
| 1.2731                                                          | X50NiCrWV1313                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.2779                                                          | X6NiCrTi2615                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.2787                                                          | X23CrNi17                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.2790                                                          | 72SiNiCrMoV54                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.2888                                                          | X20CoCrWMo109                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.3202                                                          | S12145                        | (HS12-1-5-5)           |                               | BT 15                                 | HS 12-1-5-5             |                           | 12-1-5-5                | T 15               |
| 1.3207                                                          | S104310                       | HS10-4-3-10            | Z130WKCDV10-10-04-04          |                                       | BT 42                   | HS 10-4-3-10              | 10-4-3-10               |                    |
| 1.3243                                                          | S6525                         | (HS6-5-2-5)            | KCV 06-05-05-04-02            |                                       | HS 6-5-2-5              | 2723                      | 6-5-2-5                 | M 35               |
| 1.3246                                                          | S7425                         | HS1-8-1                | Z110 WKCDV 07-05-04           |                                       | HS 7-4-2-5              |                           | 7-4-2-5                 | M 41               |
| 1.3247                                                          | S21018                        | HS2-9-1-8              | Z110 DKCWV 09-08-04           | BM 42                                 | HS 2-9-1-8              |                           | 2-10-1-8                | M 42               |
| 1.3249                                                          | S2928                         |                        |                               | BM 34                                 |                         |                           | 2-9-2-8                 |                    |
| 1.3255                                                          | S18125                        | (HS18-1-1-5)           | Z80 WKCV 18-05-04-01          | BT 4                                  | HS 18-1-1-5             |                           | 18-1-1-5                | T 4                |
| 1.3257                                                          | S181215                       |                        |                               |                                       |                         |                           |                         |                    |
| 1.3265                                                          | S181210                       | (HS18-0-1-10)          |                               | BT 5                                  | HS 18-0-1-10            |                           | 18-0-2-10               | T 5                |
| 1.3342                                                          | SC652                         | (HS6-5-2)              | Z90WDCV06-05-04-02            |                                       | HSC 6-5-3               |                           |                         | M 3                |
| 1.3343                                                          | S652                          | HS6-5-3                | Z85WDCV06-05-04-02            | BM 2                                  | HS 6-5-2                | 2722                      | 6-5-2                   | M 2                |
| 1.3344                                                          | S653                          |                        | Z120WDCV06-05-04-03           |                                       |                         |                           | 6-5-3                   | M 3 Cl.2           |
| 1.3346                                                          | S291                          | HS1-8-1                | Z85DCW08-04-02-01             | BM 1                                  | HS 1-8-1                |                           |                         | M 1                |
| 1.3348                                                          | S292                          | HS2-9-2                | Z100DCWV09-04-02-02           |                                       | HS 2-9-2                | 2782                      | 2-9-2                   | M 7                |
| 1.3355                                                          | S1801                         | HS18-0-1               | Z80WCV18-04-01                | BT 1                                  | HS 18-0-1               |                           | 18-0-1                  | T 1                |
| 1.3543                                                          | X102CrMo17                    |                        |                               |                                       | X 105 CrMo 17           |                           | X 100 CrMo 17           |                    |
| 1.3549                                                          | X89CrMoV81                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.3551                                                          | 80MoCrV4216                   |                        | 80 DCV 40                     |                                       | X 80 MoCrV 4 4          |                           | 80 MoCrV 40-16          | M 50               |
| 1.3819                                                          | X50MnCrV2014                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.3949                                                          | X5MnCr1813                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.3964                                                          | X4CrNiMnMoN19165              |                        |                               |                                       |                         |                           |                         |                    |
| 1.3968                                                          | X12MnCr1812                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.3974                                                          | X3CrNiMoNbN2317               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4718                                                          | X45CrSi93                     | X 45 CrSi 8            | Z 45 CS 9                     | 401 S 45                              | X 45 CrSi 8             |                           | X 4 SCrSi 09-03         | HNV 3              |
| 1.4748                                                          | X85CrMoV182                   |                        | Z 85 CDMV 18.02               |                                       | X 85 CrMoV 19 3         |                           | X 85 CrMoV 18-02        |                    |
| 1.4785                                                          | X60CrMnMoVNbN2110             |                        |                               |                                       |                         |                           |                         |                    |
| 1.4873                                                          | X45CrNiW189                   |                        | Z 35 CNWS 14.14               | 331 S 40                              | X 45 CrNiW 18 9         |                           | X 45 CrNiSiW 18-09      |                    |
| 1.4875                                                          | X55CrMnNiN208                 |                        |                               |                                       |                         |                           | X 55 CrMnNiN 20-08      | EV 12              |
| 1.4911                                                          | X8CrCoNiMo106                 |                        |                               | S.152                                 |                         |                           |                         |                    |
| 1.4913                                                          | X19CrMoVNbN111                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4920                                                          | X15CrMoV121                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.4922                                                          | X20CrMoV121                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.4935                                                          | X20CrMoWV121                  |                        |                               |                                       | X 22 CrMoWV 121         |                           |                         | 422                |
| 1.4945                                                          | X6CrNiWNb1616                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4960                                                          | X40CrNiCoNb1313               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4962                                                          | X12CrNiWTi1613                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4971                                                          | X12CrCoNi2120                 |                        |                               |                                       |                         |                           |                         | 661                |
| 1.4986                                                          | X8CrNiMoBNb1616               |                        |                               |                                       |                         |                           |                         |                    |

Werkstoffgruppe / material group  
4. Rostfreie Stähle / Stainless steels

|                                                       |            |                 |                |          |              |      |             |       |
|-------------------------------------------------------|------------|-----------------|----------------|----------|--------------|------|-------------|-------|
| 4.1 ferritisch/ martensitisch / ferritic/ martensitic |            |                 |                |          |              |      |             |       |
| 1.4000                                                | X6Cr13     | X 6 Cr 13       | Z 6 C 13       | 403 S 17 | X 6 Cr 13    | 2301 | X 6 Cr 13   | 403   |
| 1.4002                                                | X6CrAl13   | X 6 CrAl 13     | Z 6 CA 13      | 405 S 17 | X 6 CrAl 13  | 2302 | X 6 CrAl13  | 405   |
| 1.4005                                                | X12CrS13   | X 12 CrS 13     | Z 12 CF 13     | 416 S 21 | X 12 CrS 13  | 2380 | X 12 CrS 13 | 416   |
| 1.4006                                                | X10Cr13    | (X 12 Cr 13 KD) | Z 12 C 13      | 410 S 21 | X 12 Cr 13   | 2302 | X 12 Cr 13  | 410   |
| 1.4008                                                | GX8CrNi13  |                 | Z 12 CN 13 M   | 410 C 21 | GX 12 Cr 13  |      |             |       |
| 1.4016                                                | X6Cr17     |                 | Z 8 C 17       | 430 S 15 | X 8 Cr 17 KD | 2320 | X 8 Cr 17   | 430   |
| 1.4021                                                | X20Cr13    | X 20 Cr 13      | Z 20 C 13      | 420 S 37 | X 20 Cr 13   | 2303 | X 20 Cr 13  | 420   |
| 1.4024                                                | X15Cr13    | X 15 Cr 13      |                | 420 S 29 | X 12 Cr 13   |      |             |       |
| 1.4027                                                | GX20Cr14   |                 | Z 20 C 13 M    | 420 C 29 |              |      |             |       |
| 1.4028                                                | X30Cr13    | X 30 Cr 13      | Z 30 C 13      | 420 S 45 | X 30 Cr 13   | 2304 | X 30 Cr 13  |       |
| 1.4059                                                | GX22CrNi17 |                 | Z 20 CN 17.2 M |          |              |      |             |       |
| 1.4085                                                | GX70Cr29   |                 |                |          |              |      |             |       |
| 1.4086                                                | GX120Cr29  |                 |                |          |              |      |             |       |
| 1.4104                                                | X12CrMoS17 | X 14 CrMoS 17   | Z 10 CF 17     |          | X 10 CrS 17  | 2383 | X 10 CrS 17 | 430 F |
| 1.4105                                                | X4CrMoS18  |                 |                |          |              |      |             |       |
| 1.4106                                                | X10CrMo13  |                 |                |          |              |      |             |       |
| 1.4107                                                | GX8CrNi12  |                 |                |          |              |      |             |       |
| 1.4113                                                | X6CrMo171  | (X 8 CrMo 17)   | Z 8 CD 17.01   | 434 S 17 | X 8 CrMo 17  | 2325 |             | 434   |

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Werkstoffgruppe / material group  
4. Rostfreie Stähle / Stainless steels

| Werkstoff<br>Nr.:<br>material<br>No.:                           | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|-----------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 4.1 ferritisch / martensitisch / ferritic / martensitic         |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4119                                                          | X15CrMo13                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.4302                                                          | X5CrNi199                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.4305                                                          | X10CrNiS189                   | X 10 CrNiS 18 9        | Z 10 CNF 18.09                | 303 S 21                              | X 10 CrNiS 18 09        | 2346                      | X 10 CrNiS 18 9         | 303                |
| 1.4313                                                          | X5CrNi134                     |                        | Z 4 CDN 13.4                  |                                       | X 6 CrNi 13 04          | 2385                      |                         | CA 6-NM            |
| 1.4321                                                          | X2NiCr1816                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4332                                                          | X2CrNi2412                    |                        | Z 2 CN 24.13                  |                                       |                         |                           |                         |                    |
| 1.4337                                                          | X10CrNi309                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4340                                                          | GX40CrNi274                   |                        |                               |                                       | GX 35 CrNi 28 05        |                           |                         |                    |
| 1.4347                                                          | GX6CrNiN267                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.4351                                                          | X3CrNi134                     |                        |                               |                                       |                         |                           |                         |                    |
| 1.4370                                                          | X15CrNiMn188                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.4405                                                          | GX5CrNiMo165                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.4430                                                          | X2CrNiMo1912                  |                        | Z 2 CND 19.12                 | 316 S 93                              |                         |                           |                         |                    |
| 1.4437                                                          | GX6CrNiMo1812                 |                        |                               | 317 C 12                              |                         |                           |                         |                    |
| 1.4440                                                          | X2CrNiMo18165                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4446                                                          | GX2CrNiMoN17132               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4448                                                          | GX6CrNiMo1713                 |                        |                               | 317 C 16                              |                         |                           |                         |                    |
| 1.4449                                                          | X5CrNiMo1713                  |                        |                               | 317 S 16                              | X 5 CrNiMo 18 15        |                           |                         | 317                |
| 1.4455                                                          | X2CrNiMnMoN2016               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4463                                                          | GX6CrNiMo2482                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4502                                                          | X8CrTi18                      |                        |                               |                                       |                         |                           |                         |                    |
| 1.4505                                                          | X5NiCrMoCuNb2018              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4510                                                          | X6CrTi17                      | X 8 Cr Ti 17           | Z 8 CT 17                     |                                       | X 6 CrTi 17             |                           | X8CrTi17                | 430 Ti             |
| 1.4511                                                          | X6CrNb17                      |                        | Z 8 CNb 17                    |                                       | X 6 CrNb 17             |                           |                         | 430 Nb             |
| 1.4512                                                          | X6CrTi12                      |                        | Z 6 CT 12                     | 409 S 19                              | X 6 CrTi 12             |                           |                         | 409                |
| 1.4523                                                          | X8CrMoTi17                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4528                                                          | X105CrCoMo182                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4531                                                          | GX2NiCrMoCuN2018              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4535                                                          | X90CrCoMoV17                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.4536                                                          | GX2NiCrMoCuN2520              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4543                                                          | X5CrNiNb189                   |                        |                               |                                       | X6CrNiNb 18 11          |                           |                         |                    |
| 1.4551                                                          | X5CrNiNb199                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.4576                                                          | X5CrNiMoNb1912                |                        |                               | 318 S 96                              |                         |                           |                         |                    |
| 1.4724                                                          | X10CrAl13                     |                        | Z 10 C 13                     | (403 S 17)                            | X 10 CrAl 12            |                           | X 10 CrAl13             |                    |
| 1.4742                                                          | X10CrAl18                     |                        | Z 10 CAS 18                   | (403 S 15)                            | (X 8 Cr 17)             |                           | X 10 CrAl 18            | 430                |
| 1.4747                                                          | X80CrNiSi20                   |                        | Z 80 CSN 20.02                | 433 S 65                              | X 80 CrSiNi 20          |                           | X 80 CrSiNi20-02        | HNV 6              |
| 1.4762                                                          | X10CrAl24                     |                        | Z 10 CAS 24                   |                                       | X 16 Cr 26              |                           | X 10 CrAl 24            | 446                |
| 1.4871                                                          | X53CrMnNiN219                 |                        | Z 52 CMN 21.09                | 349 S 54                              | X 53 CrMnNiN 21 9       |                           | X 53 CrMnNiN 21-09      | EV 8               |
| 1.4882                                                          | X50CrMnNiNbN219               |                        | Z 50 CMNNb 21.09              |                                       |                         |                           |                         |                    |
| 4.2 martensitisch / martensitic                                 |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4031                                                          | X38Cr13                       | X 40 Cr 13             | Z 40 C 14                     |                                       | X 40 Cr 14              | 2304                      | X 40 Cr 13              |                    |
| 1.4034                                                          | X46Cr13                       | X 45 Cr 13             | Z 40 C 14                     | (420 S45)                             | X 40 Cr 14              |                           | X 46 Cr 13              |                    |
| 1.4057                                                          | X20CrNi172                    | X 19 CrNi 17 2         | Z 15 CN 16.02                 | 431 S 29                              | X 16 CrNi 16            | 2321                      | X 15 CrNi 16            | 431                |
| 1.4109                                                          | X65CrMo14                     |                        | Z 70 CD 14                    |                                       |                         |                           |                         |                    |
| 1.4110                                                          | X55CrMo14                     |                        | Z 50 CD 13                    |                                       |                         |                           |                         |                    |
| 1.4111                                                          | X110CrMoV15                   |                        |                               |                                       |                         |                           |                         |                    |
| 1.4112                                                          | X90CrMoV18                    |                        |                               |                                       |                         |                           |                         | 440 B              |
| 1.4115                                                          | X20CrMo171                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4116                                                          | X45CrMoV15                    |                        |                               |                                       |                         |                           | X 46 CrMo 16            |                    |
| 1.4117                                                          | X38CrMoV15                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4120                                                          | X20CrMo13                     |                        | Z 20 CD 14                    |                                       |                         |                           |                         |                    |
| 1.4122                                                          | X35CrMo17                     |                        |                               |                                       | X 35 CrMo 17            |                           |                         |                    |
| 1.4125                                                          | X105CrMo17                    |                        | Z 100 CD 17                   |                                       |                         |                           |                         | 440 C              |
| 1.4136                                                          | GX70CrMo292                   |                        | Z 60 CD 29.2 M                |                                       |                         |                           |                         |                    |
| 1.4138                                                          | GX120CrMo292                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.4729                                                          | GX40CrSi13                    |                        |                               |                                       | GX 35 Cr 13             |                           |                         |                    |
| 1.4740                                                          | GX40CrSi17                    |                        |                               |                                       | GX 35 Cr 17             |                           |                         |                    |
| 1.4745                                                          | GX40CrSi23                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4776                                                          | GX40CrSi29                    |                        |                               |                                       | GX 35 Cr 28             |                           |                         |                    |
| 1.4923                                                          | X22CrMoV121                   |                        |                               |                                       | X 22 CrMoV121           |                           |                         |                    |
| 1.4931                                                          | GX22CrMoV121                  |                        |                               |                                       |                         |                           |                         |                    |
| 2.4537                                                          | GNiMo16CrW                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.4631                                                          | NiCr20TiAl                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4319                                                          | X3CrNiN178                    |                        |                               |                                       |                         |                           |                         |                    |
| 4.3 austenitisch, austenitisch/ferritisch / austenitic/ferritic |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.2780                                                          | X15CrNiSi2012                 | X 16 CrNiSi 20 12      | Z 15 CN 24.13                 |                                       |                         |                           |                         |                    |
| 1.2782                                                          | X15CrNiSi2520                 | X 16 CrNiSi 25 20      | Z 15 CN 24.13                 |                                       |                         |                           |                         |                    |
| 1.4009                                                          | X8Cr14                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.4015                                                          | X8Cr18                        |                        |                               |                                       |                         |                           |                         |                    |
| 1.4108                                                          | X100CrMo13                    |                        |                               |                                       |                         |                           |                         |                    |
| 1.4301                                                          | X5CrNi1810                    | X 6 CrNi 18 10 KD      | Z 6 CN 18.09                  | 304 S 15                              | X 5 CrNi 18 10          | 2332                      | X 5 CrNi 18 11          | 304 H              |
| 1.4303                                                          | X5CrNi1812                    | X 8 CrNi 18 12 KD      | Z 8 CN 17.07                  | 305 S 19                              | X 8 CrNi 19 10          |                           | X 8 CrNi 18-12          | 308                |
| 1.4310                                                          | X12CrNi177                    | X 12 CrNi 17 7         | Z 12 CN 17.07                 | 301 S 21                              | X 12 CrNi 17 07         |                           | X 12 CrNi 17 07         | 301                |
| 1.4311                                                          | X2CrNiN1810                   | X 2 CrNiN 18 10        | Z 8 CN 18.12                  | 304 S 62                              | X 8 CrNi 19 10          | 2371                      | X 8 CrNi 18-12          | 304 LN             |
| 1.4312                                                          | GX10CrNi188                   |                        | Z 10 CN 18.9 M                | 302 C 25                              |                         |                           |                         |                    |



