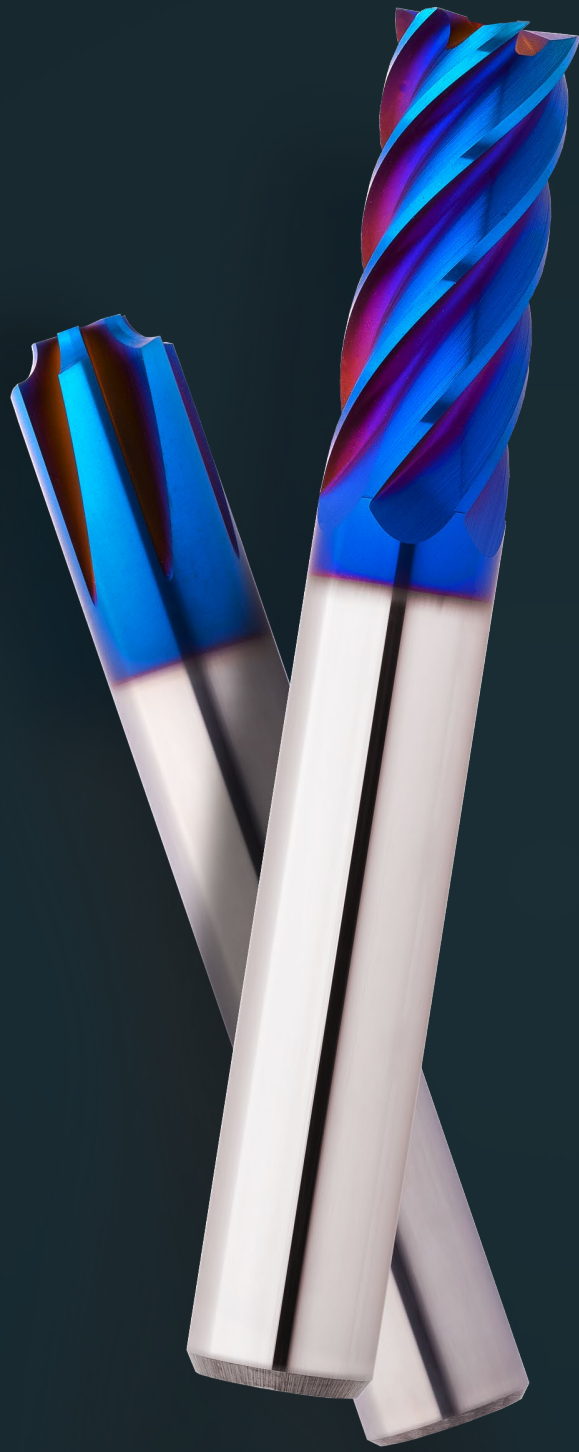


HOFMANN & VRATNY — SC MILLING CUTTERS **EN**

# HARDENED STEEL



# THE RIGHT TOOL. AT ALL TIMES.

Welcome to Hofmann & Vratny. As leading manufacturer of solid carbide tools, we enable companies throughout the world to manufacture their products.

**Every day**, our strong team works on our collective goal of producing the best tools in the world. Companies from the medical industry, semi-conductor industry, machine and plant construction, aviation, aerospace engineering and, not least, the automotive industry have been using our milling cutters for decades now. Quality – Made in Bavaria.

The success of our company is built on innovation, a culture of cooperation, open interaction with high respect and many years of successful and trustful collaboration with our business partners. You can always count on us, our tools and our irrepressible drive to shape the future of the industry together. To us, that means shaping tomorrow.

Andreas Vratny

Zdenek Vratny

Marius Heinemann-Grüder



**HARDENED  
STEEL**

**49**  
YEARS OF  
EXPERIENCE

**2 Mio.**  
TOOLS  
PRODUCED  
EVERY YEAR

## MILLING CUTTERS



**MADE IN  
BAVARIA**

PROVEN QUALITY

## DRILLS



**MADE IN  
CZECHIA**

PROVEN QUALITY

- Manufacturer of solid carbide cutting tools for a wide range of materials
- Founded 1976
- 2 locations in Bavaria and 1 location in Czechia
- Headquarters with milling cutter production in Aßling near Munich
- Regrinding center in Nuremberg
- Location with drill production in Ivančice near Brno



# BEHIND THE SCENES

## PRODUCTION ENVIRONMENT: ALWAYS UP TO DATE



On a production area of 3,751m<sup>2</sup>, we produce around 2 million tools per year. In order to guarantee the precise manufacture of our tools, our clean production halls are kept at a constant temperature of 24 °C.

### PLANT FOR MACRO TOOLS

- Manufacturing of diameter 8 - 32 mm
- Use of 5 & 6-axis CNC grinding machines with 12-position grinding wheel changer enable us to manufacture complex tool geometries
- Radius tolerance of less than 5 µm
- Laser micrometer with measuring ranges up to 50 mm covers a wide product range

### PLANT FOR MICRO TOOLS

- Manufacturing from diameter 0.1 - 6 mm
- Use of 5 & 6-axis CNC grinding machines especially with linear and hydrostatic technology
- Tolerances are 3 µm for concentricity and radii and 5 µm for diameter
- CNC measuring machines for recording and measuring the smallest geometries up to 0.1 mm diameter

### PLANT FOR SC DRILLS

- Production of standard and special drills
- Use of 5 & 6-axis grinding machines with steady rest
- Measuring technology for particularly long tools

### DEPARTMENT FOR SPECIAL TOOLS

- Production of a wide range of semi-standard and special tools
- The delivery times for the special milling cutters are as follows:
  - 3 weeks uncoated
  - 4 weeks coated
  - 6 weeks diamond-coated

### REGRINDING CENTRE

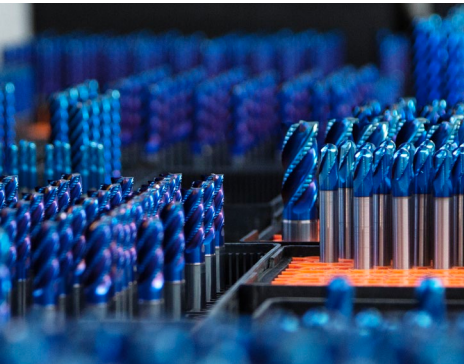
- Original reconditioning of Hofmann & Vratny tools
- Regrinding of third-party tools
- The delivery times for reground tools are as follows:
  - without colour coating: 21 calendar days
  - with colour coating: 28 calendar days

## RESEARCH & DEVELOPMENT: THE ORIGIN OF OUR INNOVATIONS



In our R&D department, we develop various milling cutter geometries and work together with our partners on innovative coatings and high-performance substrates. Furthermore, on a total of four CNC milling machines, our milling cutters and those of our competitors are tested here every day in order to develop our tools in the best possible way for state-of-the-art production processes.

## WAREHOUSE & LOGISTICS: SHIPPING TOGETHER



Through our global partner and trading network, we supply the manufacturing industries worldwide and work hand in hand to develop tools that meet customer requirements and market demands. In our warehouse and logistics department, our tools go through a multi-stage process every day to ensure that they reach the customer in perfect condition. With a stock availability of over 98.5 %, we guarantee same-day dispatch for orders received by 3 pm.

## PEOPLE ARE THE CENTRE OF ALL OUR ACTIVITIES



Every day, our team makes a significant contribution to the success of our company, which is why it is all the more important to us that our employees feel comfortable and enjoy their work alongside their day-to-day tasks. To contribute to the well-being of our employees, we offer:

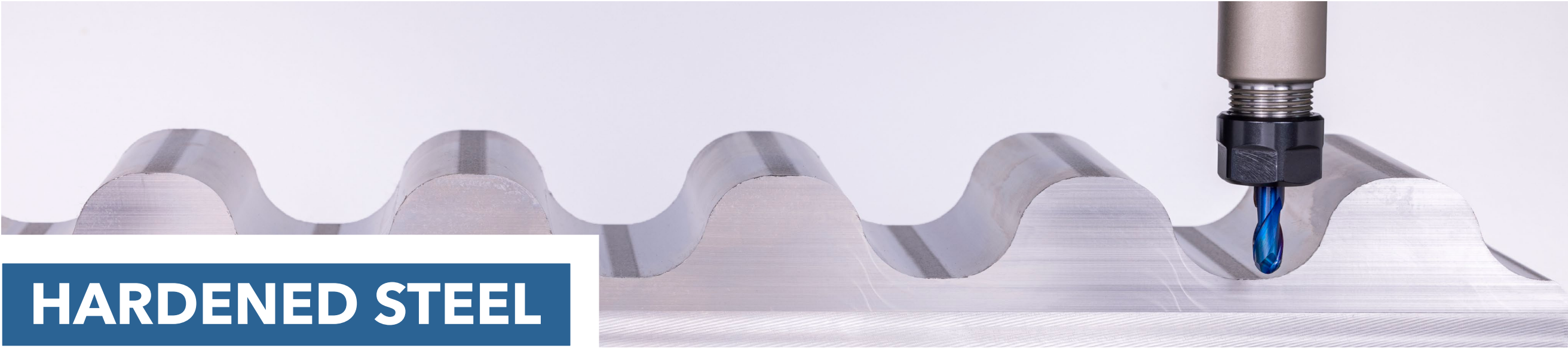
- a daily free hot lunch in our canteen
- free hot and cold drinks
- many social benefits

### WOULD YOU LIKE TO GET YOUR OWN IMPRESSION OF US?

Then come and visit us with our partner.

GET EVEN MORE INSIGHTS  
BEHIND THE SCENES:





# HARDENED STEEL

3  
PRODUCTION  
SITES

48  
YEARS OF  
EXPERIENCE

140  
MOTIVATED  
EMPLOYEES

## THE FAMOUS BLUE ORIGINAL.

The H&V Expert hard machining milling cutters have been specially designed and developed to meet the requirements of hardened steel. Selected ultrafine carbide grade, proven geometries, coordinated edge preparation and the blue coating, which has been known for years, form the perfect synergy for safe machining of hardened steels up to 70 HRC.

QUALITY  
PROCESS RELIABILITY  
ECONOMIC EFFICIENCY

## K201523 | PERFORMMAKER Z4-10 2XD ADN

### HELICAL PITCH

**Extremely** soft cut at up to 70 HRC.

### GEOMETRY

**Refined** geometry for reliable chip removal and consistently high process reliability.

### MATERIAL

**Solid** carbide specially developed for hardened steels.

### FACE

**Radius** and face geometries optimized to prevent premature breakouts.

### BLADES

**Cutting** edge preparation that has been tried and tested for decades and optimised to perfection.

### COATING

The original blue coating for hard machining, often imitated but never achieved.



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**PERFORMMAKER** | END MILL CUTTER

|                                               |    |
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| <b>K201533</b>   Performmaker Z6-10 long ADN  | 14 |



**FORMMAKER** | TORUS CUTTER

|                                               |    |
|-----------------------------------------------|----|
| <b>K202223</b>   Formmaker Z4 1xD ADN         | 16 |
| <b>K202233</b>   Formmaker Z4 1xD long ADN    | 20 |
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**BLADEMAKER** | FACE TORUS CUTTER

|                                                  |    |
|--------------------------------------------------|----|
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| <b>K207018</b>   Blademaker Z2-5 0,5xD long ADN  | 36 |



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|                                             |    |
|---------------------------------------------|----|
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|---------|-------------------|----|
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|---------|-------------------|----|



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|         |                           |    |
|---------|---------------------------|----|
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ROWMAKER MICRO | MICRO FULL RADIUS CUTTER

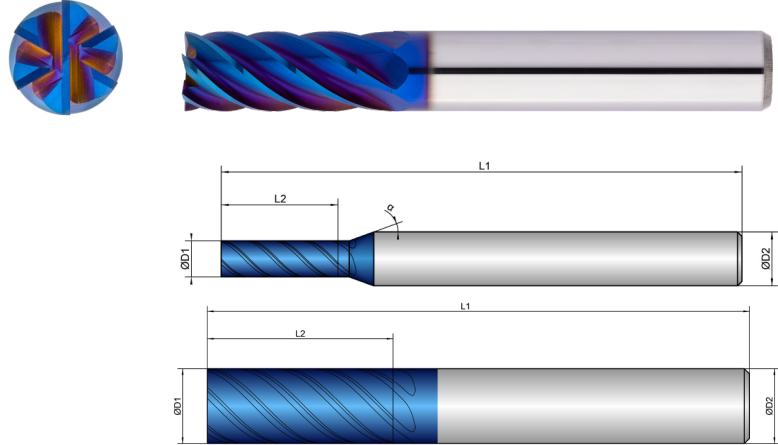
|         |                            |     |
|---------|----------------------------|-----|
| K203206 | Rowmaker Micro Z2 ADN      | 96  |
| K203212 | Rowmaker Micro Z2 long ADN | 104 |



|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                                                                                                         |                                                                                                                                                                       |                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    | ETC                                                                                                                                                                                                                                                     | HPC                                                                                                                                                                   |  |
| Application |    |                                                                                    |                                                                                     |
| Features    | HA                                                                                                                                                                                                                                                      |   | 90°                                                                                 |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- For roughing and finishing
- Reduce the axial depth of cutting with increasing hardness



| Roughing                                                                         | Finishing                                                                          |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |
| inappropriate                                                                    | optimal                                                                            |

| K201523 | D1<br><br>mm<br>ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | <br>° | α<br><br>° |
|---------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 2X8     | 2.0                                                                                                  | 8.0                                                                                             | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                              | 37.5                                                                                       | 12                                                                                              |
| 3X12    | 3.0                                                                                                  | 12.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                              | 37.5                                                                                       | 12                                                                                              |
| 4X13    | 4.0                                                                                                  | 13.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                              | 37.5                                                                                       | 12                                                                                              |
| 5X15    | 5.0                                                                                                  | 15.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 6                                                                                              | 37.5                                                                                       | 12                                                                                              |
| 6X16    | 6.0                                                                                                  | 16.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 6                                                                                              | 37.5                                                                                       |                                                                                                 |
| 8X22    | 8.0                                                                                                  | 22.0                                                                                            | 70.0                                                                                            | 8.0                                                                                                  | 6                                                                                              | 37.5                                                                                       |                                                                                                 |
| 10X25   | 10.0                                                                                                 | 25.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                              | 37.5                                                                                       |                                                                                                 |
| 12X28   | 12.0                                                                                                 | 28.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                              | 37.5                                                                                       |                                                                                                 |
| 14X30   | 14.0                                                                                                 | 30.0                                                                                            | 84.0                                                                                            | 14.0                                                                                                 | 6                                                                                              | 37.5                                                                                       |                                                                                                 |
| 16X36   | 16.0                                                                                                 | 36.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 8                                                                                              | 37.5                                                                                       |                                                                                                 |
| 18X36   | 18.0                                                                                                 | 36.0                                                                                            | 93.0                                                                                            | 18.0                                                                                                 | 10                                                                                             | 37.5                                                                                       |                                                                                                 |
| 20X41   | 20.0                                                                                                 | 41.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 10                                                                                             | 37.5                                                                                       |                                                                                                 |

| Dimension    | Ø2                                                                                  | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 | Ø14                                                                                 | Ø16                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            |
| Application  |  |  |  |  |  |  |  |  |  |  |

|     | Material       | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|----------------|-----------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |       |       |       |       |       |       |       |       |       |
| 1.1 |                | 46-55           | 130         | 0.02  | 0.025 | 0.03  | 0.035 | 0.04  | 0.045 | 0.05  | 0.055 | 0.055 |
| 1.2 |                | 56-60           | 100         | 0.018 | 0.022 | 0.028 | 0.032 | 0.038 | 0.042 | 0.047 | 0.052 | 0.052 |
| 1.3 |                | 60-65           | 85          | 0.015 | 0.02  | 0.025 | 0.03  | 0.035 | 0.04  | 0.045 | 0.05  | 0.05  |
| 1.4 |                | 66-70           | 70          | 0.012 | 0.015 | 0.02  | 0.025 | 0.03  | 0.035 | 0.04  | 0.04  | 0.05  |

| Dimension    | Ø18                                                                                 | Ø20                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            |
| Application  |  |  |

|     | Material       | Hardness in HRC | Feed (mm/Z) | fz    | fz    |
|-----|----------------|-----------------|-------------|-------|-------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |       |       |
| 1.1 |                | 46-55           | 130         | 0.07  | 0.08  |
| 1.2 |                | 56-60           | 100         | 0.065 | 0.075 |
| 1.3 |                | 60-65           | 85          | 0.06  | 0.07  |
| 1.4 |                | 66-70           | 70          | 0.05  | 0.06  |