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Werkstoffgruppe / material group

4. Rostfreie Stähle / Stainless steels

| Werkstoff<br>Nr.:<br>material<br>No.:                           | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|-----------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 4.3 austenitisch, austenitisch/ferritisch / austenitic/ferritic |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4401                                                          | X5CrNiMo17122                 | X6 CrNiMo 17 12 2 KD   | Z 6 CND 17.11                 | 316 S 16                              | X 5 CrNiMo 17 12        | 2347                      | X 5 CrNiMo 17-12        | 316                |
| 1.4404                                                          | X2CrNiMo17132                 | GX3CrNiMo 17 12 2 KD   | Z 3 CND 19.10 M               | 316 S 12                              | GX 2 CrNiMo 19 11       | 2348                      | X 2 CrNiMo 17-12-03     | 316 L              |
| 1.4406                                                          | X2CrNiMoN17122                | X 3 CrNiMoN 17 12 2    | Z 2 CND 17.12 Az              | 316 S 61                              | X 2 CrNiMoN 17 12       |                           |                         | 316 LN             |
| 1.4408                                                          | GX6CrNiMo1810                 |                        |                               | 316 C 16                              |                         | 2343                      | X 7 CrNiMo 20 10        | CF-8M              |
| 1.4410                                                          | GX10CrNiMo189                 |                        | Z 5 CND 20.10 M               |                                       |                         |                           |                         |                    |
| 1.4429                                                          | X2CrNiMoN17133                | X 3 CrNiMoN 17 13 3    | Z 2 CND 17.13 Az              | 316 S 62                              | X 2 CrNiMoN 17 13       | 2375                      |                         | 316 LN             |
| 1.4436                                                          | X5CrNiMo17133                 | X 6 CrNiMo 18 13 3 KD  | Z 6 CND 17.12                 | 316 S 16                              | X 5 CrNiMo 17 13        | 2343                      | X 6 CrNiMo 17-12-03     | 316                |
| 1.4439                                                          | X2CrNiMoN17135                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4465                                                          | X1CrNiMoN25252                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4503                                                          | X3NiCrCuMoTi2723              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4506                                                          | X5NiCrMoCuTi2018              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4529                                                          | X1NiCrMoCuN25206              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4539                                                          | X1NiCrMoCuN25205              |                        | Z 1 NCDU 25.20                |                                       |                         | 2662                      |                         |                    |
| 1.4541                                                          | X6CrNiTi1810                  | X 6 CrNiTi 18 10       | Z 6 CNT 18.10                 | 321 S 12                              | X 6 CrNiTi 18 11        | 2337                      | X 7 CrNiTi 18-11        | 321                |
| 1.4542                                                          | X5CrNiCuNb164                 | X5CrNiCuNb16-4         | Z 7 CNU 17.04                 | X5CrNiCuNb16-4                        | X5CrNiCuNb16-4          |                           |                         | 630                |
| 1.4550                                                          | X6CrNiNb1810                  | X 6 CrNiNb 18 10       | Z 6 CNNb 18.10                | 347 S 17                              | X 6 CrNiNb 18 11        | 2338                      | X 6 CrNiNb 18-11        | 347                |
| 1.4552                                                          | GY5CrNiNb189                  |                        | Z 4 CNNb 19.10 M              | 347 C 17                              |                         |                           |                         |                    |
| 1.4571                                                          | X6CrNiMoTi17122               |                        | Z 6 CNDT 17.12                | 320 S 31                              | X 6 CrNiMoTi 17 12      | 2350                      | X6 CrNiMoTi 17-12-03    | 316 Ti             |
| 1.4573                                                          | X10CrNiMoTi1812               |                        |                               | 320 S 33                              | X 6 CrNiMoTi 17 13      |                           |                         | 316 Ti             |
| 1.4575                                                          | X1CrNiMoNb2842                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4577                                                          | X3CrNiMoTi2525                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4581                                                          | GX5CrNiMoNb1810               |                        | Z 4 CNDNb 18.12 M             | 318 C 17                              | GX 6 CRNOMONb 20 11     |                           |                         |                    |
| 1.4582                                                          | X4CrNiMoNb257                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4583                                                          | X10CrNiMoNb1812               |                        |                               |                                       | X 6 CrNiMoNb 17 13      |                           |                         | 318                |
| 1.4585                                                          | GX7CrNiMoCuNb1818             |                        |                               |                                       |                         |                           |                         |                    |
| 1.4586                                                          | X5CrNiMoCuNb2218              |                        |                               |                                       |                         |                           |                         |                    |
| 1.4825                                                          | GX25CrNiSi189                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4826                                                          | GX40CrNiSi229                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4828                                                          | X15CrNiSi2012                 |                        | Z 15 CNS 20.12                | 309 S 24                              | X 16 CrNiSi 25.20       |                           | X 15 CrNiSi 20-12       | 309                |
| 1.4833                                                          | X7CrNi2314                    |                        | Z 15 CN 24.13                 | 309 S 24                              | X 6 CNI 23 14           |                           |                         | 309 S              |
| 1.4841                                                          | X15CrNiSi2520                 |                        | Z 15 CNS 25.20                |                                       | X 16 CrNiSi 25 20       |                           | X 15 CrNiSi 25-20       | 310                |
| 1.4845                                                          | X12CrNi2521                   |                        | Z 12 CN 25.20                 | 310 S 24                              | X 6 CrNi 25 20          | 2361                      | F.331                   | 310 S              |
| 1.4848                                                          | GX40CrNiSi2520                |                        |                               | 310 C 40                              | GX 40 CrNi 26 20        |                           | X 40 CrNi 25 20         | HK                 |
| 1.4878                                                          | X12CrNiTi189                  |                        | Z 6 CNT 18.12                 | 321 S 20                              | X 6 CrNiTi 18.11        | 2337                      | X 6 CrNiTi 18 11        | 321                |
| 1.4941                                                          | X8CrNiTi1810                  |                        |                               |                                       |                         |                           |                         |                    |
| 1.4948                                                          | X6CRNi1811                    |                        |                               | 304 S 51                              |                         |                           |                         |                    |
| 1.4949                                                          | X3CRNi1811                    |                        |                               |                                       | X 2 CRNiN 18 11         |                           |                         |                    |
| 1.4961                                                          | X8CrNiNb1613                  |                        |                               |                                       |                         |                           | X 7 CrNiNb 16-13        |                    |
| 1.4981                                                          | X8CrNiMoNb1616                |                        |                               |                                       |                         |                           | X 7 CrNiMo 16-16        |                    |
| 1.4460                                                          | X4CrNiMo2752                  |                        |                               |                                       |                         | 2324                      | X 8 CrNiMo 27-05        | 329                |
| 1.4462                                                          | X2CrNiMoN2253                 |                        |                               |                                       |                         | 2377                      |                         |                    |
| 1.4821                                                          | X20CrNiSi254                  |                        | Z 20 CNS 25.04                |                                       | X 20 CrNiSi 254         |                           | X 20 CrNiSi 25-04       |                    |
| 1.4523                                                          | GX40CrNiSi274                 |                        |                               |                                       |                         |                           |                         |                    |
| 1.4534                                                          | X3CrNiMoAl1382                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4547                                                          | X1CrNiMoCuN20187              | X1CrNiMoCuN20-18-7     | X1CrNiMoCuN20-18-7            | X1CrNiMoCuN20-18-7                    | X1CrNiMoCuN20-18-7      |                           | X1CrNiMoCuN20-18-7      |                    |
| 1.4548                                                          | X5CrNiCuNb1744                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4568                                                          | X7CrNiAl177                   | X7CrNiAl17-7           | X7GNiAl17-7; Z 9 CNA 17-07    | X7CrNiAl177, 301 S 81                 | X7CrNiAl17-7            |                           | X7CrNiAl17-7            |                    |

Werkstoffgruppe / material group

5. Warmfeste Legierungen/ Heat-resistant materials

|                                                                                     |                  |                     |                |                 |                  |      |                     |                 |
|-------------------------------------------------------------------------------------|------------------|---------------------|----------------|-----------------|------------------|------|---------------------|-----------------|
| 5.1 Fe-Basis bis 650 N/mm <sup>2</sup> / Fe-basis up to 650 N/mm <sup>2</sup>       |                  |                     |                |                 |                  |      |                     |                 |
| 0.6676                                                                              | GGLNiCr303       | GJLA-XNiCr 30-3     | L-NC 30 3      | L-NiCr 30 3     |                  |      |                     | A 436 Type 3    |
| 0.6680                                                                              | GGNiSiCr3055     | GJLA-XNiSiCr 30-5-5 | L-NSC 30 5 5   | L-NiSiCr 30 5 5 |                  |      |                     | A 436 Type 4    |
| 0.7676                                                                              | GGGNiCr303       | GJSA-XNiCr 30-3     | S-NC 30 3      | S-NiCr 30 3     |                  |      |                     | A 439 Type D-3  |
| 0.7677                                                                              | GGGNiCr301       | GJSA-XNiCr 30-1     | S-NC 30 1      | S-NiCr 30 1     |                  |      |                     | A 439 Type D-3A |
| 0.7679                                                                              | GGGNiSiCr3055    | GJSA-XNiSiCr 30-5-5 |                |                 |                  |      |                     |                 |
| 0.7680                                                                              | GGGNiSiCr3053    | GJSA-XNiSiCr 30-5-3 | S-NSC 30 5 5   | S-NiSiCr 30 5 5 |                  |      |                     | A 439 Type D-4  |
| 0.7683                                                                              | GGGNi35          | GJSA-XNi 35         | S-N 35         | S-Ni 35         |                  |      |                     | A 439 Type D-5  |
| 0.7685                                                                              | GGGNiCr353       | GJSA-XNiCr 35-3     | S-NC 35 3      | S-NiCr 35 3     |                  |      |                     | A 439 Type D-5A |
| 0.7688                                                                              | GGGNiNiSiCr3552  | GJSA-XNiSiCr 35-5-2 |                |                 |                  |      |                     |                 |
| 1.4335                                                                              | X1CrNi2521       |                     |                |                 |                  |      |                     |                 |
| 1.4361                                                                              | X1CrNiSi1815     |                     | Z 1 CNS 18.15  |                 |                  |      |                     |                 |
| 1.4558                                                                              | X2NiCrAlTi3220   |                     |                |                 |                  |      |                     |                 |
| 1.4562                                                                              | X1NiCrMoCu32287  |                     |                |                 |                  |      |                     |                 |
| 1.4563                                                                              | X1NiCrMoCuN31274 |                     |                |                 |                  | 2584 |                     |                 |
| 1.4857                                                                              | GX40NiCrSi3525   |                     |                |                 | GX 50 NiCr 35 25 |      |                     |                 |
| 1.4862                                                                              | X8NiCrSi3818     |                     |                |                 |                  |      |                     |                 |
| 1.4864                                                                              | X12NiCrSi3616    |                     | Z 12 NCS 37.18 | NA 17           |                  |      | X 12 CrNiSi 36-16   | 330             |
| 1.4865                                                                              | GX40NiCrSi3818   |                     |                | 330 C 40        | GX 50 NiCr 39 19 |      |                     |                 |
| 1.4876                                                                              | X10NiCrAlTi3220  |                     | Z 8 NC 32.21   | NA 15           |                  |      | X 10 NiCrAlTi 32-30 | B 163           |
| 5.2 Fe-Basis bis 750 N/mm <sup>2</sup> / Fe-basis up to 750 N/mm <sup>2</sup>       |                  |                     |                |                 |                  |      |                     |                 |
| 1.4958                                                                              | X5NiCrAlTi3120   |                     |                |                 |                  |      |                     |                 |
| 1.4977                                                                              | X40CoCrNi2020    |                     | Z 42 CNKDOWNb  |                 |                  |      |                     |                 |
| 5.3 Cr-Ni-Basis bis 800 N/mm <sup>2</sup> / Cr-Ni-basis up to 800 N/mm <sup>2</sup> |                  |                     |                |                 |                  |      |                     |                 |
| 1.4939                                                                              | X12CrNiMo12      |                     |                | S.151           |                  |      |                     |                 |

Internationaler Normenvergleich  
International comparison of standards

Werkstoffgruppe / material group  
5. Warmfeste Legierungen / Heat-resistant materials

| Werkstoff<br>Nr.:<br>material<br>No.:                                                 | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|---------------------------------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 5.3 Cr-Ni-Basis bis 800 N/mm <sup>2</sup> / Cr-Ni-basis up to 800 N/mm <sup>2</sup>   |                               |                        |                               |                                       |                         |                           |                         |                    |
| 1.4944                                                                                | A286                          |                        |                               |                                       |                         |                           |                         |                    |
| 1.4959                                                                                | X5NiCrAlTi3221                |                        |                               |                                       |                         |                           |                         |                    |
| 1.4980                                                                                | X5CrNiTi2615                  |                        | Z 6 NCTDV 25.15 B             | 286 S 31                              |                         |                           |                         | 660                |
| 2.4060                                                                                | Ni99,6                        |                        |                               |                                       |                         |                           |                         |                    |
| 2.4066                                                                                | Ni99,2                        |                        |                               | NA 11                                 |                         |                           |                         | N 02200            |
| 2.4170                                                                                | GNi95                         |                        |                               |                                       |                         |                           |                         | SZ-100             |
| 2.4175                                                                                | GNi93C                        |                        |                               |                                       |                         |                           |                         | CZ-100             |
| 2.4180                                                                                | GNi93Si                       |                        |                               |                                       |                         |                           |                         |                    |
| 2.4360                                                                                | NiCu30Fe                      |                        | NU 30                         | NA 13                                 |                         |                           |                         | N 04400            |
| 2.4602                                                                                | NiCr21Mo14W                   |                        |                               |                                       |                         |                           |                         |                    |
| 2.4605                                                                                | NiCr23Mo16Al                  |                        |                               |                                       |                         |                           |                         |                    |
| 2.4610                                                                                | NiMo16Cr16Ti                  |                        |                               |                                       |                         |                           |                         | N 06455            |
| 2.4617                                                                                | NiMo28                        |                        | NiMo28                        |                                       |                         |                           |                         | N 10665            |
| 2.4619                                                                                | NiCr22Mo7Cu                   |                        |                               |                                       |                         |                           |                         | N 06985            |
| 2.4630                                                                                | NiCr20Ti                      |                        | NC 20 T                       | HR 5                                  |                         |                           |                         | N 06075            |
| 2.4642                                                                                | NiCr29Fe                      |                        | NC 30 Fe                      |                                       |                         |                           |                         | N 06690            |
| 2.4658                                                                                | NiCr7030                      |                        |                               |                                       |                         |                           |                         |                    |
| 2.4660                                                                                | NiCr20CuMo                    |                        |                               |                                       |                         |                           |                         | N 08020            |
| 2.4665                                                                                | NiCr22Fe18Mo                  |                        |                               |                                       |                         |                           |                         |                    |
| 2.4778                                                                                | GCoCr28                       |                        |                               |                                       |                         |                           |                         |                    |
| 2.4810                                                                                | GNiMo30                       |                        |                               |                                       |                         |                           |                         | N-12 MV            |
| 2.4816                                                                                | NiCr15Fe                      |                        | NC 15 Fe                      | NA 14                                 |                         |                           |                         | N 06600            |
| 2.4819                                                                                | NiMo16Cr15W                   |                        | NC 17 D                       |                                       |                         |                           |                         | N 10276            |
| 2.4851                                                                                | NiCr23Fe                      |                        | NC 23 Fe A                    |                                       |                         |                           |                         | N 06601            |
| 2.4856                                                                                | NiCr22Mo9Nb                   |                        | NC 22 Fe DNb                  | NA 21                                 |                         |                           |                         | N 06625            |
| 2.4858                                                                                | NiCr21Mo                      |                        | NC 21 Fe Du                   | NA 16                                 |                         |                           |                         | N 08825            |
| 2.4867                                                                                | NiCr6015                      |                        |                               |                                       |                         |                           |                         |                    |
| 2.4869                                                                                | NiCr8020                      |                        |                               |                                       |                         |                           |                         |                    |
| 2.4951                                                                                | NiCr20Ti                      |                        | NC 20 T                       | HR 5                                  |                         |                           |                         | N 06075            |
| 2.4952                                                                                | NiCr20TiAl                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.4969                                                                                | NiCr20Co18Ti                  |                        |                               |                                       |                         |                           |                         |                    |
| 2.4975                                                                                | NiFeCr12Mo                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.4976                                                                                | NiCr20Mo                      |                        |                               |                                       |                         |                           |                         |                    |
| 2.4982                                                                                | NiCr20CoMo                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.4989                                                                                | CoCr20NiW                     |                        |                               |                                       |                         |                           |                         |                    |
| 5.4 Cr-Ni-Basis bis 950 N/mm <sup>2</sup> / Cr-Ni-basis up to 950 N/mm <sup>2</sup>   |                               |                        |                               |                                       |                         |                           |                         |                    |
| 2.4365                                                                                | GNiCu30Nb                     |                        |                               |                                       |                         |                           |                         | M 35-1/2           |
| 2.4367                                                                                | GNiCu30Si3                    |                        |                               |                                       |                         |                           |                         | M 30-H             |
| 2.4368                                                                                | GNiCu30Si4                    |                        |                               |                                       |                         |                           |                         | M-255              |
| 2.4669                                                                                | NiCr15FeTiAl                  |                        | NC 15 TNb A                   |                                       |                         |                           |                         | N 07750            |
| 2.4685                                                                                | GNiMo28                       |                        |                               |                                       |                         |                           |                         | N-7 M              |
| 2.4686                                                                                | GNiMo17CrW                    |                        |                               |                                       |                         |                           |                         | CW-12 MW           |
| 2.4879                                                                                | GNiCr28W                      |                        |                               |                                       |                         |                           |                         |                    |
| 2.4883                                                                                | GNiMo16CrW                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.4964                                                                                | CoCr20W15Ni                   |                        | KC 22 WN                      | HR 240                                |                         |                           |                         | R 30605            |
| 2.4973                                                                                | NiCr19Co11MoTi                |                        | NC 19 KDT                     |                                       |                         |                           |                         | AMS 5399           |
| 5.5 Cr-Ni-Basis bis 1100 N/mm <sup>2</sup> / Cr-Ni-basis up to 1100 N/mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 2.4375                                                                                | NiCu30Al                      |                        | NU 30 AT                      | NA 18                                 |                         |                           |                         | N 05500            |
| 2.4632                                                                                | NiCr20Co18Ti                  |                        |                               |                                       |                         |                           |                         |                    |
| 2.4634                                                                                | NiCo20Cr15MoAlTi              |                        |                               |                                       |                         |                           |                         |                    |
| 2.4650                                                                                | NiCo20Cr20MoTi                |                        | NCK 20 D                      | HR 10                                 |                         |                           |                         | N 70263            |
| 2.4663                                                                                | NiCr23Co12Mo                  |                        |                               |                                       |                         |                           |                         | N 06617            |
| 2.4668                                                                                | NiCr19FeNbMo                  |                        | NC 19 Fe Nb                   |                                       |                         |                           |                         | N 07718            |
| 2.4952                                                                                | NiCr20TiAl                    |                        | NC 20 TA                      | NA 20                                 |                         |                           |                         | N 07080            |
| 2.4955                                                                                | NiFe25Cr20NbTi                |                        |                               |                                       |                         |                           |                         |                    |
| 2.4983                                                                                | NiCr18Co18MoTi                |                        |                               |                                       |                         |                           |                         |                    |

Werkstoffgruppe / material group  
6. Titan- und Titanlegierungen / Titanium and titanium alloys

|                                                                                                                            |                  |  |        |            |  |  |  |         |
|----------------------------------------------------------------------------------------------------------------------------|------------------|--|--------|------------|--|--|--|---------|
| 6.1 Reintitan / Titanlegierungen bis 850 N/mm <sup>2</sup> / pure titanium and titanium alloys up to 850 N/mm <sup>2</sup> |                  |  |        |            |  |  |  |         |
| 3.7025                                                                                                                     | Ti1              |  |        | 2 TA 1     |  |  |  | R 50250 |
| 3.7035                                                                                                                     | Ti2              |  |        | 2 TA 2-5   |  |  |  | R 50400 |
| 3.7055                                                                                                                     | Ti3              |  |        | TA 3       |  |  |  | R 50550 |
| 3.7065                                                                                                                     | Ti4              |  |        | 2 TA 6-9   |  |  |  | R 50700 |
| 3.7124                                                                                                                     | TiCu2            |  |        | 2 TA 21-24 |  |  |  |         |
| 3.7195                                                                                                                     | TiAl3V2,5        |  |        |            |  |  |  |         |
| 3.7225                                                                                                                     | Ti1Pd            |  |        | TP 1       |  |  |  | R 52250 |
| 3.7235                                                                                                                     | Ti2Pd            |  |        |            |  |  |  | R 52400 |
| 3.7255                                                                                                                     | Ti3Pd            |  |        |            |  |  |  |         |
| 6.2 Titanlegierungen bis 1200 N/mm <sup>2</sup> / titanium alloys up to 1200 N/mm <sup>2</sup>                             |                  |  |        |            |  |  |  |         |
| 3.7110                                                                                                                     | TiAl5Fe2,5       |  |        |            |  |  |  |         |
| 3.7115                                                                                                                     | TiAl5Sn2         |  |        |            |  |  |  |         |
| 3.7145                                                                                                                     | TiAl6Sn2Zr4Mo2Si |  |        |            |  |  |  | R 54620 |
| 3.7155                                                                                                                     | TiAl6ZrMo0,5     |  |        | TA 43      |  |  |  |         |
| 3.7165                                                                                                                     | TiAl6V4          |  | TA 6 V | TA 10-13   |  |  |  | R 56400 |
| 3.7175                                                                                                                     | TiAl6V6Sn2       |  |        |            |  |  |  |         |
| 3.7185                                                                                                                     | TiAl4Mo4Sn2      |  |        | TA 45-51   |  |  |  |         |

Internationaler Normenvergleich  
International comparison of standards

Werkstoffgruppe / material group  
7. Gusseisen / Cast iron

| Werkstoff<br>Nr.:<br>material<br>No.:                                  | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|------------------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 7.1 Grauguss bis 180 HB / grey cast iron up to 180 HB / GG             |                               |                        |                               |                                       |                         |                           |                         |                    |
| 0.6010                                                                 | GG10                          | GJL-100                | Ft 10 B                       |                                       | G 10                    | 0110-00                   | FG 10                   | A48-20 B           |
| 0.6012                                                                 | GG150HB                       | GJL-HB 170             |                               |                                       |                         |                           |                         |                    |
| 0.6015                                                                 | GG15                          | GJL-150                | Ft 15 D                       | Grade 150                             | G 15                    | 0115-00                   | FG 15                   | A48-25 B           |
| 0.6017                                                                 | GG170HB                       | GJL-HB 205             |                               |                                       |                         |                           |                         |                    |
| 7.2 Grauguss bis 350 HB / grey cast iron up to 350 HB / GG             |                               |                        |                               |                                       |                         |                           |                         |                    |
| 0.6020                                                                 | GG20                          | GJL-200                | Ft 20 D                       | Grade 220                             | G 20                    | 0120-00                   | FG 20                   | A48-30 B           |
| 0.6022                                                                 | GG190HB                       | GJL-HB 230             |                               |                                       |                         |                           |                         |                    |
| 0.6025                                                                 | GG25                          | GJL-250                | Ft 25 D                       | Grade 260                             | G 25                    | 0125-00                   | FG 25                   | A48-40 B           |
| 0.6027                                                                 | GG220HB                       | GJL-HB 250             |                               |                                       |                         |                           |                         |                    |
| 0.6030                                                                 | GG30                          | GJL-300                | Ft 30 D                       | Grade 300                             | G 30                    | 0130-00                   | FG 30                   | A48-45 B           |
| 0.6032                                                                 | GG240HB                       | GJL-HB 275             |                               |                                       |                         |                           |                         |                    |
| 0.6035                                                                 | GG35                          | GJL-350                | Ft 35 D                       | Grade 350                             | G 35                    | 0135-00                   | FG 35                   | A48-50 B           |
| 0.6037                                                                 | GG260HB                       | GJL-HB 275             |                               |                                       |                         |                           |                         |                    |
| 0.6040                                                                 | GG40                          | GJL-400                | Ft 40 D                       | Grade 400                             |                         | 0140-00                   |                         | A48-60 B           |
| 7.3 Kugelgraphitguss bis 200 HB / modular cast iron up to 200 HB / GGG |                               |                        |                               |                                       |                         |                           |                         |                    |
| 0.6652                                                                 | GGLNiMn137                    | GJLA-XNiMn 13-7        | L-NM 13 7                     | L-NiMn 13 7                           |                         |                           |                         |                    |
| 0.6655                                                                 | GGLNiCuCr1562                 | GJLA-XNiCuCr 15-6-2    | L-NUC 15 6 2                  | L-NiCuCr 15 6 2                       |                         |                           |                         | A 436 Type 1       |
| 0.6656                                                                 | GGLNiCuCr1563                 | GJLA-XNiCuCr 15-6-3    | L-NUC 15 6 3                  | L-NiCuCr 15 6 3                       |                         |                           |                         | A 436 Type 1b      |
| 0.6660                                                                 | GGLNiCr202                    | GJLA-XNiCr 20-2        | L-NC 20 2                     | L-NiCr 20 2                           |                         | 0523-00                   |                         | A 436 Type 2       |
| 0.7033                                                                 | GGG353                        |                        |                               |                                       |                         |                           |                         |                    |
| 0.7040                                                                 | GGG40                         |                        | FGS 400-12                    | 420/12                                | GS 400-12               | 0717-02                   |                         | 60-40-18           |
| 0.7043                                                                 | GGG403                        |                        | FGS 370-17                    | 370/17                                | GSO 42/15               | 0717-15                   |                         |                    |
| 0.7050                                                                 | GGG50                         |                        | FGS 500-7                     | 500/7                                 | GS 500/7                | 0727-02                   |                         | 65-45-12           |
| 0.7652                                                                 | GGGNiMn137                    | GJSA-XNiMn             | S-Mn 13 7                     | S-NiMn 13 7                           |                         | 0772-00                   |                         |                    |
| 0.7659                                                                 | GGGNiCrNb202                  | GJSA-XNiCrNb 20-2      |                               |                                       |                         |                           |                         |                    |
| 0.7660                                                                 | GGGNiCr202                    | GJSA-XNiCr 20-2        | L-NC 20 2                     | L-NiCuCr 20 2                         |                         | 0523-00                   |                         | A 439 Type D-2     |
| 0.7665                                                                 | GGGNiSiCr2052                 | GJSA-XNiSiCr 20-5-2    | S-NSC 20 5 2                  | S-NiSiCr 20 5 2                       |                         |                           |                         |                    |
| 0.7670                                                                 | GGGNi22                       | GJSA-XNi 22            | S-N 22                        | S-Ni 22                               |                         |                           |                         | A 439 Type D-2C    |
| 07673                                                                  | GGGNiMn234                    | GJSA-XNiMn 23-4        |                               | S-NiMn 23 4                           |                         |                           |                         | A 571 Type D-2M    |
| GGGV30                                                                 | GGGV30                        |                        |                               |                                       |                         |                           |                         |                    |
| 7.4 Kugelgraphitguss bis 250 HB / modular cast iron up to 250 HB       |                               |                        |                               |                                       |                         |                           |                         |                    |
| 0.6661                                                                 | GGLNiCr203                    | GJLA-XNiCr 20-3        |                               | L-NiCr 20 3                           |                         |                           |                         | A 436 Type 2b      |
| 0.6667                                                                 | GGLNiSiCr2053                 | GJLA-XNiSiCr 20-5-3    | L-NSC 20 5 3                  | L-NiSiCr 20 5 3                       |                         |                           |                         |                    |
| 0.7060                                                                 | GGG60                         |                        | FGS 600-3                     | 600/3                                 | GS 200/3                | 0732-03                   |                         | 80-55-06           |
| 0.7070                                                                 | GGG70                         |                        | FGS 700-2                     | 700/2                                 | GS 700-2                | 0737-01                   |                         | 100-70-03          |
| 7.5 Temperguss 130 HB / malleable cast iron up to 130 HB               |                               |                        |                               |                                       |                         |                           |                         |                    |
| 0.8038                                                                 | GTWS3812                      | GJMW-360-12            |                               |                                       |                         |                           |                         |                    |
| 0.8040                                                                 | GTW4005                       | GJMW-400-5             | MB 40-10                      |                                       | GMB 40                  |                           |                         |                    |
| 0.8045                                                                 | GTW4507                       | GJMW-450-7             |                               |                                       | GMB 45                  |                           |                         |                    |
| 0.8055                                                                 | GTW55                         |                        |                               |                                       | GMB 55                  |                           |                         |                    |
| 0.8065                                                                 | GTW65                         |                        |                               |                                       | GMB 65                  |                           |                         |                    |
| 0.8135                                                                 | GTS3510                       | GJMB-350-10            | MN 35-10                      | B 340/12                              |                         | 0815                      |                         | 32510              |
| 0.8145                                                                 | GTS4506                       | GJMB-450-6             |                               | P 440/7                               |                         | 0852                      |                         | 40010              |
| 7.6 Temperguss 230 HB / malleable cast iron up to 230 HB               |                               |                        |                               |                                       |                         |                           |                         |                    |
| 0.8035                                                                 | GTW3504                       | GJMW-350-4             |                               |                                       |                         |                           |                         |                    |
| 0.8155                                                                 | GTS5504                       | GJMB-550-4             | MP 50-5                       | P 510/4                               |                         | 0854                      |                         | 50005              |
| 0.8165                                                                 | GTS6502                       | GJMB-650-2             | MP 60-3                       | P 570/3                               |                         | 0858                      |                         | 70003              |
| 0.8170                                                                 | GTS7002                       | GJMB-700-2             | Mn 700-2                      | P 690/2                               | GMN 70                  | 0862                      |                         | 90001              |

Werkstoffgruppe / material group  
8. Gehärtete Stähle / Hardened materials

|                                                           |                            |                            |                            |                            |                            |                            |                            |                            |
|-----------------------------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 8.1 Toolox 44                                             | 45-55 HRC                  | 45-55 HRC                  | 45-55 HRC                  | 45-55 HRC                  | 45-55 HRC                  | 45-55 HRC                  | 45-55 HRC                  | 45-55 HRC                  |
| 8.11 Toolox 33                                            | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> | 850-1100 N/mm <sup>2</sup> |
| 8.2 Gehärtet                                              | 55-60 HRC                  | 55-60 HRC                  | 55-60 HRC                  | 55-60 HRC                  | 55-60 HRC                  | 55-60 HRC                  | 55-60 HRC                  | 55-60 HRC                  |
| 8.3 Gehärtet                                              | 60-70 HRC                  | 60-70 HRC                  | 60-70 HRC                  | 60-70 HRC                  | 60-70 HRC                  | 60-70 HRC                  | 60-70 HRC                  | 60-70 HRC                  |
| 8.4 Hartguss bis 48 HRC / hardened cast iron up to 48 HRC |                            |                            |                            |                            |                            |                            |                            |                            |
| 0.9620                                                    | CX260NiCr42                | GJH-X260NiCr 4-2           |                            | Grade 2 A                  |                            | 0512-00                    |                            | A532 I B NiCr-LC           |
| 0.9625                                                    | CX330NiCr42                | GJH-X330NiCr 4-2           |                            | Grade 2 B                  |                            | 0513-00                    |                            | A532 I A NiCr-LC           |
| 0.9630                                                    | CX300CrNiSi952             | GJH-X300CrNiSi 9-5-2       |                            | Grade 2 C                  |                            |                            |                            | A532 I D Ni-HiCr           |
| 0.9635                                                    | CX300CrMo153               | GJH-X300CrMo 15-3          |                            | Grade 3 A                  |                            |                            |                            | A532 IIC15% CrMo-HC        |