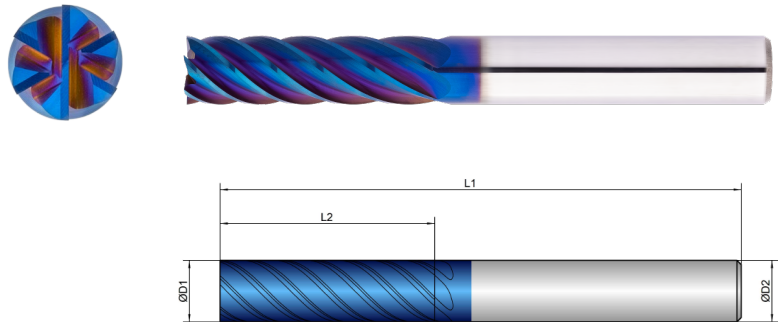
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                           |                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    | <b>ETC</b>                                                                                                                                                                                                                                              | <b>HPC</b>                                                                                                                                                                                                                                                |  |
| Application |    |                                                                                                                                                                                                                                                           |                                                                                     |
| Features    | <b>HA</b>                                                                                                                                                                                                                                               |    |  |

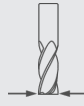
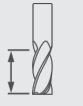
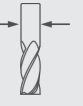
- Ultrafine carbide grade specially developed for machining hardened steels
- Adapted rake angle for safe milling up to 70 HRC
- Defined cutting edge preparation for homogeneous wear

- For roughing and finishing

- Reduce the axial depth of cutting with increasing hardness



| Roughing                                                                         |  |  |  |  | Finishing                                                                          |  |  |  |  |
|----------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |  |  |  |  | inappropriate                                                                      |  |  |  |  |
| optimal                                                                          |  |  |  |  | optimal                                                                            |  |  |  |  |

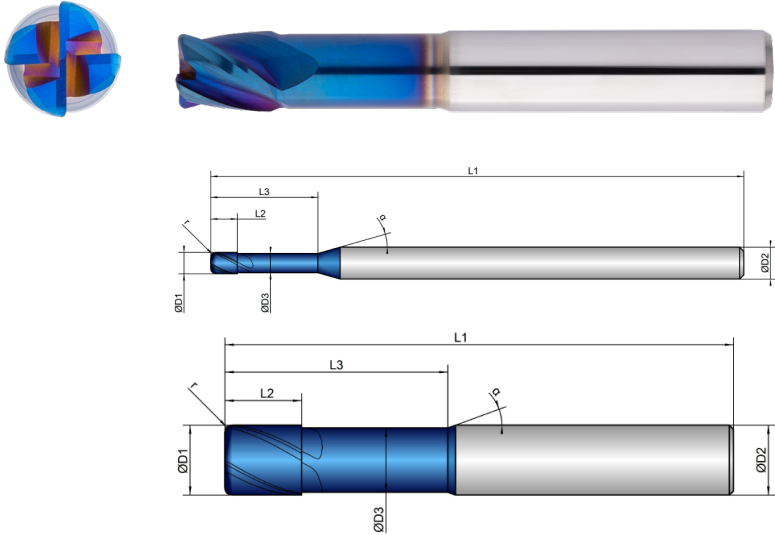
|         | <br>D1<br>mm<br>Ø | <br>L2<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>Ø | <br>z<br># | <br>° |
|---------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| K201533 |                                                                                                     |                                                                                                |                                                                                                |                                                                                                     |                                                                                                |                                                                                           |
| 6X21    | 6.0                                                                                                 | 21.0                                                                                           | 65.0                                                                                           | 6.0                                                                                                 | 6                                                                                              | 37.5                                                                                      |
| 8X28    | 8.0                                                                                                 | 28.0                                                                                           | 75.0                                                                                           | 8.0                                                                                                 | 6                                                                                              | 37.5                                                                                      |
| 10X35   | 10.0                                                                                                | 35.0                                                                                           | 85.0                                                                                           | 10.0                                                                                                | 6                                                                                              | 37.5                                                                                      |
| 12X45   | 12.0                                                                                                | 45.0                                                                                           | 100.0                                                                                          | 12.0                                                                                                | 6                                                                                              | 37.5                                                                                      |
| 14X45   | 14.0                                                                                                | 45.0                                                                                           | 100.0                                                                                          | 14.0                                                                                                | 6                                                                                              | 37.5                                                                                      |
| 16X50   | 16.0                                                                                                | 50.0                                                                                           | 110.0                                                                                          | 16.0                                                                                                | 8                                                                                              | 37.5                                                                                      |
| 16X65   | 16.0                                                                                                | 65.0                                                                                           | 125.0                                                                                          | 16.0                                                                                                | 8                                                                                              | 37.5                                                                                      |
| 18X54   | 18.0                                                                                                | 54.0                                                                                           | 114.0                                                                                          | 18.0                                                                                                | 10                                                                                             | 37.5                                                                                      |
| 20X55   | 20.0                                                                                                | 55.0                                                                                           | 126.0                                                                                          | 20.0                                                                                                | 10                                                                                             | 37.5                                                                                      |
| 20X70   | 20.0                                                                                                | 70.0                                                                                           | 135.0                                                                                          | 20.0                                                                                                | 10                                                                                             | 37.5                                                                                      |
| 20X75   | 20.0                                                                                                | 75.0                                                                                           | 135.0                                                                                          | 20.0                                                                                                | 10                                                                                             | 37.5                                                                                      |
| 25X75   | 25.0                                                                                                | 75.0                                                                                           | 150.0                                                                                          | 25.0                                                                                                | 10                                                                                             | 37.5                                                                                      |

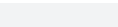
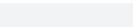
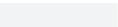
|                 |                    | Dimension   | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 | Ø14                                                                                 | Ø16                                                                                 | Ø18                                                                                 | Ø20                                                                                 | Ø25                                                                                 |
|-----------------|--------------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed<br>in mm | Application        | Feed (mm/Z) | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            | ae= 0.05xD<br>ap= L2 max                                                            |
|                 |                    |             |  |  |  |  |  |  |  |  |  |
| Material        | Hardness<br>in HRC | Feed (mm/Z) | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H               | HARDENED STEEL     | Vc (m/min)  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1             | 46-55              | 120         | 0.04                                                                                | 0.045                                                                               | 0.05                                                                                | 0.055                                                                               | 0.055                                                                               | 0.07                                                                                | 0.07                                                                                | 0.08                                                                                | 0.085                                                                               |
| 1.2             | 56-60              | 90          | 0.038                                                                               | 0.042                                                                               | 0.047                                                                               | 0.052                                                                               | 0.052                                                                               | 0.065                                                                               | 0.065                                                                               | 0.075                                                                               | 0.08                                                                                |
| 1.3             | 60-65              | 75          | 0.035                                                                               | 0.04                                                                                | 0.045                                                                               | 0.05                                                                                | 0.05                                                                                | 0.06                                                                                | 0.06                                                                                | 0.07                                                                                | 0.075                                                                               |
| 1.4             | 66-70              | 60          | 0.03                                                                                | 0.03                                                                                | 0.035                                                                               | 0.04                                                                                | 0.04                                                                                | 0.05                                                                                | 0.05                                                                                | 0.06                                                                                | 0.065                                                                               |

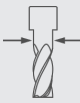
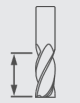
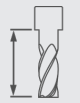
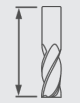
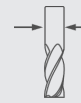
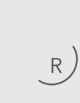
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

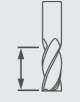
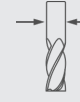
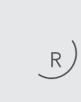
|             |                                                                                                                                                                                                                                                                                                                                             |                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    | <b>HSC</b> <b>HPC</b>                                                                                                                                                                                                                                                                                                                       |  |
| Application |     |  |
| Features    | <b>HA</b> <b>≠</b>   <b>1xD</b>                                                    |  |

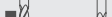
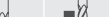
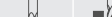
- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- Multipass milling of 3D contours
- Radius tolerance  $r \leq 1.5\text{ mm}$ :  $\pm 0.003\text{ mm}$
  - Radius tolerance  $r > 1.5\text{ mm}$ :  $\pm 0.005\text{ mm}$



| Roughing                                                                          |                                                                                    |                                                                                    |                                                                                    |                                                                                    | Finishing                                                                          |                                                                                     |                                                                                      |                                                                                      |                                                                                      |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                     |                                                                                    |                                                                                    |                                                                                    |                                                                                    | inappropriate                                                                      |                                                                                     |                                                                                      |                                                                                      |                                                                                      |
|                                                                                   |                                                                                    |                                                                                    |                                                                                    |                                                                                    | optimal                                                                            |                                                                                     |                                                                                      |                                                                                      |                                                                                      |

| K202223 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1/0,1   | 1.0                                                                                                  | 0.85                                                                                                 | 1.5                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.10                                                                                             | 35                                                                                         | 20                                                                                         |
| 1/0,2   | 1.0                                                                                                  | 0.85                                                                                                 | 1.5                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.20                                                                                             | 35                                                                                         | 20                                                                                         |
| 2/0,2   | 2.0                                                                                                  | 1.8                                                                                                  | 2.5                                                                                             | 12.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.20                                                                                             | 35                                                                                         | 20                                                                                         |
| 2/0,3   | 2.0                                                                                                  | 1.8                                                                                                  | 2.5                                                                                             | 12.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.30                                                                                             | 35                                                                                         | 20                                                                                         |
| 2/0,5   | 2.0                                                                                                  | 1.8                                                                                                  | 2.5                                                                                             | 12.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/0,25  | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.25                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/0,3   | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.30                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/0,5   | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/1     | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 1.00                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,2   | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.20                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,25  | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.25                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,4   | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.40                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,5   | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/1     | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 1.00                                                                                             | 35                                                                                         | 20                                                                                         |
| 5/0,25  | 5.0                                                                                                  | 4.6                                                                                                  | 6.0                                                                                             | 18.0                                                                                            | 54.0                                                                                            | 5.0                                                                                                  | 4                                                                                              | 0.25                                                                                             | 35                                                                                         | 20                                                                                         |
| 5/0,5   | 5.0                                                                                                  | 4.6                                                                                                  | 6.0                                                                                             | 18.0                                                                                            | 54.0                                                                                            | 5.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |

| K202223 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 5/1     | 5.0                                                                                                  | 4.6                                                                                                  | 6.0                                                                                             | 18.0                                                                                            | 54.0                                                                                            | 5.0                                                                                                  | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/0,25  | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 21.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 0.25                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/0,5   | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 21.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/0,8   | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 21.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 0.80                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/1     | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 21.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/1,5   | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 21.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/2     | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 21.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/0,25  | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 0.25                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/0,5   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/0,8   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 0.80                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/1     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/1,5   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/2     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/2,5   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 2.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/3     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/0,25 | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 0.25                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/0,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/0,8  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 0.80                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/1    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/1,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/2    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/3    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/3,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 3.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/0,5  | 12.0                                                                                                 | 9.2                                                                                                  | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/1    | 12.0                                                                                                 | 9.2                                                                                                  | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/1,5  | 12.0                                                                                                 | 9.2                                                                                                  | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/2    | 12.0                                                                                                 | 9.2                                                                                                  | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/3    | 12.0                                                                                                 | 9.2                                                                                                  | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 16/1    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 44.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 16/2    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 44.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 16/3    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 44.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 20/1    | 20.0                                                                                                 | 18.5                                                                                                 | 20.0                                                                                            | 55.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 20/2,5  | 20.0                                                                                                 | 18.5                                                                                                 | 20.0                                                                                            | 55.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 4                                                                                             | 2.50                                                                                           | 35                                                                                       | 20                                                                                       |

| Dimension       | Ø8                                                                                |               | Ø10                                                                               |               | Ø12                                                                               |               | Ø16                                                                                |               | Ø20                                                                                 |               |
|-----------------|-----------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------|---------------|
| Infeed<br>in mm | ae=<br>0.05xD                                                                     | ae=<br>0.04xD | ae=<br>0.05xD                                                                     | ae=<br>0.04xD | ae=<br>0.05xD                                                                     | ae=<br>0.04xD | ae=<br>0.05xD                                                                      | ae=<br>0.04xD | ae=<br>0.05xD                                                                       | ae=<br>0.04xD |
|                 | ap=<br>L2 max                                                                     | ap=<br>0.04xD | ap=<br>L2 max                                                                     | ap=<br>0.04xD | ap=<br>L2 max                                                                     | ap=<br>0.04xD | ap=<br>L2 max                                                                      | ap=<br>0.04xD | ap=<br>L2 max                                                                       | ap=<br>0.04xD |
| Application     |  |               |  |               |  |               |  |               |  |               |

|                                                                                        | Material       | Hardness<br>in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|----------------------------------------------------------------------------------------|----------------|--------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| H                                                                                      | HARDENED STEEL |                    | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |
| 1.1                                                                                    |                | 46-55              | 130         | 0.045 | 0.05  | 0.05  | 0.055 | 0.055 | 0.07  | 0.07  | 0.075 | 0.08  | 0.085 |
| 1.2                                                                                    |                | 56-60              | 100         | 0.042 | 0.048 | 0.047 | 0.053 | 0.052 | 0.065 | 0.065 | 0.07  | 0.075 | 0.08  |
| 1.3                                                                                    |                | 60-65              | 85          | 0.04  | 0.045 | 0.045 | 0.05  | 0.05  | 0.06  | 0.06  | 0.065 | 0.07  | 0.075 |
| 1.4                                                                                    |                | 66-70              | 70          | 0.03  | 0.035 | 0.035 | 0.045 | 0.04  | 0.055 | 0.05  | 0.06  | 0.06  | 0.07  |
| ADVICE   By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius! |                |                    |             |       |       |       |       |       |       |       |       |       |       |