Werkstoffgruppe / material group  
9. Alu-Legierungen / Aluminium alloys

|                                                                                                     |           |           |           |      |  |  |  |      |
|-----------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------|--|--|--|------|
| 9.1 Alu-Knetlegierungen bis 250 N/mm <sup>2</sup> / malleable alu alloy up to 250 N/mm <sup>2</sup> |           |           |           |      |  |  |  |      |
| 3.0255                                                                                              | Al99.5    |           | A 59050 C | L 31 |  |  |  | 1000 |
| 3.0280                                                                                              | Al99.8    |           |           |      |  |  |  |      |
| 3.0515                                                                                              | GAi995    |           |           |      |  |  |  |      |
| 3.3292                                                                                              | GDAIMg9   |           |           |      |  |  |  |      |
| 3.3315                                                                                              | AlMg1     | AW-6082   |           |      |  |  |  |      |
| 3.3535                                                                                              | AlMg3     |           |           |      |  |  |  |      |
| 3.3547                                                                                              | AlMg4,5Mn |           |           |      |  |  |  |      |
| 3.3555                                                                                              | AlMg5     |           |           |      |  |  |  |      |
| 9.2 Alu-Knetlegierungen bis 350 N/mm <sup>2</sup> / malleable alu alloy up to 350 N/mm <sup>2</sup> |           |           |           |      |  |  |  |      |
| 3.0615                                                                                              | AlMgSiPb  |           |           |      |  |  |  |      |
| 3.1325                                                                                              | AlCuMg1   | AW-2017 A |           |      |  |  |  |      |
| 3.1355                                                                                              | AlCuMg2   | AW-2024   |           |      |  |  |  |      |

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Werkstoffgruppe / material group  
9. Alu-Legierungen / Aluminium alloys

| Werkstoff<br>Nr.:<br>material<br>No.:                                                                      | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 9.2 Alu-Knetlegierungen bis 350 N/mm <sup>2</sup> / malleable alu alloy up to 350 N/mm <sup>2</sup>        |                               |                        |                               |                                       |                         |                           |                         |                    |
| 3.1371                                                                                                     | AlCu4TiMg                     |                        |                               |                                       |                         |                           |                         |                    |
| 3.1645                                                                                                     | AlCuMgPb                      |                        |                               |                                       |                         |                           |                         |                    |
| 3.1655                                                                                                     | AlCuBiPb                      |                        |                               |                                       |                         |                           |                         |                    |
| 3.1754                                                                                                     | AlCu5Ni1,5                    |                        |                               |                                       |                         |                           |                         |                    |
| 3.2315                                                                                                     | AlMgSi1                       | AW-6005 A              |                               |                                       |                         |                           |                         |                    |
| 3.3206                                                                                                     | AlMgSi0,5                     |                        |                               |                                       |                         |                           |                         |                    |
| 9.2 Alu-Knetlegierungen bis 350 N/mm <sup>2</sup> / malleable alu alloy up to 350 N/mm <sup>2</sup>        |                               |                        |                               |                                       |                         |                           |                         |                    |
| 3.3541                                                                                                     | AlMg3                         |                        |                               |                                       |                         |                           |                         |                    |
| 3.4345                                                                                                     | AlZnMgCu0,5                   |                        | AZ 4 GU/9051                  | L 86                                  | 811-04                  |                           |                         | 7050               |
| 9.3 Alu-Gusslegierungen < 12% Si bis 250 N/mm <sup>2</sup> / cast alu < 12% Si up to 250 N/mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 3.1841                                                                                                     | AlCu4Ti                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.2131                                                                                                     | AlSi5Cu1                      |                        |                               |                                       |                         |                           |                         |                    |
| 3.2151                                                                                                     | AlSi6Cu4                      |                        |                               |                                       |                         |                           |                         |                    |
| 3.2161                                                                                                     | AlSi8Cu3                      |                        |                               |                                       |                         |                           |                         |                    |
| 3.2163                                                                                                     | GDAISi9Cu3                    |                        |                               |                                       |                         |                           |                         |                    |
| 3.2211                                                                                                     | AlSi11                        |                        |                               |                                       |                         |                           |                         |                    |
| 3.2341                                                                                                     | AlSi5Mg                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.2373                                                                                                     | AlSi9Mg                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.2381                                                                                                     | AlSi10Mg                      |                        |                               |                                       |                         |                           |                         |                    |
| 3.2382                                                                                                     | GDAISi10Mg                    |                        |                               |                                       |                         |                           |                         |                    |
| 3.2383                                                                                                     | AlSi10Mg(Cu)                  |                        |                               | LM 9                                  |                         | 4253                      |                         | A 360.2            |
| 3.2581                                                                                                     | AlSi12                        |                        |                               | LM 6                                  |                         | 4261                      |                         | A 413.2            |
| 3.2582                                                                                                     | GDAISi12                      |                        |                               |                                       |                         | 4247                      |                         | A 413.0            |
| 3.2583                                                                                                     | AlSi12(Cu)                    |                        |                               | LM 20                                 |                         | 4260                      |                         | A 413.1            |
| 3.2585                                                                                                     | SAISi12                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.2982                                                                                                     | GDAISi12(Cu)                  |                        |                               |                                       |                         |                           |                         |                    |
| 3.3241                                                                                                     | AlMg3Si                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.3261                                                                                                     | AlMg5Si                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.3561                                                                                                     | AlMg5                         |                        |                               |                                       |                         |                           |                         |                    |
| 3.5101                                                                                                     | GMgZn4SE1Zr1                  | MCMgZn 4 RE 1 Zr       | G-Z 4 TR                      | MAG 5                                 |                         |                           |                         | ZE 41              |
| 3.5102                                                                                                     | GMgZn5Th2Zr1                  |                        |                               |                                       |                         |                           |                         |                    |
| 3.5103                                                                                                     | MgSE3Zn2Zr1                   | MCMgRE 3 Zn 2 Zr       | G-TR 3 Z 2                    | MAG 6                                 |                         |                           |                         | EZ 33              |
| 3.5105                                                                                                     | GMgTh3Zn2Zr1                  |                        |                               |                                       |                         |                           |                         |                    |
| 3.5106                                                                                                     | GMgAg3SE2Zr1                  | MCMgRE 2 Ag 2 Zr       | G-Ag 22,5                     | MAG 12                                |                         |                           |                         | QE 22              |
| 3.5200                                                                                                     | GMgAl8Zn1                     |                        |                               |                                       |                         |                           |                         |                    |
| 3.5470                                                                                                     | GDMgAl4Si1                    |                        |                               |                                       |                         |                           |                         | AS 41              |
| 3.5612                                                                                                     | GDMgAl6Zn1                    |                        |                               |                                       |                         |                           |                         |                    |
| 3.5662                                                                                                     | GDMgAl6                       |                        |                               |                                       |                         |                           |                         |                    |
| 3.5812                                                                                                     | GMgAl8Zn1                     | MCMgAl 8 Zn 1          | G-A 9                         | MAG 1                                 |                         |                           |                         | AZ 81              |
| 3.5912                                                                                                     | GMgAl9Zn1                     | MCMgAl 9 Zn 1          | G-A 9 Z 1                     | MAG 1                                 |                         |                           |                         | AZ 91              |
| 9.4 Alu-Gusslegierungen < 12% Si bis 300 N/mm <sup>2</sup> / cast alu < 12% Si up to 300 N/mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 2.1871                                                                                                     | AlCu4TiMg                     |                        |                               |                                       |                         |                           |                         |                    |
| 3.2371                                                                                                     | AlSi7Mg                       |                        |                               |                                       |                         |                           |                         | 4218 B             |
| 9.5 Alu-Gusslegierungen < 12% Si bis 450 N/mm <sup>2</sup> / cast alu < 12% Si up to 450 N/mm <sup>2</sup> |                               |                        |                               |                                       |                         |                           |                         |                    |
| 9.6 Magnesium / magnesium                                                                                  |                               |                        |                               |                                       |                         |                           |                         |                    |

Werkstoffgruppe / material group  
10. Kupfer- und Kupferlegierungen / Copper and copper alloys

|                                                                             |             |  |                |        |        |  |  |         |
|-----------------------------------------------------------------------------|-------------|--|----------------|--------|--------|--|--|---------|
| 10.1 Kupfer- Automatenlegierungen, Blei > 1% / copper machining alloys Pb>1 |             |  |                |        |        |  |  |         |
| 2.0290                                                                      | GCuZn33Pb   |  |                |        |        |  |  |         |
| 2.0330                                                                      | CuZn36Pb1,5 |  |                |        |        |  |  |         |
| 2.0331                                                                      | CuZn36Pb1,5 |  |                |        |        |  |  |         |
| 2.0332                                                                      | CuZu37Pb0,5 |  |                |        |        |  |  |         |
| 2.0340                                                                      | GCuZn37Pb   |  |                |        |        |  |  |         |
| 2.0401                                                                      | CuZn39Pb3   |  |                |        |        |  |  |         |
| 2.0402                                                                      | CuZn39Pb2   |  |                |        |        |  |  |         |
| 2.1061                                                                      | GCuSn12Pb   |  |                |        |        |  |  |         |
| 2.1090                                                                      | GCuSn7ZnPb  |  | U-E 7 Z 5 Pb 4 |        |        |  |  | C 93200 |
| 2.1096                                                                      | GCuSn5ZnPb  |  | U-E 5 Pb 5 Z 5 | LG 2   |        |  |  | C 83600 |
| 2.1098                                                                      | GCuSn2ZnPb  |  |                |        |        |  |  |         |
| 2.1176                                                                      | GCuPb10Sn   |  | U-E 10 Pb 10   | LB 2   |        |  |  | C 93700 |
| 2.1182                                                                      | GCuPb15Sn   |  | U-Pb 15 E 8    | LB 1   |        |  |  | C 93800 |
| 10.2 Bronze, Messing / bronze, brass                                        |             |  |                |        |        |  |  |         |
| 2.0220                                                                      | CuZn5       |  |                |        |        |  |  |         |
| 2.0240                                                                      | CuZn15      |  | CuZn 15        |        |        |  |  | C 23000 |
| 2.0250                                                                      | CuZn20      |  |                |        |        |  |  |         |
| 2.0265                                                                      | CuZn30      |  | CuZn 30        | CZ 102 |        |  |  | C 26000 |
| 2.0280                                                                      | CuZn33      |  |                |        |        |  |  |         |
| 2.0321                                                                      | CuZn37      |  | CuZn 37        | CZ 108 | C 2720 |  |  | C 27200 |
| 2.0380                                                                      | CuZn39Pb2   |  |                |        |        |  |  |         |
| 2.0492                                                                      | GCuZn15Si4  |  |                |        |        |  |  | B-198   |
| 2.0510                                                                      | CuZn37Al1   |  |                |        |        |  |  |         |
| 2.0550                                                                      | CuZn40Al2   |  |                |        |        |  |  |         |
| 2.0561                                                                      | CuZn40Al1   |  |                |        |        |  |  |         |
| 2.0590                                                                      | GCuZn40Fe   |  |                |        |        |  |  |         |
| 2.0591                                                                      | GKCuZn38Al  |  |                |        |        |  |  |         |
| 2.0592                                                                      | GCuZn35Al1  |  | U-Z 36 N 3     | HTB 1  |        |  |  | C 86500 |



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Werkstoffgruppe / material group  
10. Kupfer- und Kupferlegierungen / Copper and copper alloys

| Werkstoff<br>Nr.:<br>material<br>No.:                                                         | Deutschland<br>Germany<br>DIN | Europa<br>Europe<br>EN | Frankreich<br>France<br>AFNOR | Großbritannien<br>Great Britain<br>BS | Italien<br>Italy<br>UNI | Schweden<br>Sweden<br>SIS | Spanien<br>Spain<br>UNE | USA<br>USA<br>AISI |
|-----------------------------------------------------------------------------------------------|-------------------------------|------------------------|-------------------------------|---------------------------------------|-------------------------|---------------------------|-------------------------|--------------------|
| 10.2 Bronze, Messing / bronze, brass                                                          |                               |                        |                               |                                       |                         |                           |                         |                    |
| 2.0595                                                                                        | GKCuZn37Al1                   |                        |                               |                                       |                         |                           |                         |                    |
| 2.0596                                                                                        | GKuZn34Al2                    | U-Z 36 N 3             | HTB 1                         |                                       |                         |                           |                         | C 86200            |
| 2.0598                                                                                        | GKuZn25Al5                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.1188                                                                                        | GKuPb20Sn                     | U-Pb 20                | LB 5                          |                                       |                         |                           |                         | C 94100            |
| 2.1292                                                                                        | GKuCrF35                      |                        | CC1-FF                        |                                       |                         |                           |                         | C 81500            |
| 2.1293                                                                                        | GKuZr                         | U-Cr 0,8 Zr            | CC 102                        |                                       |                         |                           |                         | C 18200            |
| 10.2.1 Bronze 850 - 1200 N/mm <sup>2</sup>                                                    |                               |                        |                               |                                       |                         |                           |                         |                    |
| 2.1247                                                                                        | Cu Be2                        |                        |                               |                                       |                         |                           |                         |                    |
| 10.3 Kupfer, bleifreies Kupfer, Elektrokupfer / copper, lead-free copper, electrolytic copper |                               |                        |                               |                                       |                         |                           |                         |                    |
| 2.0040                                                                                        | OFCu                          |                        |                               |                                       |                         |                           |                         |                    |
| 2.0060                                                                                        | ECu57                         |                        |                               |                                       |                         |                           |                         | B-120              |
| 2.0065                                                                                        | ECu58                         |                        | Cn-a2                         | C 101                                 |                         |                           |                         | C 11000            |
| 2.0070                                                                                        | SeCu                          |                        | Cu-c1                         | C 101                                 |                         |                           |                         | C 10300            |
| 2.0082                                                                                        | GCuL45                        |                        |                               | HCC 1                                 |                         |                           |                         | C 81100            |
| 2.0085                                                                                        | GCuL50                        |                        |                               | HCC 1                                 |                         |                           |                         | C 81100            |
| 2.0241                                                                                        | CuZn40MnPb                    |                        |                               |                                       |                         |                           |                         |                    |
| 2.0460                                                                                        | CuZn20Al2                     |                        |                               |                                       |                         |                           |                         |                    |
| 2.0872                                                                                        | CuNi10Fe1Mn                   |                        |                               |                                       |                         |                           |                         |                    |
| 2.0882                                                                                        | CuNi30Mn1Fe                   |                        |                               |                                       |                         |                           |                         |                    |
| 2.0936                                                                                        | CuAl10Fe3Mn2                  |                        | U-A 10 Fe                     | CA 103                                |                         |                           |                         |                    |
| 2.0940                                                                                        | GCuAl10Fe                     |                        |                               |                                       |                         |                           |                         |                    |
| 2.0966                                                                                        | CuAl10Ni5Fe4                  |                        | U-A 10 N                      | CA 104                                |                         |                           |                         | C 63000            |
| 2.0975                                                                                        | GCuAl10Ni                     |                        |                               |                                       |                         |                           |                         | B-148-52           |
| 2.1050                                                                                        | GCuSn10                       |                        |                               | CT 1                                  |                         |                           |                         | C 90700            |
| 2.1052                                                                                        | GCuSn12                       |                        | UE 12 P                       | Pb 2                                  |                         |                           |                         | C 90800            |
| 2.1060                                                                                        | GCuSn12Ni                     |                        |                               |                                       |                         |                           |                         | C 91700            |
| 2.1086                                                                                        | GCuSn10Zn                     |                        |                               |                                       |                         |                           |                         |                    |
| 2.1093                                                                                        | GCuSn6ZnNi                    |                        |                               | LG 4                                  |                         |                           |                         |                    |