**ADVICE** | By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius!



**No problem** – simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

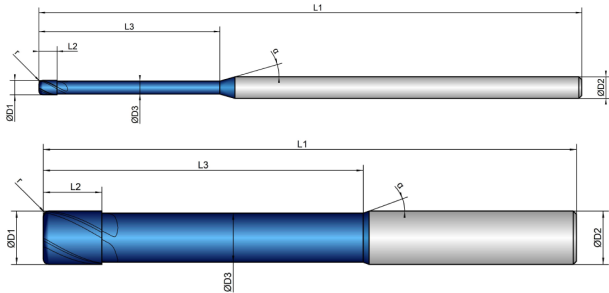
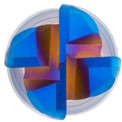
WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST

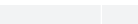
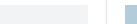
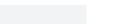


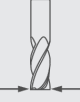
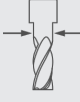
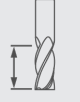
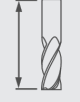
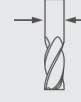
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| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

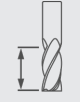
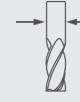
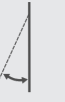
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|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    | <b>HSC</b> <b>HPC</b>                                                                                                                                                                                                                                                                                                                       |  |
| Application |     |  |
| Features    | <b>HA</b> <b>≠</b>   <b>1xD</b>                                                    |  |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- Long version for deeper cavities
  - Multipass milling of 3D contours
- Radius tolerance  $r \leq 1.5\text{ mm}$ :  $\pm 0.003\text{ mm}$
  - Radius tolerance  $r > 1.5\text{ mm}$ :  $\pm 0.005\text{ mm}$



| Roughing                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   | Finishing                                                                         |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   | inappropriate                                                                     |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |                                                                                   | optimal                                                                           |                                                                                    |                                                                                     |                                                                                     |                                                                                     |

| K202233 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1/0,1   | 1.0                                                                                                  | 0.85                                                                                                 | 1.5                                                                                             | 20.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.10                                                                                             | 35                                                                                         | 20                                                                                         |
| 1/0,2   | 1.0                                                                                                  | 0.85                                                                                                 | 1.5                                                                                             | 20.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.20                                                                                             | 35                                                                                         | 20                                                                                         |
| 2/0,2   | 2.0                                                                                                  | 1.8                                                                                                  | 2.5                                                                                             | 25.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.20                                                                                             | 35                                                                                         | 20                                                                                         |
| 2/0,3   | 2.0                                                                                                  | 1.8                                                                                                  | 2.5                                                                                             | 25.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.30                                                                                             | 35                                                                                         | 20                                                                                         |
| 2/0,5   | 2.0                                                                                                  | 1.8                                                                                                  | 2.5                                                                                             | 25.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/0,25  | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 32.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.25                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/0,3   | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 32.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.30                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/0,5   | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 32.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |
| 3/1     | 3.0                                                                                                  | 2.7                                                                                                  | 4.0                                                                                             | 32.0                                                                                            | 75.0                                                                                            | 3.0                                                                                                  | 4                                                                                              | 1.00                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,2   | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 36.0                                                                                            | 75.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.20                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,25  | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 36.0                                                                                            | 75.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.25                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,4   | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 36.0                                                                                            | 75.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.40                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/0,5   | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 36.0                                                                                            | 75.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |
| 4/1     | 4.0                                                                                                  | 3.7                                                                                                  | 5.0                                                                                             | 36.0                                                                                            | 75.0                                                                                            | 4.0                                                                                                  | 4                                                                                              | 1.00                                                                                             | 35                                                                                         | 20                                                                                         |
| 5/0,25  | 5.0                                                                                                  | 4.6                                                                                                  | 6.0                                                                                             | 40.0                                                                                            | 75.0                                                                                            | 5.0                                                                                                  | 4                                                                                              | 0.25                                                                                             | 35                                                                                         | 20                                                                                         |
| 5/0,5   | 5.0                                                                                                  | 4.6                                                                                                  | 6.0                                                                                             | 40.0                                                                                            | 75.0                                                                                            | 5.0                                                                                                  | 4                                                                                              | 0.50                                                                                             | 35                                                                                         | 20                                                                                         |

| K202233 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 5/1     | 5.0                                                                                                  | 4.6                                                                                                  | 6.0                                                                                             | 40.0                                                                                            | 75.0                                                                                            | 5.0                                                                                                  | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/0,25  | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 44.0                                                                                            | 80.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 0.25                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/0,5   | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 44.0                                                                                            | 80.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/1     | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 44.0                                                                                            | 80.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 6/1,5   | 6.0                                                                                                  | 5.5                                                                                                  | 7.0                                                                                             | 44.0                                                                                            | 80.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/0,25  | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 0.25                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/0,5   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/0,8   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 0.80                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/1     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/1,5   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/2     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 8/3     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/0,25 | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 0.25                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/0,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/0,8  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 0.80                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/1    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/1,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/2    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 10/3    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 60.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/0,5  | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 75.0                                                                                            | 120.0                                                                                           | 12.0                                                                                                 | 4                                                                                             | 0.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/1    | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 75.0                                                                                            | 120.0                                                                                           | 12.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/1,5  | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 75.0                                                                                            | 120.0                                                                                           | 12.0                                                                                                 | 4                                                                                             | 1.50                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/2    | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 75.0                                                                                            | 120.0                                                                                           | 12.0                                                                                                 | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 12/3    | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 75.0                                                                                            | 120.0                                                                                           | 12.0                                                                                                 | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 16/1    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 92.0                                                                                            | 150.0                                                                                           | 16.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 16/2    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 92.0                                                                                            | 150.0                                                                                           | 16.0                                                                                                 | 4                                                                                             | 2.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 16/3    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 92.0                                                                                            | 150.0                                                                                           | 16.0                                                                                                 | 4                                                                                             | 3.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 20/1    | 20.0                                                                                                 | 18.5                                                                                                 | 20.0                                                                                            | 92.0                                                                                            | 150.0                                                                                           | 20.0                                                                                                 | 4                                                                                             | 1.00                                                                                           | 35                                                                                       | 20                                                                                       |
| 20/2,5  | 20.0                                                                                                 | 18.5                                                                                                 | 20.0                                                                                            | 92.0                                                                                            | 150.0                                                                                           | 20.0                                                                                                 | 4                                                                                             | 2.50                                                                                           | 35                                                                                       | 20                                                                                       |

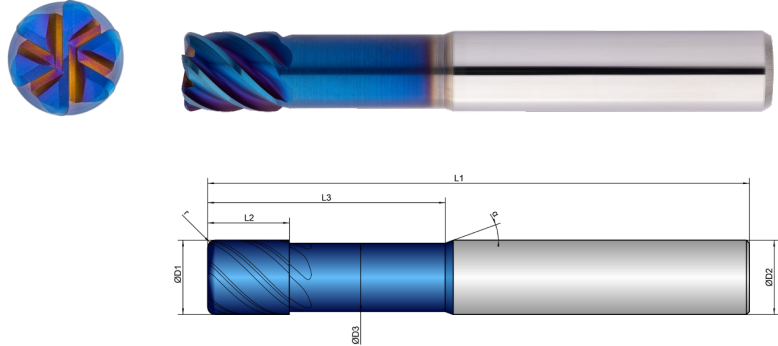
|     | Material       | Hardness<br>in HRC | Dimension       | Ø1            |               | Ø2            |               | Ø3            |               | Ø4            |               | Ø5            |               | Ø6            |               |
|-----|----------------|--------------------|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|     |                |                    | Infeed<br>in mm | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD |
|     |                |                    |                 | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD |
|     |                |                    | Application     |               |               |               |               |               |               |               |               |               |               |               |               |
|     |                |                    | Feed (mm/Z)     | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            |
| H   | HARDENED STEEL |                    | Vc (m/min)      |               |               |               |               |               |               |               |               |               |               |               |               |
| 1.1 |                | 46-55              | 105             | 0.015         | 0.017         | 0.02          | 0.025         | 0.025         | 0.03          | 0.03          | 0.035         | 0.035         | 0.04          | 0.04          | 0.045         |
| 1.2 |                | 56-60              | 80              | 0.012         | 0.014         | 0.018         | 0.022         | 0.022         | 0.028         | 0.028         | 0.032         | 0.032         | 0.038         | 0.038         | 0.042         |
| 1.3 |                | 60-65              | 70              | 0.01          | 0.012         | 0.015         | 0.02          | 0.02          | 0.025         | 0.025         | 0.03          | 0.03          | 0.035         | 0.035         | 0.04          |
| 1.4 |                | 66-70              | 60              | 0.007         | 0.009         | 0.012         | 0.017         | 0.015         | 0.02          | 0.02          | 0.025         | 0.025         | 0.03          | 0.03          | 0.035         |

|                                                                                        | Material       | Hardness<br>in HRC | Dimension       | Ø8            |               | Ø10           |               | Ø12           |               | Ø16           |               | Ø20           |               |
|----------------------------------------------------------------------------------------|----------------|--------------------|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                                                                                        |                |                    | Infeed<br>in mm | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD |
|                                                                                        |                |                    |                 | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD |
|                                                                                        |                |                    | Application     |               |               |               |               |               |               |               |               |               |               |
|                                                                                        |                |                    | Feed (mm/Z)     | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            |
| H                                                                                      | HARDENED STEEL |                    | Vc (m/min)      |               |               |               |               |               |               |               |               |               |               |
| 1.1                                                                                    |                | 46-55              | 105             | 0.045         | 0.05          | 0.05          | 0.055         | 0.055         | 0.07          | 0.07          | 0.075         | 0.08          | 0.085         |
| 1.2                                                                                    |                | 56-60              | 80              | 0.042         | 0.048         | 0.047         | 0.053         | 0.052         | 0.065         | 0.065         | 0.07          | 0.075         | 0.08          |
| 1.3                                                                                    |                | 60-65              | 70              | 0.04          | 0.045         | 0.045         | 0.05          | 0.05          | 0.06          | 0.06          | 0.065         | 0.07          | 0.075         |
| 1.4                                                                                    |                | 66-70              | 60              | 0.03          | 0.035         | 0.035         | 0.045         | 0.04          | 0.055         | 0.05          | 0.06          | 0.06          | 0.07          |
| ADVICE   By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius! |                |                    |                 |               |               |               |               |               |               |               |               |               |               |

|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                              |                                                                                     |
|-------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    | <b>HSC</b> <b>HPC</b>                                                                        |  |
| Application |            |                                                                                     |
| Features    | <b>HA</b>  |  |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- 
- Multipass milling of 3D contours
- 
- Radius tolerance  $r \leq 1.5\text{ mm}$ :  $\pm 0.003\text{ mm}$
  - Radius tolerance  $r > 1.5\text{ mm}$ :  $\pm 0.005\text{ mm}$



| Roughing                                                                         |                                                                                                     |                                                                                                     |                                                                                                |                                                                                                | Finishing                                                                                      |                                                                                                     |                                                                                              |                                                                                                 |                                                                                           |                                                                                           |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|  |                                                                                                     |                                                                                                     |                                                                                                |                                                                                                |              |                                                                                                     |                                                                                              |                                                                                                 |                                                                                           |                                                                                           |
| inappropriate                                                                    |                                                                                                     |                                                                                                     |                                                                                                |                                                                                                | inappropriate                                                                                  |                                                                                                     |                                                                                              |                                                                                                 |                                                                                           |                                                                                           |
| optimal                                                                          |                                                                                                     |                                                                                                     |                                                                                                |                                                                                                | optimal                                                                                        |                                                                                                     |                                                                                              |                                                                                                 |                                                                                           |                                                                                           |
| K202253                                                                          | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | <br>° |
| 3/0,3                                                                            | 3.0                                                                                                 | 2.7                                                                                                 | 4.0                                                                                            | 14.0                                                                                           | 50.0                                                                                           | 3.0                                                                                                 | 4                                                                                            | 0.30                                                                                            | 45                                                                                        | 20                                                                                        |
| 3/0,5                                                                            | 3.0                                                                                                 | 2.7                                                                                                 | 4.0                                                                                            | 14.0                                                                                           | 50.0                                                                                           | 3.0                                                                                                 | 4                                                                                            | 0.50                                                                                            | 45                                                                                        | 20                                                                                        |
| 3/1                                                                              | 3.0                                                                                                 | 2.7                                                                                                 | 4.0                                                                                            | 14.0                                                                                           | 50.0                                                                                           | 3.0                                                                                                 | 4                                                                                            | 1.00                                                                                            | 45                                                                                        | 20                                                                                        |
| 4/0,4                                                                            | 4.0                                                                                                 | 3.7                                                                                                 | 5.0                                                                                            | 16.0                                                                                           | 50.0                                                                                           | 4.0                                                                                                 | 4                                                                                            | 0.40                                                                                            | 45                                                                                        | 20                                                                                        |
| 4/0,5                                                                            | 4.0                                                                                                 | 3.7                                                                                                 | 5.0                                                                                            | 16.0                                                                                           | 50.0                                                                                           | 4.0                                                                                                 | 4                                                                                            | 0.50                                                                                            | 45                                                                                        | 20                                                                                        |
| 4/1                                                                              | 4.0                                                                                                 | 3.7                                                                                                 | 5.0                                                                                            | 16.0                                                                                           | 50.0                                                                                           | 4.0                                                                                                 | 4                                                                                            | 1.00                                                                                            | 45                                                                                        | 20                                                                                        |
| 5/0,5                                                                            | 5.0                                                                                                 | 4.6                                                                                                 | 6.0                                                                                            | 18.0                                                                                           | 54.0                                                                                           | 5.0                                                                                                 | 4                                                                                            | 0.50                                                                                            | 45                                                                                        | 20                                                                                        |
| 5/1                                                                              | 5.0                                                                                                 | 4.6                                                                                                 | 6.0                                                                                            | 18.0                                                                                           | 54.0                                                                                           | 5.0                                                                                                 | 4                                                                                            | 1.00                                                                                            | 45                                                                                        | 20                                                                                        |
| 6/0,5                                                                            | 6.0                                                                                                 | 5.5                                                                                                 | 7.0                                                                                            | 21.0                                                                                           | 58.0                                                                                           | 6.0                                                                                                 | 6                                                                                            | 0.50                                                                                            | 45                                                                                        | 20                                                                                        |
| 6/0,8                                                                            | 6.0                                                                                                 | 5.5                                                                                                 | 7.0                                                                                            | 21.0                                                                                           | 58.0                                                                                           | 6.0                                                                                                 | 6                                                                                            | 0.80                                                                                            | 45                                                                                        | 20                                                                                        |
| 6/1                                                                              | 6.0                                                                                                 | 5.5                                                                                                 | 7.0                                                                                            | 21.0                                                                                           | 58.0                                                                                           | 6.0                                                                                                 | 6                                                                                            | 1.00                                                                                            | 45                                                                                        | 20                                                                                        |
| 6/1,5                                                                            | 6.0                                                                                                 | 5.5                                                                                                 | 7.0                                                                                            | 21.0                                                                                           | 58.0                                                                                           | 6.0                                                                                                 | 6                                                                                            | 1.50                                                                                            | 45                                                                                        | 20                                                                                        |
| 8/0,5                                                                            | 8.0                                                                                                 | 7.4                                                                                                 | 9.0                                                                                            | 27.0                                                                                           | 64.0                                                                                           | 8.0                                                                                                 | 6                                                                                            | 0.50                                                                                            | 45                                                                                        | 20                                                                                        |