Werkstoffgruppe / material group  
11. Kunststoffe / plastics

|                                                                |                                                        |  |                 |                     |                   |  |  |                                   |
|----------------------------------------------------------------|--------------------------------------------------------|--|-----------------|---------------------|-------------------|--|--|-----------------------------------|
| 11.1 Thermoplaste / thermoplastics                             |                                                        |  |                 |                     |                   |  |  |                                   |
| PC                                                             | Makralon, Nuclon, Plastocarbon                         |  | Orgalan         | Sinvet              |                   |  |  | Lexan, Merlon                     |
| Pe                                                             | Baylon, Dekalen, Lupolen, Hostalen                     |  |                 | Fertene, Eraclene   | Carlona, Escorene |  |  | Althon, Bakelite, Chemplex, Dylan |
| PF                                                             | Alberit, Bakelit, Bulitol, Durax, Harex, Resinol       |  |                 | Fenachem, Moldesile |                   |  |  | Biralit, Biratex, Birax           |
| PfTE                                                           | Hostafilon                                             |  | Soreflon        |                     |                   |  |  | Halon, Teflon                     |
| PP                                                             | Vestolen PP, Synalen PP, Novolen, Hostalen PP          |  | Eitex P, Napryl | Moplen, Kastilen    | Carola P, Procom  |  |  | Pro-fax, Rexene, Tenite           |
| PS                                                             | Hostylon, Lorkalen, Polystyrol, Styropor               |  |                 | Sdistir, Lastinol   | Lustrex           |  |  | Carinex, Dylene, Toporex          |
| PVC                                                            | Coroplast, Hostalit, Mipolam, Opalon, Solvec, Vinoflex |  |                 |                     |                   |  |  |                                   |
| PP-H                                                           | Homopolymer (Vestolen)                                 |  |                 |                     |                   |  |  |                                   |
| PP-C                                                           | Copolymer                                              |  |                 |                     |                   |  |  |                                   |
| ABS                                                            | Acrylnitrid Butadien Styrol                            |  |                 |                     |                   |  |  |                                   |
| PMMA                                                           | Polymethyl metha Crylat (Plexiglas-Resarit-Degulan)    |  |                 |                     |                   |  |  |                                   |
| POMC                                                           | Polyoxymethylen (Hostaform-ultraform)                  |  |                 |                     |                   |  |  |                                   |
| PI                                                             | Polymid                                                |  |                 |                     |                   |  |  |                                   |
| PEI                                                            | Polytherimid                                           |  |                 |                     |                   |  |  |                                   |
| PVC-H                                                          | Polyvinilchlorid hart (Hostalit-Vinoflex-Vestolit)     |  |                 |                     |                   |  |  |                                   |
| 11.2 Duroplaste / duroplastics                                 |                                                        |  |                 |                     |                   |  |  |                                   |
| PUR 5220                                                       |                                                        |  |                 |                     |                   |  |  |                                   |
| PF 31                                                          |                                                        |  |                 |                     |                   |  |  |                                   |
| MP 183                                                         |                                                        |  |                 |                     |                   |  |  |                                   |
| 11.3 Faserverstärkte Kunststoffe / fibrous-reinforced plastics |                                                        |  |                 |                     |                   |  |  |                                   |
| AFK                                                            | Kevlar                                                 |  |                 |                     |                   |  |  |                                   |
| BFK                                                            |                                                        |  |                 |                     |                   |  |  |                                   |
| CFK                                                            |                                                        |  |                 |                     |                   |  |  |                                   |
| GFK                                                            |                                                        |  |                 |                     |                   |  |  |                                   |
| MFK                                                            |                                                        |  |                 |                     |                   |  |  |                                   |
| SFK                                                            |                                                        |  |                 |                     |                   |  |  |                                   |
| PA66-GF30                                                      | Polyamid +30% Glasfaser (Ertalon 66-GF30)              |  |                 |                     |                   |  |  |                                   |
| POM-GF25                                                       | Polyoxymethylen +25% Glasfaser (Ultraform N2200 G53)   |  |                 |                     |                   |  |  |                                   |
| PP-GF20                                                        | Polypropylen +20% Glasfaser C                          |  |                 |                     |                   |  |  |                                   |
| PVDF-GF20                                                      | Polyvinylidenfluorid +20% Glasfaser                    |  |                 |                     |                   |  |  |                                   |
| PEEK-GF30                                                      | Polyetherketon +30% Glasfaser (Victrex)                |  |                 |                     |                   |  |  |                                   |
| PEEK-CF30                                                      | Polyetherketon +30% Kohlefaser (Victrex)               |  |                 |                     |                   |  |  |                                   |
| PTFE                                                           | +25% Glas Polytetrafluorethylen                        |  |                 |                     |                   |  |  |                                   |
| PTFE                                                           | +25% Kohle Polytetrafluorethylen                       |  |                 |                     |                   |  |  |                                   |
| 11.4 Hartgummi, Holz / hard rubber                             |                                                        |  |                 |                     |                   |  |  |                                   |
| 11.5 Polyamidi                                                 |                                                        |  |                 |                     |                   |  |  |                                   |
| PA 6                                                           |                                                        |  |                 |                     |                   |  |  |                                   |
| PA 66                                                          |                                                        |  |                 |                     |                   |  |  |                                   |
| 12.0 Hardox 400 < 1350 N/mm <sup>2</sup>                       |                                                        |  |                 |                     |                   |  |  |                                   |
| 12.1 Hardox 500 < 1800 N/mm <sup>2</sup>                       |                                                        |  |                 |                     |                   |  |  |                                   |

Werkstoffgruppe / material group  
13. Federstähle bis 1500 N/mm<sup>2</sup>

|        |        |  |  |  |  |  |  |  |
|--------|--------|--|--|--|--|--|--|--|
| 1.503  | 38Si7  |  |  |  |  |  |  |  |
| 1.7176 | 55Cr3  |  |  |  |  |  |  |  |
| 1.8159 | 50CrV4 |  |  |  |  |  |  |  |

Formelbezeichnungen in der Zerspanung  
Formula classifications in the cutting tool industry

|                                                         |                                                                | Dimension                 | neues Zeichen nach DIN 6580/84 |
|---------------------------------------------------------|----------------------------------------------------------------|---------------------------|--------------------------------|
| Drehzahl                                                | • speed                                                        | min <sup>-1</sup>         |                                |
| Fräsweg, Bohrweg                                        | • milling/drilling travel                                      | mm                        | lf                             |
| Schneiddurchmesser                                      | • cutting diameter                                             | mm                        | Dc                             |
| Schnittbreite, Eingriffgröße                            | • width of cut                                                 | mm                        | ae                             |
| Schnittgeschwindigkeit                                  | • cutting speed                                                | m/min                     | Vc                             |
| Schnittkraft                                            | • cutting force                                                | N                         | Fc                             |
| Schnittkraftexponent                                    | • cutting force                                                |                           | 1 – mc                         |
| Schnittleistung                                         | • cutting power                                                | kW                        | Pc                             |
| Schnitttiefe                                            | • depth of cut                                                 | mm                        | ap                             |
| Spanungsdicke                                           | • undeformed chip thickness                                    | mm                        | h                              |
| Spanungsdicke – mittlere                                | • average undeformed chip thickness                            | mm                        |                                |
| Spezifische Schnittkraft                                | • specific cutting force                                       | N/mm <sup>2</sup>         | kc                             |
| Spezifische Schnittkraft bei h = 1 mm und b = 1 mm      | • specific cutting force at h = 1 mm and b = 1 mm              | N/mm <sup>2</sup>         | kc1.1                          |
| Spezifisches Zeitspanvolumen                            | • spec. time-chip volume                                       | cm <sup>3</sup> /kW · min | Qsp                            |
| Standweg in Vorschubrichtung                            | • tool life in feed direction                                  | mm                        | Lf                             |
| Standzeit                                               | • tool life                                                    | min                       | T                              |
| Vorschub je Umdrehung                                   | • feed per revolution                                          | mm                        | f                              |
| Vorschub je Zahn                                        | • feed per tooth                                               | mm                        | fz                             |
| Korrekturfaktor für Vf                                  | • Correction factor for Vf                                     | mm                        | f2                             |
| Vorschubgeschwindigkeit                                 | • feed rate                                                    | mm/min                    | Vf                             |
| Zähnezahl                                               | • number of tooth                                              |                           | Z                              |
| Zeitspanvolumen                                         | • time-chip-volume                                             | cm <sup>3</sup> /min      | Q                              |
| Zerspankraft                                            | • resultant cutting force                                      | N                         | F                              |
| Spiralsteigung bei Spiralinterpolation                  | • Spiral increase with spiral interpolation                    | mm                        | a                              |
| Radiales Aufmass                                        | • Radial allowance                                             | mm                        | ar                             |
| Anfahrsvorschub beim Aussenzirkularfräsen               | • Drive feed for external circular milling                     | mm                        | fza                            |
| Konturvorschub pro Zahn                                 | • Contour feed per tooth                                       | mm                        | fzkont                         |
| mittlere Spandicke                                      | • Middle cutting thickness                                     | mm                        | hm                             |
| Vorschubgeschwindigkeit beim Zirkularfräsen am Fräser-Ø | • Feeder speed for circular milling an the rotary grinder-Ø    | mm/min                    | vfkont                         |
| Antriebsleistung                                        | • Drive power                                                  | kW                        | P                              |
| Drehmoment                                              | • Torque                                                       | Nm                        | M                              |
| Maschinenwirkungsgrad                                   | • Machine efficiency                                           |                           | η                              |
| Schnittbogenwinkel / Eingriffswinkel                    | • Cut arc angle/angle of attack                                | °                         | φ                              |
| Steigungswinkel beim Spiralinterpolieren                | • Angle of incline for spiral interpolation                    | °                         | δ                              |
| Eintauchwinkel beim Nutfräsen ins Volle                 | • Angle of immersion for complete groove milling               | °                         | β                              |
| Auf den Spanungsquerschnitt bezogene Schnittkraft       | • Tensioning lateral force with reference to the cutting power | N/mm <sup>2</sup>         | kc                             |
| Freiwinkel                                              | • Free angle                                                   | °                         | α                              |

$$V_c = \frac{D_1 \cdot \pi \cdot n}{1000}$$

$$n = \frac{V_c \cdot 1000}{D_1 \cdot \pi}$$

$$V_f = f_z \cdot z \cdot n$$

$$f_z = \frac{V_f}{n \cdot z}$$

$$h = f_z \cdot \sin \kappa$$

$$Q = \frac{a_p \cdot a_e \cdot v_f}{1000}$$

$$P = \frac{a_p \cdot a_e \cdot v_f \cdot k_c}{6 \cdot 10^7 \cdot \eta}$$

$$M = \frac{9550 \cdot P}{n}$$

Formeln Zirkularfräsen  
Formula for circular milling

| Zu berechnender<br>Werkstoff | Fräserdurchmesser / Dimension                    |                                                             |                                                  |                                                             |
|------------------------------|--------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------|
| Material to be calculated    | INNEN/INSIDE                                     |                                                             | AUSSEN/OUTSIDE                                   |                                                             |
|                              | ae/D < 0.30                                      | ae/D > 0.30                                                 | ae/D < 0.30                                      | ae/D > 0.30                                                 |
| ar                           | $ar = \frac{D_1 - D_2}{2}$                       |                                                             | $ar = \frac{D_2 - D_1}{2}$                       |                                                             |
| ae                           | $\frac{D_1^2 - D_2^2}{4 \cdot D_1 - D}$          |                                                             | $\frac{D_2^2 - D_1^2}{4 \cdot D_1 + D}$          |                                                             |
| hm                           | $fz \cdot \sqrt{ae/D_1}$                         | $\frac{fz \cdot 360 \cdot ae}{D_1 \cdot \pi \cdot \varphi}$ | $fz \cdot \sqrt{ae/D_1}$                         | $\frac{fz \cdot 360 \cdot ae}{D_1 \cdot \pi \cdot \varphi}$ |
| fz                           | $hm \cdot \sqrt{D_1/ae}$                         | $\frac{hm \cdot D_1 \cdot \pi \cdot \varphi}{360 \cdot ae}$ | $hm \cdot \sqrt{D_1/ae}$                         | $\frac{hm \cdot D_1 \cdot \pi \cdot \varphi}{360 \cdot ae}$ |
| fza                          |                                                  |                                                             | $hm \cdot \sqrt{D/ar}$                           |                                                             |
| φ                            | $\arccos [1 - (2 \cdot ae/D_1)]$                 |                                                             |                                                  |                                                             |
| Vf                           | $fz \cdot z \cdot n$                             |                                                             |                                                  |                                                             |
| Vfkont                       | $\frac{fz \cdot z \cdot n \cdot D_1}{(D_1 - D)}$ |                                                             | $\frac{fz \cdot z \cdot n \cdot D_1}{(D_1 + D)}$ |                                                             |

Erläuterung der Karnasch Piktogramme und Grafiken  
Explanation of Karnasch pictograms and graphics

|                                       |                                                                                     |                                                                                                                     |                                                                                     |                                                                                         |
|---------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Schneidstoff<br>Cutting material      |    | Ultrafeinkorn-Vollhartmetall<br>Ultrafine solid carbide                                                             |    | Kubischer Bornitrid<br>Cubig boron nitride                                              |
|                                       |    | Polykristalliner Diamant in einer metallischen Bindungsmatrix<br>Polykristalline Diamond in a metabolic bond matrix |    | Polykristalliner Diamant<br>Polykristalline Diamond                                     |
|                                       |    | Chemical Vapour Deposition (99,9% Diamant/Diamond)                                                                  |    | Vollhartmetall<br>Solid carbide                                                         |
|                                       |    | Monokristalliner Diamant<br>Monokristalline Diamond                                                                 |                                                                                     |                                                                                         |
| Schneidenform<br>Type of cutting edge |    | Kugelfräser mit Innenkühlung<br>Ball nose end mill with interior cooling supply                                     |    | Spezielle Schruppschlichtverzahnung<br>Special roughing-finishing end mill              |
|                                       |    | Aluminium-Verzahnung<br>Toothing for aluminium                                                                      |    | Typ H = Hart<br>Type H = Hard                                                           |
|                                       |    | Karnasch-Spezial-Verzahnung<br>Karnasch-special-toothing                                                            |    | Spezielle Geometrie für Diamant-Fräser<br>Special geometry for Diamond coated end mills |
|                                       |    | Aluminium-Schruppverzahnung<br>Roughing cutter for aluminium                                                        |    | Metrisches ISO-Regelgewinde<br>ISO metric screw thread                                  |
|                                       |    | Aluminium Fräser geläppt<br>Lapped end mill for aluminium                                                           |    | Metrisches ISO-Feingewinde<br>ISO metric fine thread                                    |
|                                       |    | Typ N-Microwerkzeug<br>Type N-Microtool                                                                             |    | Whitworth Rohrgewinde<br>Whitworth threads                                              |
|                                       |    | Typ N mit unterschiedlicher Spankammer<br>Type N with different flutes                                              |    | 60° Flankenwinkel<br>60° thread angle                                                   |
|                                       |   | Schruppfräser Typ HR<br>Roughing end mill Type HR                                                                   |                                                                                     |                                                                                         |
| Spiralwinkel<br>Helix angle           |  | 30° Spiralwinkel<br>30° Helix angle                                                                                 |  | 40° Spiralwinkel<br>40° Helix angle                                                     |
|                                       |  | 0° Spiralwinkel (gerade genutet)<br>0° Helix angle (straight fluted)                                                |  | 20° Spiralwinkel<br>20° Helix angle                                                     |
|                                       |  | 25° Spiralwinkel<br>25° Helix angle                                                                                 |  | 45° Spiralwinkel<br>45° Helix angle                                                     |
|                                       |  | Progressiver Spiralwinkel<br>Progressive helix angle                                                                |  | 50° Spiralwinkel<br>50° Helix angle                                                     |
|                                       |  | 15° Spiralwinkel<br>15° Helix angle                                                                                 |  | 35° Spiralwinkel<br>35° Helix angle                                                     |
|                                       |  | Pyramiden-Verzahnung<br>Pyramid-toothed                                                                             |  | Ungleiche Spirale<br>Unequal helix                                                      |
|                                       |  | 30° Linksspirale – rechtsschneidend<br>30° Leftspiral – right hand cutting                                          |  | 36° Spiralwinkel<br>36° Helix angle                                                     |
|                                       |  | 30° Spiralwinkel<br>30° Helix angle                                                                                 |  | 15° Spiralwinkel<br>15° Helix angle                                                     |
|                                       |  | 35° Spiralwinkel<br>35° Helix angle                                                                                 |  | 7° Linksspirale – rechtsschneidend<br>7° Left helix – right hand cutting                |
|                                       |  | 0° Spiralwinkel, rechtsschneidend<br>0° Helix angle, right hand cutting                                             |  | Gratfreies fräsen<br>Burr-free milling                                                  |
|                                       |  | Ziehender und schiebender Schnitt<br>Drawing and pushing cut                                                        |  | 8° Linksspirale<br>8° Left helix                                                        |
|                                       |  | Gratfreies fräsen<br>Burr-free milling                                                                              |  | Ungleich geteilt<br>Unequal helix                                                       |
|                                       |  | 8° Rechtsspirale<br>8° Right helix                                                                                  |                                                                                     |                                                                                         |
| Werkzeuglänge<br>Tool length          |  | Extra kurz<br>Extra short                                                                                           |  | Kurz<br>Short                                                                           |
|                                       |  | Extra lang<br>Extra long                                                                                            |  | Lang<br>Long                                                                            |
|                                       |  | Extra kurze und kurze Ausführung<br>Extra short and short version                                                   |  | Kurze und lange Ausführung<br>Short and long version                                    |
|                                       |  | In zahlreichen Längen an Lager<br>Numerous length avialable from our stock                                          |  | Messerkopf in unterschiedlichen Durchmesser<br>Cutter head in different diameter        |