|         | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| K202253 |                                                                                                      |                                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                      |                                                                                               |                                                                                                |                                                                                          |                                                                                          |
| 8/0,8   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 0.80                                                                                           | 45                                                                                       | 20                                                                                       |
| 8/1     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 1.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 8/1,5   | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 1.50                                                                                           | 45                                                                                       | 20                                                                                       |
| 8/2     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 2.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 8/3     | 8.0                                                                                                  | 7.4                                                                                                  | 9.0                                                                                             | 27.0                                                                                            | 64.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 3.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 10/0,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 0.50                                                                                           | 45                                                                                       | 20                                                                                       |
| 10/0,8  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 0.80                                                                                           | 45                                                                                       | 20                                                                                       |
| 10/1    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 1.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 10/1,5  | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 1.50                                                                                           | 45                                                                                       | 20                                                                                       |
| 10/2    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 2.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 10/3    | 10.0                                                                                                 | 9.2                                                                                                  | 11.0                                                                                            | 32.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 3.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 12/0,5  | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 0.50                                                                                           | 45                                                                                       | 20                                                                                       |
| 12/1    | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 1.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 12/1,5  | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 1.50                                                                                           | 45                                                                                       | 20                                                                                       |
| 12/2    | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 2.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 12/3    | 12.0                                                                                                 | 11.0                                                                                                 | 12.0                                                                                            | 38.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 3.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 16/1    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 44.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 6                                                                                             | 1.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 16/2    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 44.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 6                                                                                             | 2.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 16/3    | 16.0                                                                                                 | 15.0                                                                                                 | 16.0                                                                                            | 44.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 6                                                                                             | 3.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 20/1    | 20.0                                                                                                 | 18.5                                                                                                 | 20.0                                                                                            | 50.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 6                                                                                             | 1.00                                                                                           | 45                                                                                       | 20                                                                                       |
| 20/2,5  | 20.0                                                                                                 | 18.5                                                                                                 | 20.0                                                                                            | 50.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 6                                                                                             | 2.50                                                                                           | 45                                                                                       | 20                                                                                       |

|     | Material       | Hardness<br>in HRC | Dimension       | Ø 3           |               | Ø 4           |               | Ø 5           |               | Ø 6           |               | Ø 8           |               | Ø 10          |               |
|-----|----------------|--------------------|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|     |                |                    | Infeed<br>in mm | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD |
|     |                |                    |                 | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD |
|     |                |                    | Application     |               |               |               |               |               |               |               |               |               |               |               |               |
|     |                |                    | Feed (mm/Z)     | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            | fz            |
| H   | HARDENED STEEL |                    | Vc (m/min)      |               |               |               |               |               |               |               |               |               |               |               |               |
| 1.1 |                | 46-55              | 125             | 0.025         | 0.03          | 0.03          | 0.035         | 0.035         | 0.04          | 0.04          | 0.045         | 0.045         | 0.05          | 0.05          | 0.055         |
| 1.2 |                | 56-60              | 95              | 0.022         | 0.028         | 0.028         | 0.032         | 0.032         | 0.038         | 0.038         | 0.042         | 0.042         | 0.048         | 0.047         | 0.053         |
| 1.3 |                | 60-65              | 80              | 0.02          | 0.025         | 0.025         | 0.03          | 0.03          | 0.035         | 0.035         | 0.04          | 0.04          | 0.045         | 0.045         | 0.05          |
| 1.4 |                | 66-70              | 70              | 0.015         | 0.02          | 0.02          | 0.025         | 0.025         | 0.03          | 0.03          | 0.035         | 0.03          | 0.035         | 0.035         | 0.045         |

|                                                                                        | Material       | Hardness<br>in HRC | Dimension       | Ø 12          |               | Ø 16          |               | Ø 20          |               |
|----------------------------------------------------------------------------------------|----------------|--------------------|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                                                                                        |                |                    | Infeed<br>in mm | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD | ae=<br>0.05xD | ae=<br>0.04xD |
|                                                                                        |                |                    |                 | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD | ap=<br>L2 max | ap=<br>0.04xD |
|                                                                                        |                |                    | Application     |               |               |               |               |               |               |
|                                                                                        |                |                    | Feed (mm/Z)     | fz            | fz            | fz            | fz            | fz            | fz            |
| H                                                                                      | HARDENED STEEL |                    | Vc (m/min)      |               |               |               |               |               |               |
| 1.1                                                                                    |                | 46-55              | 125             | 0.055         | 0.07          | 0.07          | 0.075         | 0.08          | 0.085         |
| 1.2                                                                                    |                | 56-60              | 95              | 0.052         | 0.065         | 0.065         | 0.07          | 0.075         | 0.08          |
| 1.3                                                                                    |                | 60-65              | 80              | 0.05          | 0.06          | 0.06          | 0.065         | 0.07          | 0.075         |
| 1.4                                                                                    |                | 66-70              | 70              | 0.04          | 0.055         | 0.05          | 0.06          | 0.06          | 0.07          |
| ADVICE   By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius! |                |                    |                 |               |               |               |               |               |               |



|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

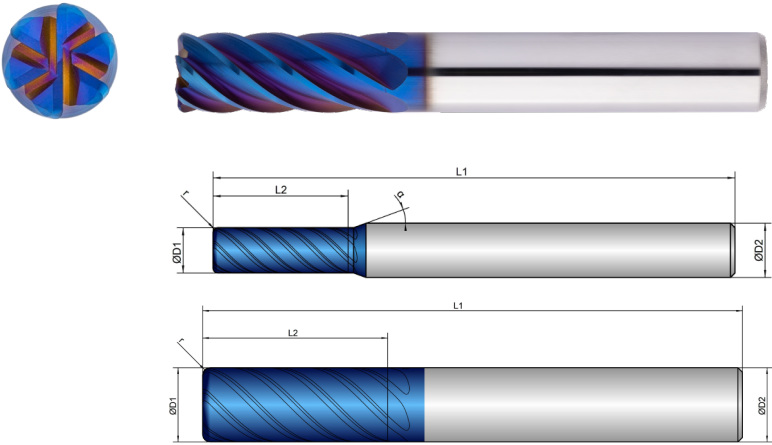
|             |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                           |            |                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------|
| Strategy    | <b>ETC</b>                                                                                                                                                                                                                                                                                                                                  | <b>HSC</b>                                                                                                                                                                                                                                                | <b>HPC</b> |  |
| Application |     |                                                                                                                                                                                                                                                           |            |                                                                                     |
| Features    | <b>HA</b>                                                                                                                                                                                                                                                                                                                                   |    |            |  |

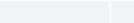
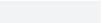


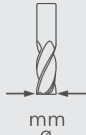
- Ultrafine carbide grade specially developed for machining hardened steels
- Adapted rake angle for safe milling up to 70 HRC
- Defined cutting edge preparation for homogeneous wear

- Multipass milling of 3D contours

- Radius tolerance  $r \leq 1.5$  mm:  $\pm 0.003$  mm
- Radius tolerance  $r > 1.5$  mm:  $\pm 0.005$  mm
- Reduce the axial depth of cutting with increasing hardness



| Roughing                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   | Finishing                                                                         |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   | inappropriate                                                                     |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |                                                                                   | optimal                                                                           |                                                                                    |                                                                                     |                                                                                     |                                                                                     |

|         | <br>D1<br>mm<br>ø | <br>L2<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>r<br>mm | <br>α<br>° |
|---------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| K202293 |                                                                                                      |                                                                                                 |                                                                                                 |                                                                                                      |                                                                                               |                                                                                                  |                                                                                                 |
| 5/0,5   | 5.0                                                                                                  | 15.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                            |
| 5/1     | 5.0                                                                                                  | 15.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 6/0,5   | 6.0                                                                                                  | 16.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                            |
| 6/1     | 6.0                                                                                                  | 16.0                                                                                            | 58.0                                                                                            | 6.0                                                                                                  | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 8/0,5   | 8.0                                                                                                  | 22.0                                                                                            | 70.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                            |
| 8/1     | 8.0                                                                                                  | 22.0                                                                                            | 70.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 10/0,5  | 10.0                                                                                                 | 25.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                            |
| 10/1    | 10.0                                                                                                 | 25.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 10/1,5  | 10.0                                                                                                 | 25.0                                                                                            | 73.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 1.50                                                                                             | 37.5                                                                                            |
| 12/0,5  | 12.0                                                                                                 | 28.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                            |
| 12/1    | 12.0                                                                                                 | 28.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 12/1,5  | 12.0                                                                                                 | 28.0                                                                                            | 84.0                                                                                            | 12.0                                                                                                 | 6                                                                                             | 1.50                                                                                             | 37.5                                                                                            |
| 14/1    | 14.0                                                                                                 | 30.0                                                                                            | 84.0                                                                                            | 14.0                                                                                                 | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 16/1    | 16.0                                                                                                 | 36.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 8                                                                                             | 1.00                                                                                             | 37.5                                                                                            |
| 16/2    | 16.0                                                                                                 | 36.0                                                                                            | 93.0                                                                                            | 16.0                                                                                                 | 8                                                                                             | 2.00                                                                                             | 37.5                                                                                            |
| 18/1    | 18.0                                                                                                 | 36.0                                                                                            | 93.0                                                                                            | 18.0                                                                                                 | 10                                                                                            | 1.00                                                                                             | 37.5                                                                                            |
| 20/1    | 20.0                                                                                                 | 41.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 10                                                                                            | 1.00                                                                                             | 37.5                                                                                            |
| 20/2    | 20.0                                                                                                 | 41.0                                                                                            | 104.0                                                                                           | 20.0                                                                                                 | 10                                                                                            | 2.00                                                                                             | 37.5                                                                                            |



| Dimension    | Ø5                                                                                  |                                                                                     | Ø6                                                                                  |                                                                                     | Ø8                                                                                  |                                                                                     | Ø10                                                                                 |                                                                                     | Ø12                                                                                 |                                                                                     | Ø14                                                                                 |                                                                                     |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          |
|              | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          |
| Application  |  |  |  |  |  |  |  |  |  |  |  |  |

|     | Material       | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|----------------|-----------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 |                | 46-55           | 125         | 0.035 | 0.04  | 0.04  | 0.045 | 0.045 | 0.05  | 0.05  | 0.055 | 0.055 | 0.07  | 0.055 |
| 1.2 |                | 56-60           | 95          | 0.032 | 0.038 | 0.038 | 0.042 | 0.042 | 0.048 | 0.047 | 0.053 | 0.052 | 0.065 | 0.052 |
| 1.3 |                | 60-65           | 80          | 0.03  | 0.035 | 0.035 | 0.04  | 0.04  | 0.045 | 0.045 | 0.05  | 0.05  | 0.06  | 0.05  |
| 1.4 |                | 66-70           | 70          | 0.025 | 0.03  | 0.03  | 0.035 | 0.03  | 0.035 | 0.035 | 0.045 | 0.04  | 0.055 | 0.04  |

| Dimension    | Ø16                                                                                 |                                                                                     | Ø18                                                                                 |                                                                                     | Ø20                                                                                 |                                                                                     |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          | ae= 0.05xD                                                                          | ae= 0.04xD                                                                          |
|              | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          | ap= L2 max                                                                          | ap= 0.04xD                                                                          |
| Application  |  |  |  |  |  |  |

|                                                                                        | Material       | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    |
|----------------------------------------------------------------------------------------|----------------|-----------------|-------------|-------|-------|-------|-------|-------|-------|
| H                                                                                      | HARDENED STEEL |                 | Vc (m/min)  |       |       |       |       |       |       |
| 1.1                                                                                    |                | 46-55           | 125         | 0.07  | 0.075 | 0.07  | 0.075 | 0.08  | 0.085 |
| 1.2                                                                                    |                | 56-60           | 95          | 0.065 | 0.07  | 0.065 | 0.07  | 0.075 | 0.08  |
| 1.3                                                                                    |                | 60-65           | 80          | 0.06  | 0.065 | 0.06  | 0.065 | 0.07  | 0.075 |
| 1.4                                                                                    |                | 66-70           | 70          | 0.05  | 0.06  | 0.05  | 0.06  | 0.06  | 0.07  |
| ADVICE   By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius! |                |                 |             |       |       |       |       |       |       |

## STILL CAN'T FIND A SUITABLE MILLING CUTTER?

**No problem** – simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

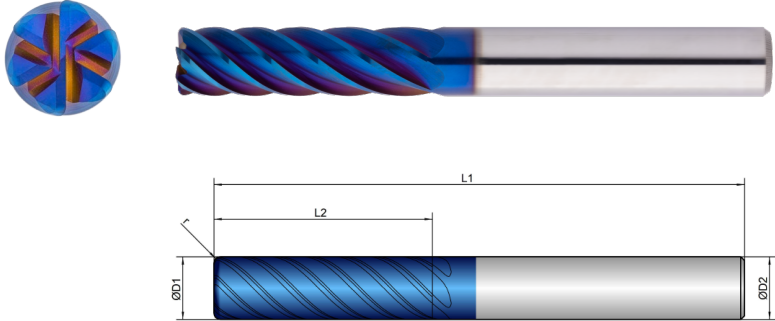
WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST



|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
|-------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    | <b>ETC</b>                                                                        | <b>HPC</b>                                                                        |  |                                                                                     |
| Application |  |  |                                                                                     |                                                                                     |
| Features    | <b>HA</b>                                                                         |  |  |  |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- Multipass milling of 3D contours
- Radius tolerance  $r \leq 1.5$  mm:  $\pm 0.003$  mm
  - Radius tolerance  $r > 1.5$  mm:  $\pm 0.005$  mm
  - Reduce the axial depth of cutting with increasing hardness



| Roughing                                                                         |  |  |  |  | Finishing                                                                          |  |  |  |  |
|----------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |  |  |  |  | inappropriate                                                                      |  |  |  |  |
|                                                                                  |  |  |  |  | optimal                                                                            |  |  |  |  |

|         | D1<br><br>mm<br>ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° |
|---------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| K202303 |                                                                                                      |                                                                                                 |                                                                                                 |                                                                                                      |                                                                                               |                                                                                                  |                                                                                            |
| 6/0,5   | 6.0                                                                                                  | 21.0                                                                                            | 65.0                                                                                            | 6.0                                                                                                  | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                       |
| 6/1     | 6.0                                                                                                  | 21.0                                                                                            | 65.0                                                                                            | 6.0                                                                                                  | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 8/0,5   | 8.0                                                                                                  | 28.0                                                                                            | 75.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                       |
| 8/1     | 8.0                                                                                                  | 28.0                                                                                            | 75.0                                                                                            | 8.0                                                                                                  | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 10/0,5  | 10.0                                                                                                 | 35.0                                                                                            | 85.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                       |
| 10/1    | 10.0                                                                                                 | 35.0                                                                                            | 85.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 10/1,5  | 10.0                                                                                                 | 35.0                                                                                            | 85.0                                                                                            | 10.0                                                                                                 | 6                                                                                             | 1.50                                                                                             | 37.5                                                                                       |
| 12/0,5  | 12.0                                                                                                 | 45.0                                                                                            | 100.0                                                                                           | 12.0                                                                                                 | 6                                                                                             | 0.50                                                                                             | 37.5                                                                                       |
| 12/1    | 12.0                                                                                                 | 45.0                                                                                            | 100.0                                                                                           | 12.0                                                                                                 | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 12/1,5  | 12.0                                                                                                 | 45.0                                                                                            | 100.0                                                                                           | 12.0                                                                                                 | 6                                                                                             | 1.50                                                                                             | 37.5                                                                                       |
| 14/1    | 14.0                                                                                                 | 45.0                                                                                            | 100.0                                                                                           | 14.0                                                                                                 | 6                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 16/1    | 16.0                                                                                                 | 50.0                                                                                            | 110.0                                                                                           | 16.0                                                                                                 | 8                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 16/2    | 16.0                                                                                                 | 50.0                                                                                            | 110.0                                                                                           | 16.0                                                                                                 | 8                                                                                             | 2.00                                                                                             | 37.5                                                                                       |
| 18/1    | 18.0                                                                                                 | 54.0                                                                                            | 114.0                                                                                           | 18.0                                                                                                 | 10                                                                                            | 1.00                                                                                             | 37.5                                                                                       |
| 20/1    | 20.0                                                                                                 | 55.0                                                                                            | 126.0                                                                                           | 20.0                                                                                                 | 10                                                                                            | 1.00                                                                                             | 37.5                                                                                       |
| 20/2    | 20.0                                                                                                 | 55.0                                                                                            | 126.0                                                                                           | 20.0                                                                                                 | 10                                                                                            | 2.00                                                                                             | 37.5                                                                                       |