Erläuterung der Karnasch Piktogramme und Grafiken  
Explanation of Karnasch pictograms and graphics

|                                                |                                                                                     |                                                                                                                            |                                                                                     |                                                                                                                                           |
|------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Bearbeitungsrichtung<br>Direction of machining |    | Mögliche Bearbeitungsrichtungen<br>Possible machining directions                                                           |    | Mögliche Fräzustellungen bei Vielzahnfräsern mit Zentrumschnitt<br>Possible milling directions for multi tooth end mills with a centrecut |
|                                                |    | Zirkular fräsen<br>Circular milling                                                                                        |    | Für Durchgangs- und Sackloch<br>For through- and blind hole                                                                               |
| Werkzeugverwendung<br>Machining applications   |    | Kopierfräser<br>Copy milling                                                                                               |    | 45° Entgraten<br>45° Deburring                                                                                                            |
|                                                |    | Abzeilen<br>Machining in small steps                                                                                       |    | Nuten<br>Grooving                                                                                                                         |
|                                                |    | Umfangfräsen<br>Side milling                                                                                               |    | Umfangfräsen und Nuten<br>Side milling and grooving                                                                                       |
|                                                |    | Abzeilen<br>Machining in small steps                                                                                       |    | Kegelsenken<br>Countersinking                                                                                                             |
|                                                |    | Fräser mit konischer Schneide<br>End mill with conical cutting edge                                                        |    | Bohren und fräsen<br>Drilling and milling                                                                                                 |
|                                                |    | Vorwärts- und Rückwärtsgraten (Viertelkreis)<br>Forward- and backward deburring (quadrant)                                 |    | Bohren mit Innenkühlung<br>Drilling with interior cooling supply                                                                          |
|                                                |    | Vorwärts- und Rückwärtsgraten<br>Forward- and backward deburring                                                           |    | Gewindebohrer<br>Tapping                                                                                                                  |
|                                                |    | 30° Entgraten<br>30° Deburring                                                                                             |    | Gewindefräsen inkl. senken<br>Thread milling incl. countersink                                                                            |
|                                                |  | Viertelkreis-Entgraten<br>Corner rounding                                                                                  |  | Reiben ohne Innenkühlung<br>Reaming without interior cooling supply                                                                       |
|                                                |  | Stufenbohrer<br>Stepdrill                                                                                                  |  | Fräser mit Bohrspitze<br>Milling cutter with drill bit                                                                                    |
|                                                |  | Bohren ohne Innenkühlung<br>Drilling without interior cooling supply                                                       |  | Fräser in der Werkzeugmitte positionieren<br>Adjust the end mill into the middle of the workpiece                                         |
|                                                |  | 180° bohren mit Innenkühlung<br>180° drilling with interior cooling supply                                                 |  | Planfräsen<br>Face milling                                                                                                                |
|                                                |  | PKD-Bohrer<br>PCD-Drill                                                                                                    |  | Stirnfräsen<br>Face milling                                                                                                               |
|                                                |  | Gewindefräsen<br>Thread milling                                                                                            |                                                                                     |                                                                                                                                           |
| Norm<br>Shank                                  |  | Entspricht DIN 6527<br>Equal to DIN 6527                                                                                   |  | Entspricht DIN 371 + 376 für Maschinengewindebohrer<br>Equal to DIN 371 + 376 for machine taps                                            |
|                                                |  | Karnasch Werksnorm<br>Karnasch company standard                                                                            |  | Entspricht DIN 5156<br>Equal to DIN 5156                                                                                                  |
|                                                |  | Entspricht DIN 335 C für Kegelsenker<br>Equal to DIN 335 C for Countersinker                                               |  | Für Gewinde nach DIN 13<br>For threads in accordance to DIN 13                                                                            |
| Schaftausführung<br>Shank type                 |  | Entspricht DIN 6535 mit Innenkühlung, Form HAK<br>Equal to DIN 6535 with interior cooling supply, Form HAK                 |  | Entspricht DIN 6535 ohne Innenkühlung, Form HE<br>Equal to DIN 6535 without interior cooling supply, Form HE                              |
|                                                |  | Entspricht DIN 6535 ohne Innenkühlung, Form HA<br>Equal to DIN 6535 without interior cooling supply, Form HA               |  | Entspricht DIN 6535 mit Innenkühlung, Form HEK<br>Equal to DIN 6535 with interior cooling supply, Form HEK                                |
|                                                |  | Entspricht DIN 6535 ohne Innenkühlung, Form HB<br>Equal to DIN 6535 without interior cooling supply, Form HB               |  | Ausführung für Messerkopfaufnahmen<br>Design for face mill arbor                                                                          |
|                                                |  | Entspricht DIN 6535 ohne Innenkühlung, Form HA und HB<br>Equal to DIN 6535 without interior cooling supply, Form HA and HB |                                                                                     |                                                                                                                                           |
| Werkzeugausführung<br>Tool design              |  | Kugelfräser mit Innenkühlung<br>Ballnose and mill with interior cooling supply                                             |  | Kugelfräser<br>Ballnose end mill                                                                                                          |
|                                                |  | Entgrater<br>Deburrer                                                                                                      |  | 90° Schneidecke<br>90° cutting edge                                                                                                       |
|                                                |  | Fräser mit Eckenradius<br>End mill with corner radius                                                                      |  | 90° Schneidecke<br>90° cutting edge                                                                                                       |



Erläuterung der Karnasch Piktogramme und Grafiken  
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|                                   |                                                                                     |                                                                                                                      |                                                                                     |                                                                                                                                              |
|-----------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Werkzeugausführung<br>Tool design |    | 45° Eckenfase<br>45° Corner chamber                                                                                  |    | 220° Kugelfräser<br>220° Ballnose end mill                                                                                                   |
|                                   |    | Kugelfräser ohne Halsfreischliff<br>Ballnose end mill without neck lengths                                           |    | Kugelfräser und Fräser mit Eckenfase<br>Ballnose and corner chamber end mills                                                                |
|                                   |    | Eckenfase<br>Corner chamber                                                                                          |    | Kugelfräser mit langer Schneide<br>Ballnose end mill with long cutting edge                                                                  |
|                                   |    | Fräser mit Eckenradius<br>End mill with corner radius                                                                |    | Einzahn-Kugelfräser<br>One-tooth ballnose end mill                                                                                           |
|                                   |    | Fräser mit Eckenradius und konischer Schneide<br>End mill with corner radius and conical cutting edge                |    | 170° Spitzenwinkel<br>170° Point angle                                                                                                       |
|                                   |    | Fräser mit Eckenradius und Eckenfase<br>End mill with corner radius and corner chamber                               |    | 140° Spitzenwinkel<br>140° Point angle                                                                                                       |
|                                   |    | Kugelfräser mit zylindrischem und konischem Hals<br>Ballnose end mill with cylindrical and conical neck              |    | 130° Spitzenwinkel<br>130° Point angle                                                                                                       |
|                                   |    | 250° Kugelfräser<br>250° Ball nose end mill                                                                          |    | 142° Spitzenwinkel<br>142° Point angle                                                                                                       |
|                                   |    | Viertelkreis Vorwärts- und Rückwärtsentgrater<br>Quadrant forward- and backward deburrer                             |    | 137° Spitzenwinkel<br>137° Point angle                                                                                                       |
|                                   |    | Vorwärts- und Rückwärtsentgrater, 45°<br>Forward- and backward deburrer, 45°                                         |    | 180° Spitzenwinkel<br>180° Point angle                                                                                                       |
|                                   |    | Viertelkreis - Profilfräser<br>Corner rounding cutter                                                                |    | Gewindefräser<br>Thread milling cutter                                                                                                       |
|                                   |   | Kegelsenker 90°<br>Countersinker 90°                                                                                 |   | Bohrspitze für Aramidfasern<br>Point angle for aramide fibres                                                                                |
|                                   |  | Anschnittform D nach DIN 197 für Maschinen-<br>gewindebohrer<br>Chamfer form D according to DIN 197 for machine taps |  | Anschnittform B nach DIN 197 für Maschinen-<br>gewindebohrer<br>Chamfer form B according to DIN 197 for machine taps                         |
|                                   |  | 90° Bohrspitze<br>90° Point angle                                                                                    |  | Kreuzverzahnter Fräser mit V-Spitze<br>Cross cut end mill with V-Point                                                                       |
|                                   |  | Anschnitt VHM-Reibahle<br>Cutting geometry                                                                           |  | 45° Eckenfräser mit einer Stärke von 0,1mm<br>45° Corner chamber with a size of 0,1mm                                                        |
|                                   |  | Anschnitt VHM-Reibahle<br>Cutting geometry                                                                           |  | Gratfreies fräsen<br>Burrfree milling                                                                                                        |
|                                   |  | Anschnitt VHM-Reibahle<br>Cutting geometry                                                                           |  | Mit einem speziellen Radius-Anschliff<br>With a special radius grinding                                                                      |
|                                   |  | Bohren und fräsen von Aramid<br>Drilling and milling of aramide                                                      |                                                                                     |                                                                                                                                              |
| Zerspanungsverfahren<br>Machining |  | Hochgeschwindigkeitszerspanung, Hartfräsen<br>High Speed Cutting, High Hard Cutting                                  |  | Hartfräsen, Hochgeschwindigkeitszerspanung,<br>Hochleistungszerspanung<br>High Hard Cutting, High Speed Cutting, High<br>Performance Cutting |
|                                   |  | Hochgeschwindigkeitszerspanung, Hochleistungs-<br>zerspanung,<br>High Speed Cutting, High Performance Cutting        |  | Hochgeschwindigkeitszerspanung, Alu-Ne<br>Zerspanung<br>High Speed Cutting, Alu-Non ferrous Cutting                                          |
|                                   |  | Hochgeschwindigkeitszerspanung<br>Hich Speed Cutting                                                                 |  | Hochleistungszerspanung<br>High Performance Cutting                                                                                          |
|                                   |  | Hochleistungszerspanung<br>High Performance Cutting                                                                  |  | Zum schnellen Fräsen bei hohem Spanvolumen<br>Extreme Rapid Cutting                                                                          |
|                                   |  | Multi Task Cutting                                                                                                   |  | Für exotisches Material<br>For exotic materials                                                                                              |
|                                   |  | Hartfräsen<br>High Hard Cutting                                                                                      |  | Ziehender und schiebender Schnitt<br>Drawing and pushing cut                                                                                 |
| Kühlmittel<br>Coolant             |  | Zur Verwendung mit Innenkühlung<br>To use with cooling liquid                                                        |  | Zur Verwendung mit MMKS<br>To use with MQL                                                                                                   |
|                                   |  | Zur Verwendung mit Öl, Emulsion, Luft oder MMKS<br>To use with oil, cutting emulsion, air or MQL                     |  | Zur Verwendung mit Öl oder Emulsion<br>To use with oil or cutting emulsion                                                                   |
|                                   |  | Zur Verwendung mit Kühlflüssigkeit oder trocken<br>To use with cooling liquid or dry                                 |  | Zur Verwendung mit Luftkühlung<br>To use with air cooling                                                                                    |

Erläuterung der Karnasch Piktogramme und Grafiken  
Explanation of Karnasch pictograms and graphics

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                        |  |                                                                                                                   |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------|
| Kühlmittel<br>Coolant                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Zur Verwendung mit Öl, Emulsion, und MMKS<br>To us with oil, cutting emulsion and MQL  |  | Zur Verwendung mit Öl oder unserer Schneidpaste<br>Art. 601150<br>To use with oil or our cutting-past Art. 601150 |
|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Zur Verwendung mit 50-80 bar Kühlmitteldruck<br>To use with 50-80 bar coolant pressure |  | Zur Verwendung mit 10-20 bar Kühlmitteldruck<br>To use with 10-20 bar coolant pressure                            |
|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Zur Verwendung mit Emulsion oder MMKS<br>To use with cutting emulsion or MQL           |  |                                                                                                                   |
| Beschichtungen/<br>Oberflächen<br>Coatings/Surfaces | NE-Metalle, Kunststoffe<br>Non ferrous metal, Plastics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                        |  |                                                                                                                   |
|                                                     | <div><div>GELÄPPT<br/>LAPPED</div><div>POLIERT<br/>POLISHED</div><div>NHC<br/>7000</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                        |  |                                                                                                                   |
|                                                     | Stahl, Edelstähle, Gusseisen<br>Steel, stainless steel, cast iron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                        |  |                                                                                                                   |
|                                                     | <div><div>HXC-NANO<sup>3</sup></div><div>UFX-1<br/>NANO</div><div>UFX-3</div><div>HVS</div><div>DVC-X2</div><div>XP-772</div><div>UFX-2<sup>®</sup></div><div>UFX-24</div><div>UFX-22</div><div>OXS-V2</div><div>INOX F<sup>2</sup></div><div>HXP-7</div><div>Tcx<sup>3</sup></div><div>INOX<br/>HP</div><div>DVC-X2</div></div> <div><div>DVC-X2<sup>2</sup><br/>Nano-finish</div><div>DVC-X2<br/>hp<sup>2</sup>-finish</div><div>XFN-2<br/>NANO</div><div>DMC-X2</div><div>DVC-X1</div><div>DVC-X1<sup>2</sup></div><div>HARDLUBE</div><div>XXM-1</div><div>FX-70</div></div> |                                                                                        |  |                                                                                                                   |
|                                                     | Graphit, Composites, Hartmetall<br>Graphite, Composites, Cemented Carbide                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                        |  |                                                                                                                   |
|                                                     | <div><div>DIAMANT<br/>DCA-06</div><div>DCC<br/>0318</div><div>DCA-06<br/>PLUS</div><div>DCA-06</div><div>DCC031<br/>impuls</div><div>D-CC</div><div>DCC<br/>G</div></div>                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                        |  |                                                                                                                   |
|                                                     | Titan, Titanlegierungen<br>Titanium, Titanium alloy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                        |  |                                                                                                                   |
|                                                     | <div><div>MICROGRAIN<br/>POLISHED</div><div>TI-X<sup>2</sup></div><div>GELÄPPT<br/>LAPPED</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                        |  |                                                                                                                   |

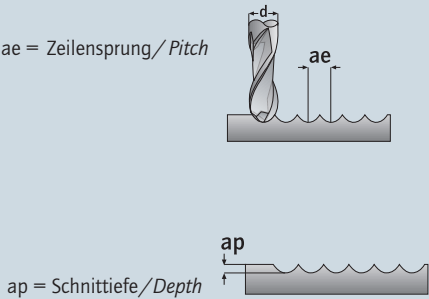
Berechnung von Schnittgeschwindigkeit, Drehzahl, Vorschubgeschwindigkeit und Vorschub pro Zahn  
Calculation of cutting speed, rpm, feed speed and feed per tooth

Zeitspanvolumen  
Time-chip volume

$$Q = \frac{a_e \cdot a_p \cdot Vf}{1000} \quad (\text{cm}^3/\text{min})$$

Schnittgeschwindigkeit u. Drehzahl – Kopierfräsen  
Cutting speed and rpm – Copying milling

$$V_c = \frac{n \cdot \pi \cdot a_e}{1000} \quad (\text{m}/\text{min})$$
$$n = \frac{V_c \cdot 1000}{\pi \cdot a_e} \quad (\text{m}/\text{min})$$
$$a_e = 2 \cdot \sqrt{a_p (d_1 - a_p)} \quad (\text{mm})$$





**Kernlochbohrer – Lochsägen –  
Stufenbohrer – Blechschälbohrer**

Core drills – Hole saws – Step drills –  
Conical drills



**Hartmetall-Frässtifte**

Solid carbide burs



**Hartmetall-bestückte Kreissägeblätter**

Carbide tipped circular saws



**Metallkreissägeblätter – Segmentkreis-  
sägeblätter – Vollhartmetallkreissägeblätter**

Metal circular saw blades – Segmental saw  
blades – Solid carbide saw blades



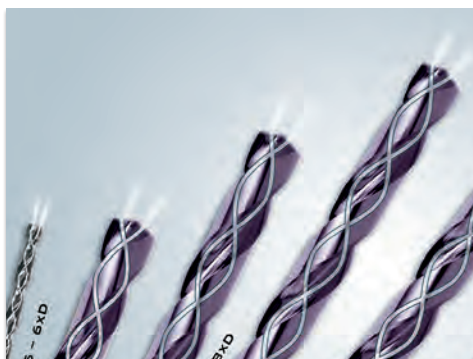
**Maschinen-, Hand- und Bandsägeblätter**