|     |                | Dimension       |             | Ø6                                                                                  |                                                                                     | Ø8                                                                                  |                                                                                     | Ø10                                                                                 |                                                                                     | Ø12                                                                                 |                                                                                     | Ø14                                                                                 |                                                                                     | Ø16                                                                                 |                                                                                     |
|-----|----------------|-----------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| H   | Material       | Hardness in HRC | Feed (mm/Z) | Infeed in mm                                                                        |                                                                                     | Infeed in mm                                                                        |                                                                                     | Infeed in mm                                                                        |                                                                                     | Infeed in mm                                                                        |                                                                                     | Infeed in mm                                                                        |                                                                                     | Infeed in mm                                                                        |                                                                                     |
|     |                |                 |             | ae=                                                                                 | ap=                                                                                 | ae=                                                                                 | ap=                                                                                 | ae=                                                                                 | ap=                                                                                 | ae=                                                                                 | ap=                                                                                 | ae=                                                                                 | ap=                                                                                 | ae=                                                                                 | ap=                                                                                 |
|     |                |                 |             | 0.05xD                                                                              | L2 max                                                                              | 0.04xD                                                                              | L2 max                                                                              | 0.05xD                                                                              | L2 max                                                                              | 0.04xD                                                                              | L2 max                                                                              | 0.05xD                                                                              | L2 max                                                                              | 0.04xD                                                                              | L2 max                                                                              |
|     |                |                 |             |  |  |  |  |  |  |  |  |  |  |  |  |
|     |                |                 |             | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
|     |                |                 | Vc (m/min)  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1 | HARDENED STEEL | 46-55           | 115         | 0.04                                                                                | 0.045                                                                               | 0.045                                                                               | 0.05                                                                                | 0.05                                                                                | 0.055                                                                               | 0.055                                                                               | 0.07                                                                                | 0.055                                                                               | 0.07                                                                                | 0.07                                                                                | 0.075                                                                               |
| 1.2 |                | 56-60           | 90          | 0.038                                                                               | 0.042                                                                               | 0.042                                                                               | 0.048                                                                               | 0.047                                                                               | 0.053                                                                               | 0.052                                                                               | 0.065                                                                               | 0.052                                                                               | 0.065                                                                               | 0.065                                                                               | 0.07                                                                                |
| 1.3 |                | 60-65           | 75          | 0.035                                                                               | 0.04                                                                                | 0.04                                                                                | 0.045                                                                               | 0.045                                                                               | 0.05                                                                                | 0.05                                                                                | 0.06                                                                                | 0.05                                                                                | 0.06                                                                                | 0.06                                                                                | 0.065                                                                               |
| 1.4 |                | 66-70           | 65          | 0.03                                                                                | 0.035                                                                               | 0.03                                                                                | 0.035                                                                               | 0.035                                                                               | 0.045                                                                               | 0.04                                                                                | 0.055                                                                               | 0.04                                                                                | 0.055                                                                               | 0.05                                                                                | 0.06                                                                                |

|                                                                                        |                | Dimension       |             | Ø18                                                                                 |                                                                                     | Ø20                                                                                 |                                                                                     |
|----------------------------------------------------------------------------------------|----------------|-----------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| H                                                                                      | Material       | Hardness in HRC | Feed (mm/Z) | Infeed in mm                                                                        |                                                                                     | Infeed in mm                                                                        |                                                                                     |
|                                                                                        |                |                 |             | ae=                                                                                 | ap=                                                                                 | ae=                                                                                 | ap=                                                                                 |
|                                                                                        |                |                 |             | 0.05xD                                                                              | L2 max                                                                              | 0.04xD                                                                              | L2 max                                                                              |
|                                                                                        |                |                 |             |  |  |  |  |
|                                                                                        |                |                 |             | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
|                                                                                        |                |                 | Vc (m/min)  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1                                                                                    | HARDENED STEEL | 46-55           | 115         | 0.07                                                                                | 0.075                                                                               | 0.08                                                                                | 0.085                                                                               |
| 1.2                                                                                    |                | 56-60           | 90          | 0.065                                                                               | 0.07                                                                                | 0.075                                                                               | 0.08                                                                                |
| 1.3                                                                                    |                | 60-65           | 75          | 0.06                                                                                | 0.065                                                                               | 0.07                                                                                | 0.075                                                                               |
| 1.4                                                                                    |                | 66-70           | 65          | 0.05                                                                                | 0.06                                                                                | 0.06                                                                                | 0.07                                                                                |
| ADVICE   By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius! |                |                 |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

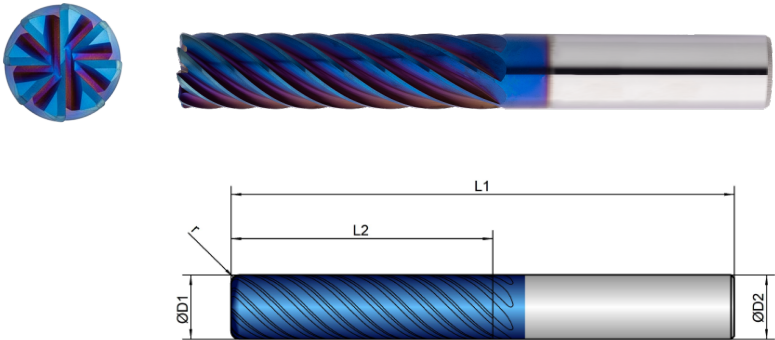
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | e8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
|-------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    |  |  |  |                                                                                     |
| Application |  |  |                                                                                     |                                                                                     |
| Features    |  |  |  |  |

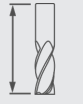
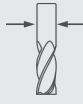
- Ultrafine carbide grade specially developed for machining hardened steels
- Adapted rake angle for safe milling up to 70 HRC
- Defined cutting edge preparation for homogeneous wear

- Multipass milling of 3D contours

- Radius tolerance  $r \leq 1.5$  mm:  $\pm 0.003$  mm
- Radius tolerance  $r > 1.5$  mm:  $\pm 0.005$  mm
- Reduce the axial depth of cutting with increasing hardness



| Roughing                                                                         |  |  |  |  | Finishing                                                                          |  |  |  |  |
|----------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |  |  |  |  | inappropriate                                                                      |  |  |  |  |
|                                                                                  |  |  |  |  | optimal                                                                            |  |  |  |  |

|         | D1<br><br>mm<br>Ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>Ø | z<br><br># | r<br><br>mm | <br>° |
|---------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| K202307 |                                                                                                      |                                                                                                 |                                                                                                 |                                                                                                      |                                                                                               |                                                                                                  |                                                                                            |
| 16/1    | 16.0                                                                                                 | 65.0                                                                                            | 125.0                                                                                           | 16.0                                                                                                 | 8                                                                                             | 1.00                                                                                             | 37.5                                                                                       |
| 16/2    | 16.0                                                                                                 | 65.0                                                                                            | 125.0                                                                                           | 16.0                                                                                                 | 8                                                                                             | 2.00                                                                                             | 37.5                                                                                       |
| 20/1    | 20.0                                                                                                 | 70.0                                                                                            | 135.0                                                                                           | 20.0                                                                                                 | 10                                                                                            | 1.00                                                                                             | 37.5                                                                                       |
| 20/2    | 20.0                                                                                                 | 70.0                                                                                            | 135.0                                                                                           | 20.0                                                                                                 | 10                                                                                            | 2.00                                                                                             | 37.5                                                                                       |

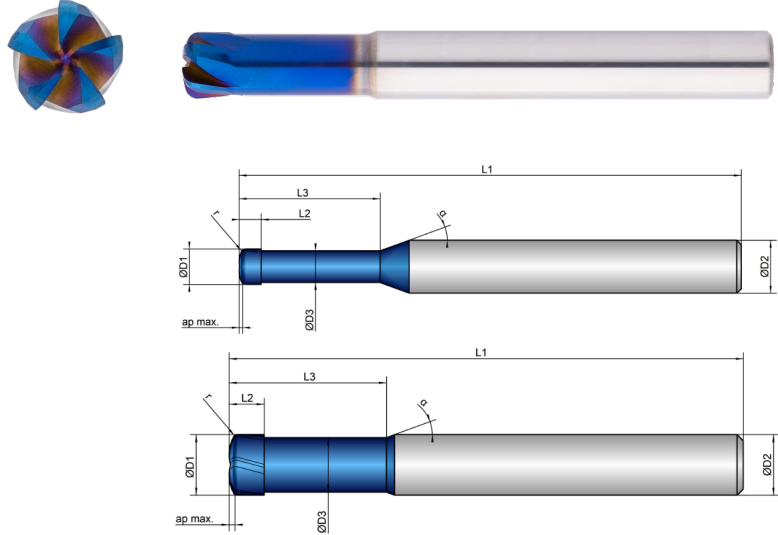
| Dimension       | Ø 16                                                                                                                                                                    |                                                                                                                                                                         | Ø 20                                                                                                                                                                    |                                                                                                                                                                         |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Infeed<br>in mm | ae=<br>0.03xD                                                                                                                                                           | ae=<br>0.03xD                                                                                                                                                           | ae=<br>0.03xD                                                                                                                                                           | ae=<br>0.03xD                                                                                                                                                           |
|                 | ap=<br>L2 max                                                                                                                                                           | ap=<br>0.03xD                                                                                                                                                           | ap=<br>L2 max                                                                                                                                                           | ap=<br>0.03xD                                                                                                                                                           |
| Application     |   |   |   |   |

|                                                                                        | Material       | Hardness<br>in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    |
|----------------------------------------------------------------------------------------|----------------|--------------------|-------------|-------|-------|-------|-------|
| H                                                                                      | HARDENED STEEL |                    | Vc (m/min)  |       |       |       |       |
| 1.1                                                                                    |                | 46-55              | 105         | 0.06  | 0.065 | 0.07  | 0.075 |
| 1.2                                                                                    |                | 56-60              | 80          | 0.055 | 0.06  | 0.065 | 0.07  |
| 1.3                                                                                    |                | 60-65              | 65          | 0.055 | 0.06  | 0.065 | 0.07  |
| 1.4                                                                                    |                | 66-70              | 55          | 0.05  | 0.055 | 0.06  | 0.065 |
| ADVICE   By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius! |                |                    |             |       |       |       |       |

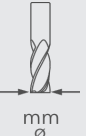
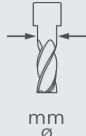
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | h9                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                                                                                                                |  |
| Application |                                                                                                                                                                            |                                                                                     |
| Features    |      |  |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Geometry with tangential transitions for HSC milling
  - Defined cutting edge preparation for homogeneous wear
- 
- For roughing and finishing under HSC conditions
- 
- Check programming radius and ap max. according to the variant table



| Roughing                                                                          |  |  |  |  | Finishing                                                                           |  |  |  |  |
|-----------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                     |  |  |  |  | inappropriate                                                                       |  |  |  |  |
| optimal                                                                           |  |  |  |  | optimal                                                                             |  |  |  |  |

| K207013 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | <br>mm | <br>mm<br>max | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 2       | 2.0                                                                                                  | 1.7                                                                                                  | 1.5                                                                                             | 13.0                                                                                            | 54.0                                                                                            | 6.0                                                                                                  | 2                                                                                             | 0.3                                                                                        | 0.06                                                                                               | 12                                                                                         | 20                                                                                         |
| 3       | 3.0                                                                                                  | 2.7                                                                                                  | 1.5                                                                                             | 15.0                                                                                            | 54.0                                                                                            | 6.0                                                                                                  | 2                                                                                             | 0.3                                                                                        | 0.10                                                                                               | 12                                                                                         | 20                                                                                         |
| 4       | 4.0                                                                                                  | 3.6                                                                                                  | 2.5                                                                                             | 16.0                                                                                            | 57.0                                                                                            | 6.0                                                                                                  | 2                                                                                             | 0.5                                                                                        | 0.15                                                                                               | 12                                                                                         | 20                                                                                         |
| 5       | 5.0                                                                                                  | 4.6                                                                                                  | 3.5                                                                                             | 18.0                                                                                            | 65.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 0.5                                                                                        | 0.17                                                                                               | 12                                                                                         | 20                                                                                         |
| 6       | 6.0                                                                                                  | 5.2                                                                                                  | 3.5                                                                                             | 20.0                                                                                            | 65.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.0                                                                                        | 0.20                                                                                               | 12                                                                                         | 20                                                                                         |
| 8       | 8.0                                                                                                  | 7.0                                                                                                  | 4.8                                                                                             | 24.0                                                                                            | 70.0                                                                                            | 8.0                                                                                                  | 5                                                                                             | 1.5                                                                                        | 0.25                                                                                               | 12                                                                                         | 20                                                                                         |
| 10      | 10.0                                                                                                 | 9.0                                                                                                  | 5.8                                                                                             | 26.0                                                                                            | 85.0                                                                                            | 10.0                                                                                                 | 5                                                                                             | 2.0                                                                                        | 0.30                                                                                               | 12                                                                                         | 20                                                                                         |
| 12      | 12.0                                                                                                 | 11.0                                                                                                 | 6.8                                                                                             | 30.0                                                                                            | 93.0                                                                                            | 12.0                                                                                                 | 5                                                                                             | 2.0                                                                                        | 0.40                                                                                               | 12                                                                                         | 20                                                                                         |
| 16      | 16.0                                                                                                 | 14.5                                                                                                 | 8.8                                                                                             | 35.0                                                                                            | 100.0                                                                                           | 16.0                                                                                                 | 5                                                                                             | 2.5                                                                                        | 0.50                                                                                               | 12                                                                                         | 20                                                                                         |

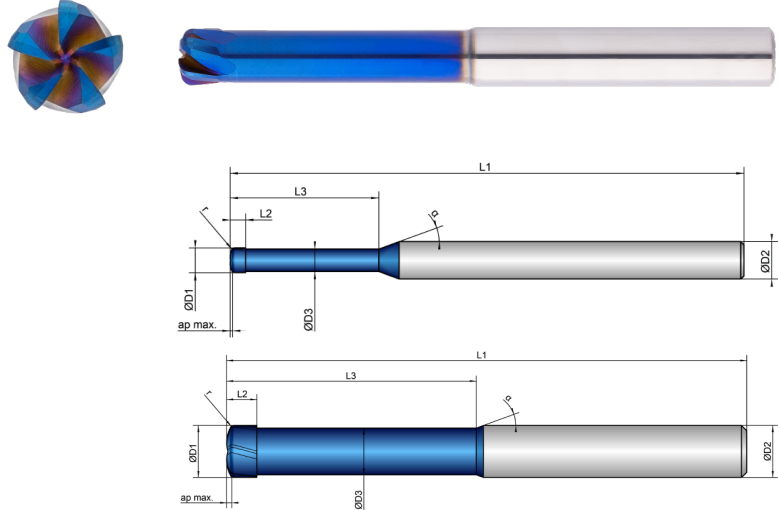
| Dimension    | Ø2                                                                                  | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 | Ø16                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 1xD<br>ap <sub>max</sub> = 0.06mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.1mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.15mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.17mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.2mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.25mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.3mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.4mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.5mm                                                |
| Application  |  |  |  |  |  |  |  |  |  |

|     |                | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz   | fz   | fz   |
|-----|----------------|-----------------|-------------|-------|-------|-------|-------|-------|------|------|------|
| H   | MATERIAL       |                 | Vc (m/min)  |       |       |       |       |       |      |      |      |
| 1.1 | HARDENED STEEL | 46-55           | 160         | 0.028 | 0.05  | 0.07  | 0.08  | 0.09  | 0.11 | 0.13 | 0.16 |
| 1.2 |                | 56-60           | 120         | 0.025 | 0.045 | 0.065 | 0.075 | 0.085 | 0.1  | 0.12 | 0.15 |
| 1.3 |                | 60-65           | 85          | 0.022 | 0.04  | 0.06  | 0.07  | 0.08  | 0.09 | 0.11 | 0.14 |
| 1.4 |                | 66-70           | 55          | 0.017 | 0.035 | 0.055 | 0.065 | 0.075 | 0.08 | 0.1  | 0.13 |

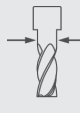
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | h9                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                     |  |  |  |  |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|-------------------------------------------------------------------------------------|--|--|--|--|
| Strategy    |                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |                                                                                                                                                                            |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                          |  |  |  |  |  |  |  |  |  |
| Application |                                                                                                                                                                            |  |  |  |  |    |  |  |  |  |                                                                                       |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                          |  |  |  |  |                                                                                                                                                                                                                                                             |  |  |  |  |                                                                                     |  |  |  |  |
| Features    |      |  |  |  |  |    |  |  |  |  |    |  |  |  |  |    |  |  |  |  |    |  |  |  |  |    |  |  |  |  |    |  |  |  |  |                                                                                     |  |  |  |  |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Geometry with tangential transitions for HSC milling
  - Defined cutting edge preparation for homogeneous wear
- Long version for deeper cavities
  - For roughing and finishing under HSC conditions
- Check programming radius and ap max. according to the variant table



| Roughing                                                                          | Finishing                                                                           |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |
| inappropriate                                                                     | optimal                                                                             |

| K207018 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | <br>mm | <br>mm<br>max | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 2       | 2.0                                                                                                  | 1.7                                                                                                  | 1.5                                                                                             | 18.0                                                                                            | 75.0                                                                                            | 6.0                                                                                                  | 2                                                                                             | 0.3                                                                                        | 0.06                                                                                               | 12                                                                                         | 20                                                                                         |
| 3       | 3.0                                                                                                  | 2.7                                                                                                  | 1.5                                                                                             | 20.0                                                                                            | 75.0                                                                                            | 6.0                                                                                                  | 2                                                                                             | 0.3                                                                                        | 0.10                                                                                               | 12                                                                                         | 20                                                                                         |
| 4       | 4.0                                                                                                  | 3.6                                                                                                  | 2.5                                                                                             | 24.0                                                                                            | 83.0                                                                                            | 6.0                                                                                                  | 2                                                                                             | 0.5                                                                                        | 0.15                                                                                               | 12                                                                                         | 20                                                                                         |
| 5       | 5.0                                                                                                  | 4.6                                                                                                  | 3.5                                                                                             | 28.0                                                                                            | 100.0                                                                                           | 6.0                                                                                                  | 4                                                                                             | 0.5                                                                                        | 0.17                                                                                               | 12                                                                                         | 20                                                                                         |
| 6       | 6.0                                                                                                  | 5.2                                                                                                  | 3.5                                                                                             | 28.0                                                                                            | 100.0                                                                                           | 6.0                                                                                                  | 4                                                                                             | 1.0                                                                                        | 0.20                                                                                               | 12                                                                                         | 20                                                                                         |
| 8       | 8.0                                                                                                  | 7.0                                                                                                  | 4.8                                                                                             | 40.0                                                                                            | 100.0                                                                                           | 8.0                                                                                                  | 5                                                                                             | 1.5                                                                                        | 0.25                                                                                               | 12                                                                                         | 20                                                                                         |
| 10      | 10.0                                                                                                 | 9.0                                                                                                  | 5.8                                                                                             | 48.0                                                                                            | 100.0                                                                                           | 10.0                                                                                                 | 5                                                                                             | 2.0                                                                                        | 0.30                                                                                               | 12                                                                                         | 20                                                                                         |
| 12      | 12.0                                                                                                 | 11.0                                                                                                 | 6.8                                                                                             | 56.0                                                                                            | 119.0                                                                                           | 12.0                                                                                                 | 5                                                                                             | 2.0                                                                                        | 0.40                                                                                               | 12                                                                                         | 20                                                                                         |
| 16      | 16.0                                                                                                 | 14.5                                                                                                 | 8.8                                                                                             | 65.0                                                                                            | 150.0                                                                                           | 16.0                                                                                                 | 5                                                                                             | 2.5                                                                                        | 0.50                                                                                               | 12                                                                                         | 20                                                                                         |

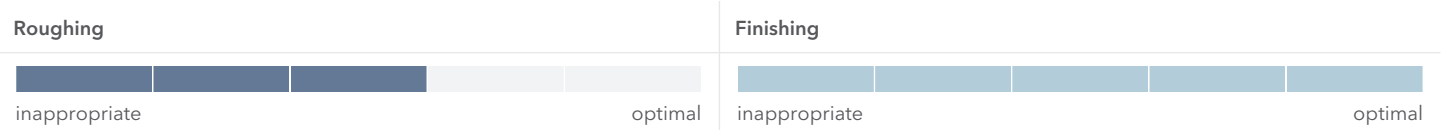
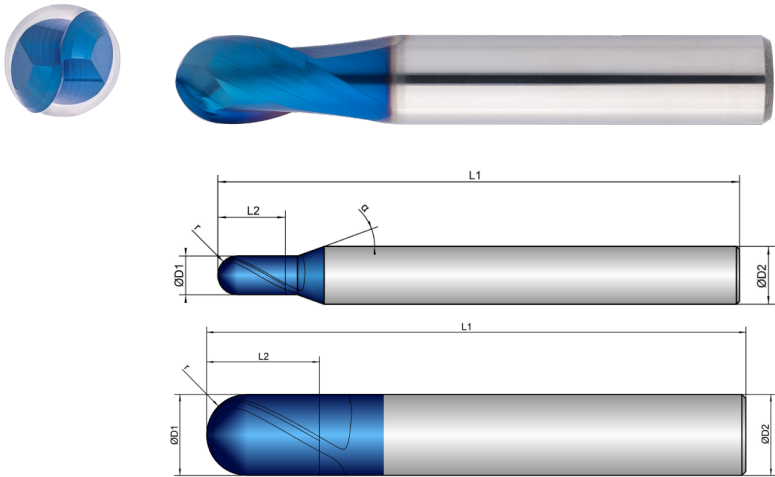
| Dimension    | Ø2                                                                                  | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 | Ø16                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 1xD<br>ap <sub>max</sub> = 0.06mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.1mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.15mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.17mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.2mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.25mm                                               | ae= 1xD<br>ap <sub>max</sub> = 0.3mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.4mm                                                | ae= 1xD<br>ap <sub>max</sub> = 0.5mm                                                |
| Application  |  |  |  |  |  |  |  |  |  |

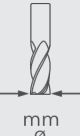
| Material | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz   | fz   | fz   | fz   |
|----------|-----------------|-------------|-------|-------|-------|-------|-------|------|------|------|------|
| H        | HARDENED STEEL  | Vc (m/min)  |       |       |       |       |       |      |      |      |      |
| 1.1      | 46-55           | 140         | 0.028 | 0.05  | 0.07  | 0.08  | 0.09  | 0.11 | 0.13 | 0.16 | 0.22 |
| 1.2      | 56-60           | 100         | 0.025 | 0.045 | 0.065 | 0.075 | 0.085 | 0.1  | 0.12 | 0.15 | 0.2  |
| 1.3      | 60-65           | 75          | 0.022 | 0.04  | 0.06  | 0.07  | 0.08  | 0.09 | 0.11 | 0.14 | 0.18 |
| 1.4      | 66-70           | 45          | 0.017 | 0.035 | 0.055 | 0.065 | 0.075 | 0.08 | 0.1  | 0.13 | 0.16 |

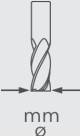
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | f8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                                                                                                                                                                                             |                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                            |  |
| Application |                                                                                        |                                                                                     |
| Features    |     |  |

- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- Radius tolerance  $r \leq 2\text{ mm}$ :  $\pm 0.003\text{mm}$
  - Radius tolerance  $r > 2\text{ mm}$ :  $\pm 0.005\text{mm}$



| K203103 | <br>mm<br>ø | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 0,1/3   | 0.1                                                                                            | 0.2                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.05                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,15/3  | 0.15                                                                                           | 0.3                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.075                                                                                      | 30                                                                                         | 8                                                                                          |
| 0,2/3   | 0.2                                                                                            | 0.4                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.10                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,25/3  | 0.25                                                                                           | 0.5                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.125                                                                                      | 30                                                                                         | 8                                                                                          |
| 0,3/3   | 0.3                                                                                            | 1.0                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.15                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,35/3  | 0.35                                                                                           | 1.0                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.175                                                                                      | 30                                                                                         | 8                                                                                          |
| 0,4/3   | 0.4                                                                                            | 1.0                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.20                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,5/3   | 0.5                                                                                            | 1.5                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.25                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,5/6   | 0.5                                                                                            | 1.5                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.25                                                                                       | 30                                                                                         | 12                                                                                         |
| 0,6/3   | 0.6                                                                                            | 1.5                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.30                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,7/3   | 0.7                                                                                            | 2.0                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.35                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,8/3   | 0.8                                                                                            | 2.0                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.40                                                                                       | 30                                                                                         | 8                                                                                          |

|       | <br>mm<br>ø | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>mm | <br>° | <br>° |
|-------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 0,9/3 | 0.9                                                                                            | 2.5                                                                                       | 38.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.45                                                                                      | 30                                                                                       | 8                                                                                        |
| 1/3   | 1.0                                                                                            | 2.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.50                                                                                      | 30                                                                                       | 8                                                                                        |
| 1/6   | 1.0                                                                                            | 2.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.50                                                                                      | 30                                                                                       | 12                                                                                       |
| 1,1/3 | 1.1                                                                                            | 3.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.55                                                                                      | 30                                                                                       | 8                                                                                        |
| 1,2/3 | 1.2                                                                                            | 3.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.60                                                                                      | 30                                                                                       | 8                                                                                        |
| 1,4/3 | 1.4                                                                                            | 3.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.70                                                                                      | 30                                                                                       | 8                                                                                        |
| 1,5/3 | 1.5                                                                                            | 3.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.75                                                                                      | 30                                                                                       | 8                                                                                        |
| 1,5/6 | 1.5                                                                                            | 3.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.75                                                                                      | 30                                                                                       | 12                                                                                       |
| 1,6/3 | 1.6                                                                                            | 4.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.80                                                                                      | 30                                                                                       | 8                                                                                        |
| 1,8/3 | 1.8                                                                                            | 4.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.90                                                                                      | 30                                                                                       | 8                                                                                        |
| 2/3   | 2.0                                                                                            | 4.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.00                                                                                      | 30                                                                                       | 8                                                                                        |
| 2/6   | 2.0                                                                                            | 4.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.00                                                                                      | 30                                                                                       | 12                                                                                       |
| 2,5/3 | 2.5                                                                                            | 5.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.25                                                                                      | 30                                                                                       | 8                                                                                        |
| 2,5/6 | 2.5                                                                                            | 5.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.25                                                                                      | 30                                                                                       | 12                                                                                       |
| 3/3   | 3.0                                                                                            | 6.0                                                                                       | 50.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.50                                                                                      | 30                                                                                       |                                                                                          |
| 3/6   | 3.0                                                                                            | 6.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.50                                                                                      | 30                                                                                       | 12                                                                                       |
| 4/4   | 4.0                                                                                            | 7.0                                                                                       | 54.0                                                                                      | 4.0                                                                                            | 2                                                                                        | 2.00                                                                                      | 30                                                                                       |                                                                                          |
| 4/6   | 4.0                                                                                            | 7.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 2.00                                                                                      | 30                                                                                       | 12                                                                                       |
| 5/5   | 5.0                                                                                            | 8.0                                                                                       | 54.0                                                                                      | 5.0                                                                                            | 2                                                                                        | 2.50                                                                                      | 30                                                                                       |                                                                                          |
| 5/6   | 5.0                                                                                            | 8.0                                                                                       | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 2.50                                                                                      | 30                                                                                       | 12                                                                                       |
| 6/6   | 6.0                                                                                            | 10.0                                                                                      | 54.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 3.00                                                                                      | 30                                                                                       |                                                                                          |
| 8/8   | 8.0                                                                                            | 12.0                                                                                      | 59.0                                                                                      | 8.0                                                                                            | 2                                                                                        | 4.00                                                                                      | 30                                                                                       |                                                                                          |
| 10/10 | 10.0                                                                                           | 14.0                                                                                      | 67.0                                                                                      | 10.0                                                                                           | 2                                                                                        | 5.00                                                                                      | 30                                                                                       |                                                                                          |
| 12/12 | 12.0                                                                                           | 16.0                                                                                      | 74.0                                                                                      | 12.0                                                                                           | 2                                                                                        | 6.00                                                                                      | 30                                                                                       |                                                                                          |
| 14/14 | 14.0                                                                                           | 18.0                                                                                      | 75.0                                                                                      | 14.0                                                                                           | 2                                                                                        | 7.00                                                                                      | 30                                                                                       |                                                                                          |
| 16/16 | 16.0                                                                                           | 22.0                                                                                      | 83.0                                                                                      | 16.0                                                                                           | 2                                                                                        | 8.00                                                                                      | 30                                                                                       |                                                                                          |
| 20/20 | 20.0                                                                                           | 26.0                                                                                      | 93.0                                                                                      | 20.0                                                                                           | 2                                                                                        | 10.00                                                                                     | 30                                                                                       |                                                                                          |