Hacksaws – Handsaws – Bandsaws



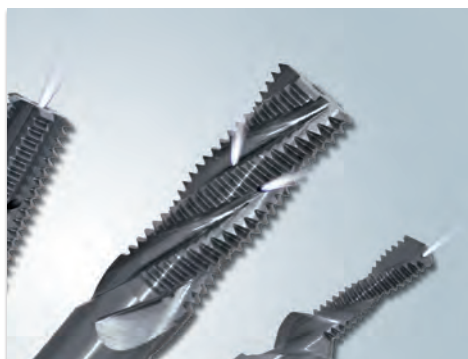
**Schaftfräser/Microfräser Vollhartmetall –  
Diamant – PKD – CBN – Cermet – CVD**

End mills/Micro end mills solid carbide –  
diamond – PCD – CBN – Cermet – CVD



**Hochleistungsbohrer/Microbohrer  
Vollhartmetall – PKD**

High performance twist drill/Micro twist  
drill solid carbide – PKD



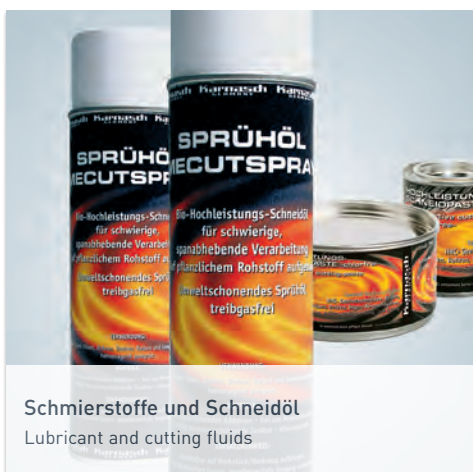
**Gewindefräser/Microgewindefräser  
Vollhartmetall**

Thread mills/Micro thread mills solid carbide



**Reibahlen/Microreibahlen  
Vollhartmetall – Cermet – PKD**

Reamers/Micro reamers solid carbide –  
Cermet – PCD



**Schmierstoffe und Schneidöl**

Lubricant and cutting fluids



**Werkzeuge für die Luft- und  
Raumfahrtindustrie – Composites**

Tools for aeronautic and space flight  
industry – Composites



**Dental-Technik Werkzeuge**

Dental technology tools



ALLGEMEINE GESCHÄFTSBEDINGUNGEN VON KARNASCH PROFESSIONAL TOOLS GMBH

§ 1 Geltungsbereich

(1) Die vorliegenden Geschäftsbedingungen der Karnasch Professional Tools GmbH, Siemensstraße 1, 68542 Heddeshofen gelten für alle Bestellungen von Unternehmern in unserem Onlineshop oder aus unseren Katalogen, soweit diese nicht durch schriftliche Vereinbarungen zwischen den Parteien abgeändert werden. Abweichende oder entgegenstehende Bedingungen werden von uns nicht anerkannt, sofern wir diesen nicht ausdrücklich zugestimmt haben.  
(2) Änderungen dieser Geschäftsbedingungen werden Ihnen schriftlich, per Telefax oder per E-Mail mitgeteilt. Widersprechen Sie dieser Änderung nicht innerhalb von vier Wochen nach Zugang der Mitteilung, gelten die Änderungen als durch Sie anerkannt. Auf das Widerspruchsrecht und die Rechtsfolgen des Schweigens werden Sie im Falle der Änderung der Geschäftsbedingungen noch gesondert hingewiesen.

§ 2 Registrierung als Nutzer bei Bestellungen im Onlineshop

(1) Ihre Registrierung als Gewerbekunde in unserem Handelssystem erfolgt kostenlos. Ein Anspruch auf Zulassung zu unserem Handelssystem besteht nicht. Teilnahmeberechtigt sind ausschließlich unbeschränkt geschäftsfähige Unternehmer im Sinne des § 14 BGB. Auf unser Verlangen haben Sie uns eine Kopie Ihres Personalausweises oder eine Bestätigung Ihrer Eigenschaft als Unternehmer zuzusenden. Zur Zulassung füllen Sie elektronisch das auf unserer Website vorhandene Anmeldeformular aus und mailen uns dieses zu. Die für die Anmeldung erforderlichen Daten sind von Ihnen vollständig und wahrheitsgemäß anzugeben. Mit der Anmeldung wählen Sie einen persönlichen Nutzernamen (E-Mail-Adresse) und ein Passwort. Der Nutzername darf weder gegen Rechte Dritter noch gegen sonstige Namens- und Markenrechte oder die guten Sitten verstoßen. Sie sind verpflichtet, das Passwort geheim zu halten und dieses Dritten keinesfalls mitzuteilen.  
(2) Abgesehen von der Erklärung Ihres Einverständnisses mit der Geltung dieser Allgemeinen Geschäftsbedingungen ist Ihre Registrierung mit keinerlei Verpflichtungen verbunden. Sie können Ihren Eintrag jederzeit wieder unter „Mein Benutzerkonto“ löschen. Allein mit der Eintragung bei uns besteht keinerlei Kaufverpflichtung hinsichtlich der von uns angebotenen Waren.  
(3) Soweit sich Ihre persönlichen Angaben ändern, sind Sie selbst für deren Aktualisierung verantwortlich. Alle Änderungen können online nach Anmeldung unter „Mein Benutzerkonto“ vorgenommen werden.

§ 3 Datenschutz

(1) Sämtliche von Ihnen mitgeteilten personenbezogenen Daten (z. B. Anrede, Name, Anschrift, Geburtsdatum, E-Mail-Adresse, Telefonnummer, Telefaxnummer, Bankverbindung, Kreditkartennummer) werden von uns ausschließlich gemäß den Bestimmungen des deutschen Datenschutzrechts erhoben, verarbeitet und gespeichert.  
(2) Soweit über die gesetzlichen Erlaubnistatbestände hinaus eine Erhebung, Verarbeitung oder Speicherung personenbezogener Daten beabsichtigt ist, erfolgt diese nur bei Vorliegen einer gesonderten Einwilligung von Ihnen.  
(3) Weiterführende Hinweise zum Datenschutz werden dem Kunden im Rahmen der Datenschutzerklärung im Onlineshop zur Verfügung gestellt.

§ 4 Vertragsschluss

Die Präsentation unserer Waren im Onlineshop oder in unseren Katalogen stellt kein bindendes Angebot unsererseits dar. Erst die Bestellung einer Ware durch Sie ist ein bindendes Angebot nach § 145 BGB. Im Falle der Annahme dieses Angebots versenden wir an Sie eine Auftragsbestätigung.

§ 5 Preise

(1) Alle Preisangaben erfolgen in Euro. Die Preise verstehen sich als Nettopreise zuzüglich der jeweils gültigen gesetzlichen Mehrwertsteuer.  
(2) Die Preise gelten ab Werk ohne Verpackung und Transportkosten.  
(3) Alle von uns aufgeführten Preise gelten für die im Onlineshop oder im Katalog bezeichnete bzw. dargestellte Ausführung und Abmessung. Soweit Sie bei Ihrer Bestellung hiervon abweichen, führt dies auch ohne ausdrückliche vorherige Ankündigung zu einer neuen Preisermessung durch uns.  
(4) An Sonderangebote sind wir nur bis einschließlich des 14. Tages ab dem Datum der Veröffentlichung gebunden, es sei denn im konkreten Angebot ist etwas Gegenteiliges ausgewiesen.

§ 6 Zahlungsbedingungen und Aufrechnung

(1) Die Zahlung der Ware erfolgt auf Rechnung per Nachname oder gegen Vorkasse.  
(2) Die Bezahlung der Lieferung hat innerhalb von 8 Tagen mit 2 % Skonto oder innerhalb von 30 Tagen, jeweils am Rechnungsdatum in bar ohne jeden Abzug zu erfolgen.  
(3) Reparatur- und Schärfaufträge sind entgegen Abs.2 nach Erhalt der Rechnung sofort ohne jeden Abzug zahlbar.  
(4) Bei Zahlungsverzug sind wir berechtigt, Zinsen gemäß § 288 Abs.2 BGB geltend zu machen.  
(5) Ist eine Teilzahlungsabrede getroffen und kommen Sie mit mehr als zwei Teilzahlungen in Verzug, so wird der Restbetrag gesamtfällig. Das gleiche gilt auch für den Fall, dass uns Umstände bekannt werden, die die Sicherheit der Forderung als gefährdet erscheinen lassen.  
(6) Aufrechnungsrechte stehen Ihnen nur zu, wenn Ihre Gegenansprüche rechtskräftig festgestellt, unbestritten oder von uns anerkannt sind.

§ 7 Lieferbedingungen

(1) Wir liefern die Ware gemäß den mit Ihnen getroffenen Vereinbarungen. Liefertermine und Lieferfristen sind nur verbindlich, wenn sie von uns schriftlich bestätigt wurden.  
(2) Soweit wir die Lieferung der Ware nicht oder nicht vertragsgemäß erbringen, müssen Sie uns zur Bewirkung der Leistung eine Nachfrist setzen. Ansonsten sind Sie nicht berechtigt, vom Vertrag zurückzutreten.  
(3) Innerhalb Deutschlands liefern wir bei einem Auftragswert von über € 1.000,- netto frachtfrei bis zur Bahnstation des Empfängers.  
(4) Außerhalb Deutschlands liefern wir bei einem Auftragswert unter € 1000,- netto, ausschl. Porto und Verpackung, unverzollt und unversichert. Weitere Kosten gehen ebenfalls zu Ihren Lasten, sofern nicht ausdrücklich eine andere Regelung getroffen wurde.  
(5) Bei Auslandslieferungen über € 1000,- netto vergüten wir Ihnen 1 % des Rechnungswertes inkl. Verpackung (unverzollt) als Transportkostenanteil. Weitere Kosten gehen zu Ihren Lasten, sofern nicht ausdrücklich eine andere Regelung getroffen wurde.  
(6) Anfallende Versandkosten werden von uns gesondert auf der Rechnung ausgewiesen.  
(7) Der Mindestauftragswert beträgt € 50,- netto.  
(8) Bei bruch- bzw. kälteempfindlichen Werkzeugen sowie Sonderanfertigungen behalten wir uns vor, von der bestellten Menge eine Über- oder Unterlieferung bis zu 10 % auch ohne gesonderte Vereinbarung vorzunehmen. Berechnet wird die Liefermenge.  
(9) Unsere günstigen Preise zwingen uns, für Kleinaufträge außerhalb der Europäischen Union die nachstehend genannten Bearbeitungsgebühren (Zollformular, Ausstellung der Zollpapiere, Bankspesen etc.) zu erheben:  
bis € 100,- netto pro Auftrag und Lieferung: € 25,- Bearbeitungsgebühr  
bis € 250,- netto pro Auftrag und Lieferung: € 15,- Bearbeitungsgebühr  
bis € 500,- netto pro Auftrag und Lieferung: € 10,- Bearbeitungsgebühr  
(10) Beim Eintritt und während der Dauer höherer Gewalt werden die vertraglichen Rechte und Pflichten suspendiert. Die betroffene Partei informiert die andere Partei unverzüglich über Eintritt, Ursache der Verzögerung und später über deren Beendigung. Falls die höhere Gewalt ununterbrochen über einen Zeitraum von mindestens 6 Monaten andauert, treffen beide Parteien eine Vereinbarung über die weitere Abwicklung des Vertrages. Falls eine Einigung nicht zustande kommt, entscheidet das vorgesehene Schiedsgericht.  
(11) § 10 Abs. 6 – 9 gelten entsprechend.

§ 8 Gefahrübergang, Abnahme

(1) Die Gefahr geht auf den Besteller über, wenn der Liefergegenstand das Werk bzw. den Versendungsort verlassen hat, und zwar auch dann, wenn Teillieferungen erfolgen oder der

Lieferer noch andere Leistungen, z. B. die Aufstellung des Liefergegenstandes übernommen hat. Soweit eine Abnahme zu erfolgen hat, ist diese für den Gefahrübergang maßgebend. Sie muss unverzüglich zum Abnahmetermin, hilfsweise nach der Meldung des Lieferers über die Abnahmebereitschaft durchgeführt werden. Sie dürfen die Abnahme bei Vorliegen eines nicht wesentlichen Mangels nicht verweigern.  
(2) Verzögert sich oder unterbleibt der Versand bzw. die Abnahme infolge von Umständen, die uns nicht zuzurechnen sind, geht die Gefahr vom Tage der Meldung der Versand- bzw. Abnahmebereitschaft auf Sie über.  
(3) Teillieferungen sind zulässig, soweit dies für Sie zumutbar ist.

§ 9 Eigentumsvorbehalt

(1) Die Ware bleibt bis zur vollständigen Bezahlung unser Eigentum. Geraten Sie mit der Zahlung länger als 10 Tage in Verzug, haben wir das Recht, vom Vertrag zurückzutreten und die Ware zurückzufordern.  
(2) Sie sind zur Weiterveräußerung der unter Eigentumsvorbehalt stehenden Ware im gewöhnlichen Geschäftsverkehr berechtigt. In diesem Falle treten Sie jedoch in Höhe des Rechnungswertes unserer Forderung bereits jetzt alle Forderungen aus einer solchen Weiterveräußerung, gleich ob diese vor oder nach einer evtl. Verarbeitung der unter Eigentumsvorbehalt gelieferten Ware erfolgt, an uns ab. Unbesehen unserer Befugnis, die Forderung selbst einzuziehen, bleiben Sie auch nach der Abtretung zum Einzug der Forderung ermächtigt. In diesem Zusammenhang verpflichten wir uns, die Forderung nicht einzuziehen, so lange und so weit Sie Ihren Zahlungsverpflichtungen nachkommen, kein Antrag auf Eröffnung eines Insolvenz- oder ähnlichen Verfahrens gestellt ist und keine Zahlungseinstellung vorliegt. Insoweit die oben genannten Sicherheiten die zu sichernden Forderungen um mehr als 10 % übersteigen, sind wir verpflichtet, die Sicherheiten nach unserer Auswahl auf Ihr Verlangen freizugeben.

§ 10 Sachmängel

(1) Alle diejenigen Teile sind nach unserer Wahl nachzubessern oder mangelfrei zu ersetzen, die sich infolge eines vor dem Gefahrübergang liegenden Umstandes als mangelhaft herausstellen. Die Feststellung solcher Mängel ist uns unverzüglich schriftlich anzuzeigen. Ersetzte Teile werden unser Eigentum.  
(2) Zur Vornahme aller uns notwendig erscheinenden Nachbesserungen und Ersatzlieferungen haben Sie uns nach Absprache die erforderliche Zeit und Gelegenheit zu geben; anderenfalls sind wir von der Haftung für die daraus entstehenden Folgen befreit. Nur in dringenden Fällen der Gefährdung der Betriebssicherheit bzw. zur Abwehr unverhältnismäßig großer Schäden – in diesen Fällen sind wir sofort zu verständigen – haben Sie das Recht, den Mangel selbst oder durch Dritte beseitigen zu lassen und von uns Ersatz der erforderlichen Aufwendungen zu verlangen.  
(3) Sie haben im Rahmen der gesetzlichen Vorschriften ein Recht zum Rücktritt vom Vertrag, wenn wir – unter Berücksichtigung der gesetzlichen Ausnahmefälle – eine gesetzte angemessene Frist für die Nachbesserung oder Ersatzlieferung wegen eines Sachmangels fruchtlos verstreichen lassen. Liegt nur ein unerheblicher Mangel vor, steht Ihnen lediglich ein Recht zur Minderung des Vertragspreises zu. Das Recht auf Minderung des Vertragspreises bleibt ansonsten ausgeschlossen.  
(4) Keine Gewährleistung wird insbesondere übernommen bei ungeeigneter oder unsachgemäßer Verwendung, fehlerhafter Montage bzw. Inbetriebsetzung durch Sie oder Dritte, natürlicher Abnutzung, fehlerhafter oder nachlässiger Behandlung, nicht ordnungsgemäßer Wartung, Nutzung ungeeigneter Betriebsmittel, chemischer, elektrochemischer oder elektrischer Einflüsse – sofern solche nicht von uns zu verantworten sind.  
(5) Bessern Sie oder ein Dritter unsachgemäß nach, haften wir nicht für die daraus resultierenden Folgen. Gleiches gilt für Änderungen des Liefergegenstandes ohne unsere vorherige Zustimmung.  
(6) Die Rücksendung der Ware ist Ihnen nur nach vorheriger schriftlicher Vereinbarung mit uns gestattet. Ohne eine solche schriftliche Vereinbarung sind die Kosten der Rücksendung von Ihnen zu tragen. Wir sind berechtigt, unfrei zugesandte Rücksendungen nicht anzunehmen.  
(7) Sonderanfertigungen werden grundsätzlich nicht zurückgenommen.  
(8) Sofern wir Ihnen eine Warengutschrift gewähren, ergibt sich die Höhe der Gutschrift aus dem Betrag der Originalrechnung abzüglich 15 % Bearbeitungsgebühr. Die Mindestbearbeitungsgebühr beträgt 15,-.  
(9) Im Falle einer Warengutschriftvereinbarung haben Sie die Ware auf Ihre Kosten an uns zurückzusenden.

§ 11 Rechtsmängel

(1) Führt die Benutzung des Liefergegenstandes zur Verletzung von gewerblichen Schutzrechten oder Urheberrechten im Inland, werden wir versuchen, Ihnen auf unsere Kosten das Recht zum weiteren Gebrauch zu verschaffen oder den Liefergegenstand in für Sie zumutbarer Weise derart zu modifizieren, dass die Schutzrechtsverletzung nicht mehr besteht. Ist dies zu wirtschaftlich angemessenen Bedingungen oder in angemessener Frist nicht möglich, sind Sie zum Rücktritt vom Vertrag berechtigt. Unter den genannten Voraussetzungen steht auch ein Recht zum Rücktritt vom Vertrag zu.  
(2) Voraussetzung für die Geltendmachung Ihrer Ansprüche ist, dass  
• Sie uns unverzüglich von geltend gemachten Schutz- oder Urheberrechtsverletzungen unterrichtet haben,  
• Sie uns in angemessenem Umfang bei der Abwehr der geltend gemachten Ansprüche unterstützen bzw. uns die Durchführung der Modifizierungsmaßnahmen ermöglicht haben,  
• uns alle Abwehrmaßnahmen einschließlich außergerichtlicher Regelungen vorbehalten bleiben,  
• der Rechtsmangel nicht auf der Eigenart Ihrer Anweisung / Bestellung beruht und  
• die Rechtsverletzung nicht dadurch verursacht wurde, dass Sie den Liefergegenstand eigenmächtig geändert oder in einer nicht vertragsgemäßen Weise verwendet haben.  
(3) § 10 Abs. 6 – 9 gelten entsprechend.

§ 12 Haftungsausschluss

(1) Führt die Benutzung des Liefergegenstandes zur Verletzung von gewerblichen Schutzrechten oder Urheberrechten im Inland, werden wir versuchen, Ihnen auf unsere Kosten das Recht zum weiteren Gebrauch zu verschaffen oder den Liefergegenstand in für Sie zumutbarer Weise derart zu modifizieren, dass die Schutzrechtsverletzung nicht mehr besteht. Ist dies zu wirtschaftlich angemessenen Bedingungen oder in angemessener Frist nicht möglich, sind Sie zum Rücktritt vom Vertrag berechtigt. Unter den genannten Voraussetzungen steht auch ein Recht zum Rücktritt vom Vertrag zu.  
(2) Voraussetzung für die Geltendmachung Ihrer Ansprüche ist, dass  
• Sie uns unverzüglich von geltend gemachten Schutz- oder Urheberrechtsverletzungen unterrichtet haben,  
• Sie uns in angemessenem Umfang bei der Abwehr der geltend gemachten Ansprüche unterstützen bzw. uns die Durchführung der Modifizierungsmaßnahmen ermöglicht haben,  
• uns alle Abwehrmaßnahmen einschließlich außergerichtlicher Regelungen vorbehalten bleiben,  
• der Rechtsmangel nicht auf der Eigenart Ihrer Anweisung / Bestellung beruht und  
• die Rechtsverletzung nicht dadurch verursacht wurde, dass Sie den Liefergegenstand eigenmächtig geändert oder in einer nicht vertragsgemäßen Weise verwendet haben.  
(3) § 10 Abs. 6 – 9 gelten entsprechend.

§ 13 Verjährung

(1) Ihre Ansprüche – gleich aus welchem Rechtsgrund – verjähren innerhalb von 12 Monaten. Für vorsätzliches oder arglistiges Verhalten, im Falle schuldhafter Verletzung von Leben, Körper und Gesundheit sowie bei Ansprüchen nach dem Produkthaftungsgesetz gelten die gesetzlichen Fristen. Sie gelten auch für Mängel eines Bauwerks oder für Liefergegenstände, die entsprechend ihrer üblichen Verwendungsweise für ein Bauwerk verwendet wurden und dessen Mangelhaftigkeit verursacht haben.  
(2) Soweit im Rahmen unserer Mängelbeseitigung Rechte von Ihnen wegen Sachmängeln neu entstehen, verjähren sämtliche Ansprüche spätestens in 24 Monaten ab Lieferung des ursprünglichen Lieferteils.

§ 14 Schlussbestimmungen

(1) Es gilt das Recht der Bundesrepublik Deutschland unter Ausschluss des UN-Kaufrechts.  
(2) Erfüllungsort ist unser Geschäftssitz.  
(3) Sofern Sie Kaufmann sind, ist ausschließlicher Gerichtsstand für alle Streitigkeiten aus oder im Zusammenhang mit diesem Vertrag Sitz unseres Unternehmens.

# GENERAL TERMS AND CONDITIONS OF KARNASCH PROFESSIONAL TOOLS GMBH

## § 1 Scope of application

(1) The present terms and conditions of Karnasch Professional Tools GmbH, Siemensstraße 1, D-68542 Heddeshheim, apply to all orders placed by entrepreneurs through our online shop or our catalogues, unless amended by written agreement between the Parties. Deviating or opposing terms and conditions will not be recognised by us, unless we have expressly agreed to them.  
(2) Amendments to these terms and conditions will be communicated to you in writing, by fax or email. If you do not object to such amendment within four weeks after receipt of the communication, the amendments will be deemed to have been accepted by you. With the amendment, you will be informed separately about your right to object and about the legal consequences of any failure to respond.

## § 2 Registration as a user for orders in the online shop

(1) As a commercial customer, you can register free of charge for our trading system. There is no entitlement to admission to our trading system. Only entrepreneurs with unlimited legal capacity within the meaning of Section 14 of the German Civil Code (BGB) are entitled to participate. At our request, you are obliged to send us a copy of your identity card or a confirmation of your status as an entrepreneur. In order to be admitted, you have to electronically complete the registration form on our website and transmit it to us. The data submitted for registration purposes must be comprehensive and truthful. Upon registration, you have to select a personal username (email address) and a password. The username may not violate the rights of third parties, nor any other name rights and trademark rights or public policy. You are required to keep the password secret and refrain from disclosing it to third parties under any circumstances.  
(2) Apart from declaring your consent to the application of these General Terms and Conditions, your registration does not entail any obligation. You can delete your entry at any time in the section "My user account". Mere registration with our system does not entail any purchase obligation with respect to the goods offered by us.  
(3) If your personal details change, you are responsible for updating yourself. All changes can be made online after registration under "My user account".

## § 3 Data protection

(1) All personal data provided by you (e.g. title, name, address, date of birth, email address, telephone number, telefax number, bank account, credit card number) will be collected, processed and saved by us exclusively in accordance with the provisions of German data protection law.  
(2) To the extent that any collection, processing or saving of personal data beyond the scope permitted by law is envisaged, such handling of the data shall be made solely on the basis of a specific consent granted by you.  
(3) Further information on data protection will be provided to you as part of the online Privacy Policy available in the online shop.

## § 4 Conclusion of contract

The presentation of our goods in our online shop or in our catalogues does not present a binding offer by us. Only the order of goods by you constitutes a binding offer pursuant to Section 145 BGB. In the event that we accept this offer, we will send you an order confirmation.

## § 5 Prices

(1) All prices are quoted in euros. All prices are quoted exclusive of VAT in addition to the respective applicable statutory value-added tax.  
(2) The prices apply ex works without packaging and shipping costs.  
(3) All prices listed by us apply to the version and the dimensions indicated in the online shop or the catalogue. To the extent that you deviate from them in your order, this leads to a new price quote even without express prior notice.  
(4) Special offers are only valid for a period of 14 days from the date of publication unless specifically stipulated otherwise in the offer concerned.

## § 6 Terms of payment and set-off

(1) Payment of the goods is made against invoice, C.O.D or against prepayment.  
(2) Payment for the delivery shall be made within 8 days - against an early payment discount of 2% - or within 30 days; in each case on the date of invoice in cash and without deduction of any nature.  
(3) Contrary to subsection (2), payment for repairs and sharpening is immediately due for payment without any deductions.  
(4) In the event of payment default, we are entitled to interest pursuant to section 288(2) BGB.  
(5) If the parties have agreed on payment in instalments, and if you are in arrears with more than two instalments, the total amount due is due for payment. The same applies if we become aware of circumstances that may give rise to doubts as to the security of the receivable.  
(6) You are only entitled to set off claims if such counter-claims have been confirmed by a final and binding court ruling, are uncontested or acknowledged by us.

## § 7 Terms of delivery

(1) We will deliver the goods in accordance with the agreements concluded with you. Delivery dates and delivery periods are only binding if confirmed by us in writing.  
(2) If we fail to deliver or deliver not according to the terms of the contract, you are obliged to allow us a grace period for the delivery of the performance. Otherwise, you are not entitled to withdraw from the contract.  
(3) Within Germany, we will deliver orders with a net value of more than € 1,000.00 to the railway station of the recipient, carriage paid.  
(4) Outside Germany, we will deliver orders with a net value of less than € 1,000.00, excluding postage and packaging, customs duties unpaid and uninsured. Additional costs are also at your expense, unless expressly agreed otherwise.  
(5) For international deliveries with a net value of more than € 1,000.00, we will refund 1% of the invoice amount including package (customs duties unpaid) as part of the shipping costs. Additional costs shall be at your expense, unless expressly agreed otherwise.  
(6) Any shipping costs incurred will be indicated separately in our invoice.  
(7) The minimum net order value is € 50.00.  
(8) For goods that are prone to breakage or sensitive to the cold, as well as for custom-made products, we reserve the right to make overdelivery or underdelivery by up to 10% even without an express agreement. The invoice will be calculated on the quantity delivered.  
(9) Due to our competitive pricing, we are obliged to charge the following processing fees (for customs forms, issue of the customs documents, bank charges, etc.) for small orders outside the European Union:  
up to € 100.00 net per order and delivery: € 25.00 processing fee  
up to € 250.00 net per order and delivery: € 15.00 processing fee  
up to € 500.00 net per order and delivery: € 10.00 processing fee  
(10) Contractual rights and duties shall be suspended upon occurrence of force majeure events for as long as they last. The affected party shall inform the other party without undue delay about the occurrence of such an event, the cause of the delay and later about the termination of the delay. If the force majeure events persist continuously over a period of at least 6 months, the parties may conclude an agreement on the further course of the contract. If no agreement is reached, the indicated arbitral tribunal shall decide.  
(11) Section 10(6) to (9) shall apply mutatis mutandis.

## § 8 Transfer of risk, acceptance

(1) The risk passes to you as soon as the goods to be delivered leave the factory or the place of dispatch, even in the case of partial deliveries or if the supplier has agreed to perform additional services, such as the installation of the goods delivered. To the extent that the parties have agreed on acceptance, such acceptance shall be decisive for the transfer of risk. The acceptance must take place without undue delay at the date of acceptance, alternatively after notification by

the supplier that the goods are ready for acceptance. Acceptance may not be refused due to a non-essential defect.  
(2) If the dispatch or acceptance is delayed or cannot take place for reasons beyond our control, the risk passes to you on the date of our notification that the goods are ready for dispatch or acceptance.  
(3) Partial deliveries are permitted to the extent that the customer can be reasonably expected to accept them.

## § 9 Retention of title

(1) The goods remain our property until full payment has been made. If you are in default of payment for a period of more than 10 days, we are entitled to withdraw from the contract and recover the goods.  
(2) You remain entitled to resell the goods delivered subject to retention of title in the ordinary course of business. However, in this case you shall assign all claims obtained from such resale up to the invoiced amount of our claim to us, irrespective of whether the resale is made before or after any processing of the goods delivered subject to retention of title. Notwithstanding our right to collect the claims ourselves, you remain entitled to collect the claims even after they have been assigned. In this connection, we undertake not to collect a claim as long as you comply with your payment obligations and no motion to commence insolvency proceedings or similar proceedings has been filed and payments have not been suspended. To the extent that the above securities exceed the secured claim by more than 10%, we shall release the securities at our discretion at your request.

## § 10 Material defects

(1) All parts that are shown to be defective due to circumstances that have occurred prior to the transfer of risk shall be, at our discretion, repaired or replaced with non-defective parts. The detection of such defects must be notified to us in writing without undue delay. Replaced parts become our property.  
(2) After consultation, you shall allow us the necessary time and opportunity to make all repairs and substitute deliveries that we deem to be necessary; otherwise, we shall be relieved of the liability for any resulting consequences. Only in urgent cases of a threat to operational safety or to prevent disproportional damage - in which cases we have to be notified immediately - you are entitled to repair the defect yourself or to have it remedied by a third party and claim reimbursement of the necessary expenses from us.  
(3) Within the scope of the statutory provisions, you are entitled to withdraw from the contract, provided that - subject to the statutory exceptions - we have failed to make the repairs or replace the goods within a reasonable grace period. In the case of a merely insignificant defect, you are merely entitled to reduce the contract price. In all other cases, the right to reduce the contract price is excluded.  
(4) No warranty is provided in particular in the case of inappropriate or improper use, faulty assembly or commissioning by you or a third party, natural wear and tear, faulty or negligent handling, improper maintenance, use of unsuitable operating materials, chemical, electro-chemical or electrical impacts, to the extent that such causes do not fall within our sphere of responsibility.  
(5) If you or a third party repairs the goods in an improper manner, we shall not be liable for any resulting consequences. The same applies to modifications to the goods delivered without our prior consent.  
(6) You may only return the goods after a prior written agreement with us. In the absence of such an agreement, you shall bear the costs for the return shipment. We are entitled to refuse returned goods that have been sent to us freight collect.  
(7) Custom-made goods cannot be returned as a matter of principle.  
(8) To the extent that we have granted you a trade-in credit, the amount of the credit is equal to the original invoiced amount less a 15% processing fee. The minimum processing fee is € 15.00.  
(9) In the event of a trade-in credit, the goods shall be shipped to us at your expense.

## § 11 Legal defects

(1) If the use of the goods delivered leads to an infringement of industrial property rights or intellectual property in Germany, we shall seek to provide you with the right to continue use of the goods or modify the goods in a manner that is reasonably acceptable for you to end the infringement of the proprietary rights. If this is not possible under economically reasonable conditions or within a reasonable time, you are entitled to withdraw from the contract. Under these conditions, we are likewise entitled to withdraw from the contract.  
(2) Your right to assert of your claims requires that  
• you have informed us without undue delay of the alleged infringement of industrial or intellectual property rights,  
• you have assisted us to a reasonable extent in the defence against the assert rights or have permitted us to make the necessary modifications,  
• all means of defence, including out-of-court settlements, are reserved,  
• the defect is not based on the nature of your specifications/order and  
• the infringement was not caused by an unauthorised modification or use of the delivered goods by you.  
(3) Section 10(6) to (9) shall apply mutatis mutandis.

## § 12 Limitation of liability

(1) Our liability is limited to intent and gross negligence. In addition, we shall be liable for negligent breach of duties, the fulfilment of which is prerequisite for the proper execution of the contract, the breach of which endangers the purpose of the contract and on the compliance of which a customer typically relies. However, in the latter case, our liability is limited to the foreseeable, contract-typical damage. Our liability does not extend to the slightly negligent breach of any obligations other than those specified in preceding sentences.  
The above limitation of liability does not apply to the loss of life, personal injury or health impairments. Liability under product liability laws remains unaffected.  
(2) Section 10(4) applies mutatis mutandis to liability.

## § 13 Limitation

(1) Your claims - irrespective of their legal base - are subject to a limitation period of 12 months. The statutory limitation periods apply to intentional or fraudulent conduct, culpable violation of life, body and health, as well as for claims under the product liability act. They also apply for defects in a building or for goods delivered that were used as intended for the construction of a building and have thus caused the defect in the building.  
(2) To the extent that you obtain new rights in terms of material defects as a result of our remedy of the defect, all claims shall expire no later than 24 months after delivery of the original part.

## § 14 Final provisions

(1) These terms are governed by law of the Federal Republic of Germany subject to the exclusion of the UN Convention on the International Sale of Goods.  
(2) Place of performance is our registered office.  
(3) In the event that you are a merchant, the exclusive place of jurisdiction for all disputes arising out of or in connection with this Contract shall be the registered office of our company.