|          |                 |             | Dimension    | Ø0.1                                                                              | Ø0.15                                                                             | Ø0.2                                                                              | Ø0.25                                                                             | Ø0.3                                                                              | Ø0.35                                                                              | Ø0.4                                                                                | Ø0.5                                                                                | Ø0.6                                                                                | Ø0.7                                                                                |
|----------|-----------------|-------------|--------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                 |             | Infeed in mm | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                             | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              |
|          |                 |             | Application  |  |  |  |  |  |  |  |  |  |  |
| Material | Hardness in HRC | Feed (mm/Z) | fz           | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL  | Vc (m/min)  |              |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55           | 110         | 0.014        | 0.014                                                                             | 0.017                                                                             | 0.017                                                                             | 0.018                                                                             | 0.018                                                                             | 0.019                                                                              | 0.024                                                                               | 0.024                                                                               | 0.024                                                                               | 0.024                                                                               |
| 1.2      | 56-60           | 70          | 0.012        | 0.012                                                                             | 0.016                                                                             | 0.016                                                                             | 0.017                                                                             | 0.017                                                                             | 0.018                                                                              | 0.023                                                                               | 0.023                                                                               | 0.023                                                                               | 0.023                                                                               |
| 1.3      | 60-65           | 50          | 0.01         | 0.01                                                                              | 0.014                                                                             | 0.014                                                                             | 0.015                                                                             | 0.015                                                                             | 0.017                                                                              | 0.022                                                                               | 0.022                                                                               | 0.022                                                                               | 0.022                                                                               |
| 1.4      | 66-70           | 40          | 0.008        | 0.008                                                                             | 0.012                                                                             | 0.012                                                                             | 0.013                                                                             | 0.013                                                                             | 0.014                                                                              | 0.019                                                                               | 0.019                                                                               | 0.019                                                                               | 0.019                                                                               |

|          |                 |             | Dimension    | Ø0.8                                                                              | Ø0.9                                                                              | Ø1                                                                                | Ø1.1                                                                              | Ø1.2                                                                              | Ø1.4                                                                               | Ø1.5                                                                                | Ø1.6                                                                                | Ø1.8                                                                                | Ø2                                                                                  |
|----------|-----------------|-------------|--------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                 |             | Infeed in mm | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                            | ae=0.05xD<br>ap=0.05xD                                                             | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              |
|          |                 |             | Application  |  |  |  |  |  |  |  |  |  |  |
| Material | Hardness in HRC | Feed (mm/Z) | fz           | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL  | Vc (m/min)  |              |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55           | 110         | 0.026        | 0.029                                                                             | 0.03                                                                              | 0.03                                                                              | 0.033                                                                             | 0.033                                                                             | 0.034                                                                              | 0.034                                                                               | 0.036                                                                               | 0.036                                                                               | 0.036                                                                               |
| 1.2      | 56-60           | 70          | 0.025        | 0.025                                                                             | 0.029                                                                             | 0.029                                                                             | 0.032                                                                             | 0.032                                                                             | 0.033                                                                              | 0.033                                                                               | 0.035                                                                               | 0.035                                                                               | 0.035                                                                               |
| 1.3      | 60-65           | 50          | 0.024        | 0.024                                                                             | 0.028                                                                             | 0.028                                                                             | 0.03                                                                              | 0.03                                                                              | 0.032                                                                              | 0.032                                                                               | 0.034                                                                               | 0.034                                                                               | 0.034                                                                               |
| 1.4      | 66-70           | 40          | 0.021        | 0.021                                                                             | 0.024                                                                             | 0.024                                                                             | 0.026                                                                             | 0.026                                                                             | 0.028                                                                              | 0.028                                                                               | 0.03                                                                                | 0.03                                                                                | 0.03                                                                                |

|          |                 |             | Dimension    | Ø2.5                                                                                | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                   | Ø10                                                                                   | Ø12                                                                                   | Ø14                                                                                   | Ø16                                                                                   |
|----------|-----------------|-------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|          |                 |             | Infeed in mm | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                              | ae=0.05xD<br>ap=0.05xD                                                               | ae=0.05xD<br>ap=0.05xD                                                                | ae=0.05xD<br>ap=0.05xD                                                                | ae=0.05xD<br>ap=0.05xD                                                                | ae=0.05xD<br>ap=0.05xD                                                                |
|          |                 |             | Application  |  |  |  |  |  |  |  |  |  |  |
| Material | Hardness in HRC | Feed (mm/Z) | fz           | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                   | fz                                                                                    | fz                                                                                    | fz                                                                                    | fz                                                                                    |
| H        | HARDENED STEEL  | Vc (m/min)  |              |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
| 1.1      | 46-55           | 160         | 0.04         | 0.044                                                                               | 0.055                                                                               | 0.08                                                                                | 0.09                                                                                | 0.11                                                                                | 0.13                                                                                 | 0.14                                                                                  | 0.14                                                                                  | 0.15                                                                                  | 0.15                                                                                  |
| 1.2      | 56-60           | 125         | 0.038        | 0.042                                                                               | 0.052                                                                               | 0.075                                                                               | 0.085                                                                               | 0.105                                                                               | 0.12                                                                                 | 0.13                                                                                  | 0.13                                                                                  | 0.14                                                                                  | 0.14                                                                                  |
| 1.3      | 60-65           | 110         | 0.035        | 0.04                                                                                | 0.05                                                                                | 0.07                                                                                | 0.08                                                                                | 0.1                                                                                 | 0.11                                                                                 | 0.12                                                                                  | 0.12                                                                                  | 0.13                                                                                  | 0.13                                                                                  |
| 1.4      | 66-70           | 85          | 0.03         | 0.035                                                                               | 0.045                                                                               | 0.06                                                                                | 0.07                                                                                | 0.085                                                                               | 0.09                                                                                 | 0.1                                                                                   | 0.1                                                                                   | 0.11                                                                                  | 0.11                                                                                  |

|          |                 |             | Dimension    | Ø20                                                                                 |
|----------|-----------------|-------------|--------------|-------------------------------------------------------------------------------------|
|          |                 |             | Infeed in mm | ae=0.05xD<br>ap=0.05xD                                                              |
|          |                 |             | Application  |  |
| Material | Hardness in HRC | Feed (mm/Z) | fz           |                                                                                     |
| H        | HARDENED STEEL  | Vc (m/min)  |              |                                                                                     |
| 1.1      | 46-55           | 160         | 0.18         |                                                                                     |
| 1.2      | 56-60           | 125         | 0.17         |                                                                                     |
| 1.3      | 60-65           | 110         | 0.15         |                                                                                     |
| 1.4      | 66-70           | 85          | 0.13         |                                                                                     |

DO YOU HAVE BLUNT MILLING CUTTERS THAT URGENTLY NEED REGRINDING?



➔ DISCOVER OUR H&V REGRINDING SERVICE

... and have your tools reconditioned to their original state!



|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | f8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

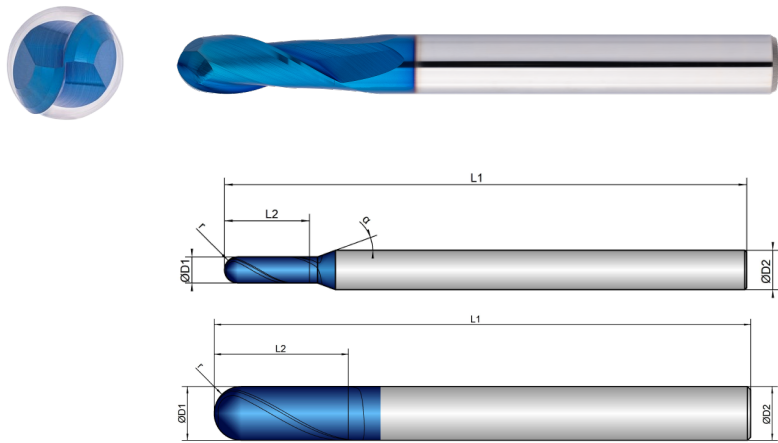
|             |                                                                                                                                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                            |
| Application |                                                                                        |
| Features    |     |

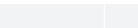
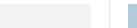


- Ultrafine carbide grade specially developed for machining hardened steels
- Adapted rake angle for safe milling up to 70 HRC
- Defined cutting edge preparation for homogeneous wear

- Long version with extra long cutting length

- Radius tolerance  $r \leq 2$  mm:  $\pm 0.003$  mm
- Radius tolerance  $r > 2$  mm:  $\pm 0.005$  mm



| Roughing                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   | Finishing                                                                         |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   | inappropriate                                                                     |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| optimal                                                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   | optimal                                                                           |                                                                                    |                                                                                     |                                                                                     |                                                                                     |

| K203143 | <br>mm<br>ø | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 0,5/3   | 0.5                                                                                            | 1.5                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.25                                                                                       | 30                                                                                         | 8                                                                                          |
| 0,5/6   | 0.5                                                                                            | 1.5                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.25                                                                                       | 30                                                                                         | 12                                                                                         |
| 1/3     | 1.0                                                                                            | 3.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.50                                                                                       | 30                                                                                         | 8                                                                                          |
| 1/6     | 1.0                                                                                            | 3.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.50                                                                                       | 30                                                                                         | 8                                                                                          |
| 1,5/3   | 1.5                                                                                            | 4.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 0.75                                                                                       | 30                                                                                         | 8                                                                                          |
| 1,5/6   | 1.5                                                                                            | 4.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.75                                                                                       | 30                                                                                         | 12                                                                                         |
| 2/3     | 2.0                                                                                            | 6.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.00                                                                                       | 30                                                                                         | 8                                                                                          |
| 2/6     | 2.0                                                                                            | 6.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.00                                                                                       | 30                                                                                         | 12                                                                                         |
| 2,5/3   | 2.5                                                                                            | 8.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.25                                                                                       | 30                                                                                         | 8                                                                                          |
| 2,5/6   | 2.5                                                                                            | 8.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.25                                                                                       | 30                                                                                         | 12                                                                                         |
| 3/3     | 3.0                                                                                            | 10.0                                                                                      | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.50                                                                                       | 30                                                                                         |                                                                                            |

| K203143 | <br>mm<br>ø | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 3/6     | 3.0                                                                                            | 10.0                                                                                      | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.50                                                                                      | 30                                                                                       | 12                                                                                       |
| 4/4     | 4.0                                                                                            | 13.0                                                                                      | 75.0                                                                                      | 4.0                                                                                            | 2                                                                                        | 2.00                                                                                      | 30                                                                                       |                                                                                          |
| 4/6     | 4.0                                                                                            | 13.0                                                                                      | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 2.00                                                                                      | 30                                                                                       | 12                                                                                       |
| 5/5     | 5.0                                                                                            | 14.0                                                                                      | 75.0                                                                                      | 5.0                                                                                            | 2                                                                                        | 2.50                                                                                      | 30                                                                                       |                                                                                          |
| 5/6     | 5.0                                                                                            | 14.0                                                                                      | 100.0                                                                                     | 6.0                                                                                            | 2                                                                                        | 2.50                                                                                      | 30                                                                                       | 12                                                                                       |
| 6/6     | 6.0                                                                                            | 16.0                                                                                      | 100.0                                                                                     | 6.0                                                                                            | 2                                                                                        | 3.00                                                                                      | 30                                                                                       |                                                                                          |
| 8/8     | 8.0                                                                                            | 22.0                                                                                      | 100.0                                                                                     | 8.0                                                                                            | 2                                                                                        | 4.00                                                                                      | 30                                                                                       |                                                                                          |
| 10/10   | 10.0                                                                                           | 25.0                                                                                      | 100.0                                                                                     | 10.0                                                                                           | 2                                                                                        | 5.00                                                                                      | 30                                                                                       |                                                                                          |
| 12/12   | 12.0                                                                                           | 26.0                                                                                      | 100.0                                                                                     | 12.0                                                                                           | 2                                                                                        | 6.00                                                                                      | 30                                                                                       |                                                                                          |
| 14/14   | 14.0                                                                                           | 26.0                                                                                      | 100.0                                                                                     | 14.0                                                                                           | 2                                                                                        | 7.00                                                                                      | 30                                                                                       |                                                                                          |
| 16/16   | 16.0                                                                                           | 30.0                                                                                      | 150.0                                                                                     | 16.0                                                                                           | 2                                                                                        | 8.00                                                                                      | 30                                                                                       |                                                                                          |
| 20/20   | 20.0                                                                                           | 40.0                                                                                      | 150.0                                                                                     | 20.0                                                                                           | 2                                                                                        | 10.00                                                                                     | 30                                                                                       |                                                                                          |

| Material | Hardness<br>in HRC | Dimension       | Ø0.5                                                                              | Ø1                                                                                | Ø1.5                                                                              | Ø2                                                                                | Ø2.5                                                                              | Ø3                                                                                 | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                  |
|----------|--------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                    | Infeed<br>in mm | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                     | ae=<br>0.05xD<br>ap=<br>0.05xD                                                      | ae=<br>0.05xD<br>ap=<br>0.05xD                                                      | ae=<br>0.05xD<br>ap=<br>0.05xD                                                      | ae=<br>0.05xD<br>ap=<br>0.05xD                                                      |
|          |                    | Application     |  |  |  |  |  |  |  |  |  |  |
|          |                    | Feed (mm/Z)     | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL     | Vc (m/min)      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55              | 160             | 0.02                                                                              | 0.024                                                                             | 0.029                                                                             | 0.03                                                                              | 0.033                                                                             | 0.036                                                                              | 0.045                                                                               | 0.065                                                                               | 0.075                                                                               | 0.09                                                                                |
| 1.2      | 56-60              | 125             | 0.019                                                                             | 0.023                                                                             | 0.028                                                                             | 0.029                                                                             | 0.032                                                                             | 0.034                                                                              | 0.042                                                                               | 0.06                                                                                | 0.07                                                                                | 0.085                                                                               |
| 1.3      | 60-65              | 110             | 0.018                                                                             | 0.022                                                                             | 0.026                                                                             | 0.028                                                                             | 0.03                                                                              | 0.032                                                                              | 0.04                                                                                | 0.055                                                                               | 0.065                                                                               | 0.08                                                                                |
| 1.4      | 66-70              | 85              | 0.015                                                                             | 0.019                                                                             | 0.022                                                                             | 0.024                                                                             | 0.026                                                                             | 0.028                                                                              | 0.035                                                                               | 0.05                                                                                | 0.06                                                                                | 0.075                                                                               |

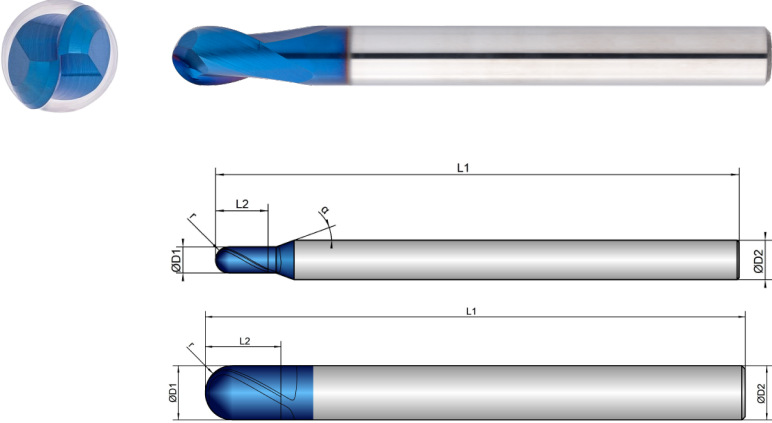
| Material | Hardness<br>in HRC | Dimension       | Ø10                                                                               | Ø12                                                                               | Ø14                                                                               | Ø16                                                                               | Ø20                                                                               |
|----------|--------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|          |                    | Infeed<br>in mm | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    | ae=<br>0.05xD<br>ap=<br>0.05xD                                                    |
|          |                    | Application     |  |  |  |  |  |
|          |                    | Feed (mm/Z)     | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                |
| H        | HARDENED STEEL     | Vc (m/min)      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
| 1.1      | 46-55              | 160             | 0.1                                                                               | 0.12                                                                              | 0.12                                                                              | 0.125                                                                             | 0.15                                                                              |
| 1.2      | 56-60              | 125             | 0.095                                                                             | 0.11                                                                              | 0.11                                                                              | 0.115                                                                             | 0.14                                                                              |
| 1.3      | 60-65              | 110             | 0.09                                                                              | 0.1                                                                               | 0.1                                                                               | 0.105                                                                             | 0.12                                                                              |
| 1.4      | 66-70              | 85              | 0.085                                                                             | 0.09                                                                              | 0.09                                                                              | 0.1                                                                               | 0.11                                                                              |

|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | f8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

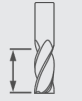
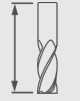
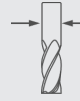
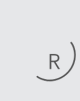
|             |                                                                                                                                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                            |
| Application |                                                                                        |
| Features    |     |



- Ultrafine carbide grade specially developed for machining hardened steels
- Adapted rake angle for safe milling up to 70 HRC
- Defined cutting edge preparation for homogeneous wear



| Roughing                                                                         |  |  |  |  | Finishing                                                                          |  |  |  |  |
|----------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |  |  |  |  | inappropriate                                                                      |  |  |  |  |
|                                                                                  |  |  |  |  | optimal                                                                            |  |  |  |  |

|         | D1                                                                                             | L2                                                                                        | L1                                                                                        | D2                                                                                             | z                                                                                        | r                                                                                          |                                                                                            | α                                                                                          |
|---------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| K203153 | <br>mm<br>ø | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>mm | <br>° | <br>° |
| 1/6     | 1.0                                                                                            | 2.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.50                                                                                       | 30                                                                                         | 12                                                                                         |
| 1,5/6   | 1.5                                                                                            | 3.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 0.75                                                                                       | 30                                                                                         | 12                                                                                         |
| 2/6     | 2.0                                                                                            | 4.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.00                                                                                       | 30                                                                                         | 12                                                                                         |
| 2,5/6   | 2.5                                                                                            | 5.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.25                                                                                       | 30                                                                                         | 12                                                                                         |
| 3/3     | 3.0                                                                                            | 5.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 2                                                                                        | 1.50                                                                                       | 30                                                                                         |                                                                                            |
| 3/6     | 3.0                                                                                            | 5.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 1.50                                                                                       | 30                                                                                         | 12                                                                                         |
| 4/4     | 4.0                                                                                            | 8.0                                                                                       | 75.0                                                                                      | 4.0                                                                                            | 2                                                                                        | 2.00                                                                                       | 30                                                                                         |                                                                                            |
| 4/6     | 4.0                                                                                            | 8.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 2                                                                                        | 2.00                                                                                       | 30                                                                                         | 12                                                                                         |
| 5/5     | 5.0                                                                                            | 9.0                                                                                       | 75.0                                                                                      | 5.0                                                                                            | 2                                                                                        | 2.50                                                                                       | 30                                                                                         |                                                                                            |
| 5/6     | 5.0                                                                                            | 9.0                                                                                       | 100.0                                                                                     | 6.0                                                                                            | 2                                                                                        | 2.50                                                                                       | 30                                                                                         | 12                                                                                         |
| 6/6     | 6.0                                                                                            | 10.0                                                                                      | 100.0                                                                                     | 6.0                                                                                            | 2                                                                                        | 3.00                                                                                       | 30                                                                                         |                                                                                            |
| 8/8     | 8.0                                                                                            | 12.0                                                                                      | 100.0                                                                                     | 8.0                                                                                            | 2                                                                                        | 4.00                                                                                       | 30                                                                                         |                                                                                            |
| 10/10   | 10.0                                                                                           | 14.0                                                                                      | 100.0                                                                                     | 10.0                                                                                           | 2                                                                                        | 5.00                                                                                       | 30                                                                                         |                                                                                            |
| 12/12   | 12.0                                                                                           | 16.0                                                                                      | 100.0                                                                                     | 12.0                                                                                           | 2                                                                                        | 6.00                                                                                       | 30                                                                                         |                                                                                            |
| 14/14   | 14.0                                                                                           | 18.0                                                                                      | 100.0                                                                                     | 14.0                                                                                           | 2                                                                                        | 7.00                                                                                       | 30                                                                                         |                                                                                            |
| 16/16   | 16.0                                                                                           | 22.0                                                                                      | 150.0                                                                                     | 16.0                                                                                           | 2                                                                                        | 8.00                                                                                       | 30                                                                                         |                                                                                            |
| 20/20   | 20.0                                                                                           | 26.0                                                                                      | 150.0                                                                                     | 20.0                                                                                           | 2                                                                                        | 10.00                                                                                      | 30                                                                                         |                                                                                            |

| Dimension    | Ø1                                                                                  | Ø1.5                                                                                | Ø2                                                                                  | Ø2.5                                                                                | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            |
| Application  |  |  |  |  |  |  |  |  |  |  |

|     | Material       | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|----------------|-----------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |       |       |       |       |       |       |       |       |       |
| 1.1 |                | 46-55           | 145         | 0.024 | 0.029 | 0.03  | 0.033 | 0.036 | 0.045 | 0.065 | 0.075 | 0.09  |
| 1.2 |                | 56-60           | 115         | 0.023 | 0.028 | 0.029 | 0.032 | 0.034 | 0.042 | 0.06  | 0.07  | 0.085 |
| 1.3 |                | 60-65           | 100         | 0.022 | 0.026 | 0.028 | 0.03  | 0.032 | 0.04  | 0.055 | 0.065 | 0.08  |
| 1.4 |                | 66-70           | 75          | 0.019 | 0.022 | 0.024 | 0.026 | 0.028 | 0.035 | 0.05  | 0.06  | 0.075 |

| Dimension    | Ø12                                                                                 | Ø14                                                                                 | Ø16                                                                                 | Ø20                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            |
| Application  |  |  |  |  |

|     | Material       | Hardness in HRC | Feed (mm/Z) | fz   | fz   | fz    | fz   |
|-----|----------------|-----------------|-------------|------|------|-------|------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |      |      |       |      |
| 1.1 |                | 46-55           | 145         | 0.12 | 0.12 | 0.125 | 0.15 |
| 1.2 |                | 56-60           | 115         | 0.11 | 0.11 | 0.115 | 0.14 |
| 1.3 |                | 60-65           | 100         | 0.1  | 0.1  | 0.105 | 0.12 |
| 1.4 |                | 66-70           | 75          | 0.09 | 0.09 | 0.1   | 0.11 |

## STILL CAN'T FIND A SUITABLE MILLING CUTTER?

**No problem** – simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST



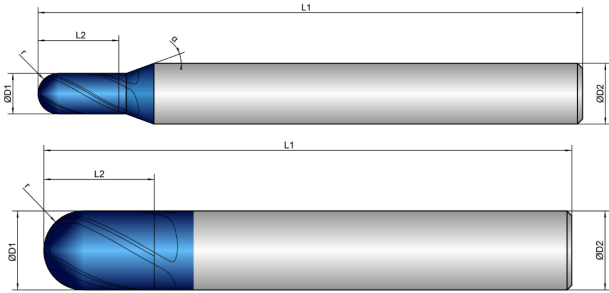
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | f8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                            |
| Application |                                                                                        |
| Features    |     |



- Ultrafine carbide grade specially developed for machining hardened steels
- Adapted rake angle for safe milling up to 70 HRC
- Defined cutting edge preparation for homogeneous wear

- 4 cutting edges to the center
- Radius tolerance  $r \leq 2\text{ mm}$ :  $\pm 0.003\text{ mm}$
- Radius tolerance  $r > 2\text{ mm}$ :  $\pm 0.005\text{ mm}$



| Roughing                                                                         |  |  |  |  | Finishing                                                                          |  |  |  |  |
|----------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |  |  |  |  | inappropriate                                                                      |  |  |  |  |
| optimal                                                                          |  |  |  |  | optimal                                                                            |  |  |  |  |

|         | <br>D1<br>mm<br>ø | <br>L2<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>r<br>mm | <br>° | <br>α<br>° |
|---------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| K203333 |                                                                                                      |                                                                                                 |                                                                                                 |                                                                                                      |                                                                                               |                                                                                                 |                                                                                            |                                                                                                 |
| 2/3     | 2.0                                                                                                  | 4.0                                                                                             | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                             | 1.00                                                                                            | 30                                                                                         | 8                                                                                               |
| 2/6     | 2.0                                                                                                  | 4.0                                                                                             | 54.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.00                                                                                            | 30                                                                                         | 12                                                                                              |
| 2,5/6   | 2.5                                                                                                  | 5.0                                                                                             | 54.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.25                                                                                            | 30                                                                                         | 12                                                                                              |
| 3/3     | 3.0                                                                                                  | 5.0                                                                                             | 50.0                                                                                            | 3.0                                                                                                  | 4                                                                                             | 1.50                                                                                            | 30                                                                                         |                                                                                                 |
| 3/6     | 3.0                                                                                                  | 5.0                                                                                             | 54.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 1.50                                                                                            | 30                                                                                         | 12                                                                                              |
| 4/4     | 4.0                                                                                                  | 8.0                                                                                             | 54.0                                                                                            | 4.0                                                                                                  | 4                                                                                             | 2.00                                                                                            | 30                                                                                         |                                                                                                 |
| 4/6     | 4.0                                                                                                  | 8.0                                                                                             | 54.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 2.00                                                                                            | 30                                                                                         | 12                                                                                              |
| 5/5     | 5.0                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 5.0                                                                                                  | 4                                                                                             | 2.50                                                                                            | 30                                                                                         |                                                                                                 |
| 5/6     | 5.0                                                                                                  | 9.0                                                                                             | 54.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 2.50                                                                                            | 30                                                                                         | 12                                                                                              |
| 6/6     | 6.0                                                                                                  | 10.0                                                                                            | 54.0                                                                                            | 6.0                                                                                                  | 4                                                                                             | 3.00                                                                                            | 30                                                                                         |                                                                                                 |
| 7/8     | 7.0                                                                                                  | 12.0                                                                                            | 59.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 3.50                                                                                            | 30                                                                                         |                                                                                                 |
| 8/8     | 8.0                                                                                                  | 12.0                                                                                            | 59.0                                                                                            | 8.0                                                                                                  | 4                                                                                             | 4.00                                                                                            | 30                                                                                         |                                                                                                 |
| 9/10    | 9.0                                                                                                  | 14.0                                                                                            | 67.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 4.50                                                                                            | 30                                                                                         |                                                                                                 |
| 10/10   | 10.0                                                                                                 | 14.0                                                                                            | 67.0                                                                                            | 10.0                                                                                                 | 4                                                                                             | 5.00                                                                                            | 30                                                                                         |                                                                                                 |
| 12/12   | 12.0                                                                                                 | 16.0                                                                                            | 74.0                                                                                            | 12.0                                                                                                 | 4                                                                                             | 6.00                                                                                            | 30                                                                                         |                                                                                                 |
| 14/14   | 14.0                                                                                                 | 18.0                                                                                            | 75.0                                                                                            | 14.0                                                                                                 | 4                                                                                             | 7.00                                                                                            | 30                                                                                         |                                                                                                 |
| 16/16   | 16.0                                                                                                 | 22.0                                                                                            | 83.0                                                                                            | 16.0                                                                                                 | 4                                                                                             | 8.00                                                                                            | 30                                                                                         |                                                                                                 |
| 20/20   | 20.0                                                                                                 | 26.0                                                                                            | 93.0                                                                                            | 20.0                                                                                                 | 4                                                                                             | 10.00                                                                                           | 30                                                                                         |                                                                                                 |

| Dimension    | Ø2                                                                                  | Ø2.5                                                                                | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø7                                                                                  | Ø8                                                                                  | Ø9                                                                                  | Ø10                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            |
| Application  |  |  |  |  |  |  |  |  |  |  |

|     | Material       | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|----------------|-----------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |       |       |       |       |       |       |       |       |       |
| 1.1 |                | 46-55           | 160         | 0.03  | 0.031 | 0.034 | 0.045 | 0.06  | 0.07  | 0.07  | 0.09  | 0.1   |
| 1.2 |                | 56-60           | 125         | 0.029 | 0.03  | 0.033 | 0.042 | 0.058 | 0.068 | 0.068 | 0.085 | 0.095 |
| 1.3 |                | 60-65           | 110         | 0.028 | 0.029 | 0.032 | 0.04  | 0.055 | 0.065 | 0.065 | 0.08  | 0.09  |
| 1.4 |                | 66-70           | 85          | 0.024 | 0.025 | 0.028 | 0.035 | 0.05  | 0.06  | 0.06  | 0.07  | 0.08  |

| Dimension    | Ø12                                                                                 | Ø14                                                                                 | Ø16                                                                                 | Ø20                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            | ae= 0.05xD<br>ap= 0.05xD                                                            |
| Application  |  |  |  |  |

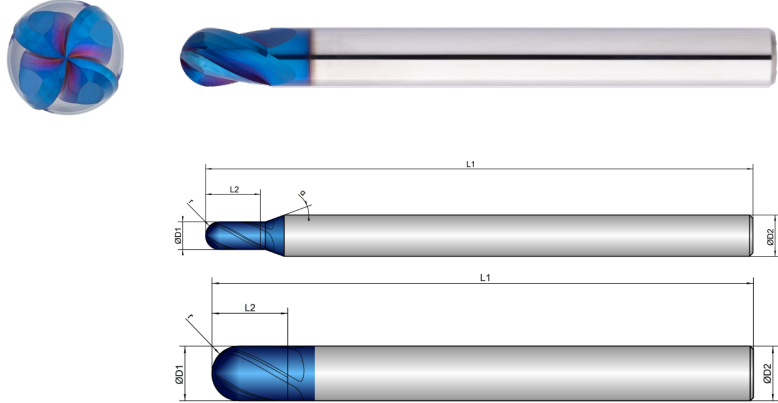
|     | Material       | Hardness in HRC | Feed (mm/Z) | fz   | fz   | fz    | fz   |
|-----|----------------|-----------------|-------------|------|------|-------|------|
| H   | HARDENED STEEL |                 | Vc (m/min)  |      |      |       |      |
| 1.1 |                | 46-55           | 160         | 0.12 | 0.12 | 0.125 | 0.15 |
| 1.2 |                | 56-60           | 125         | 0.11 | 0.11 | 0.115 | 0.14 |
| 1.3 |                | 60-65           | 110         | 0.1  | 0.1  | 0.105 | 0.12 |
| 1.4 |                | 66-70           | 85          | 0.09 | 0.09 | 0.095 | 0.11 |

|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | f8                                                                                                                                                                  |
| Coating   | AlphaDura Navy                                                                                                                                                      |

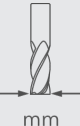
|             |                                                                                                                                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                            |
| Application |                                                                                        |
| Features    |     |



- Ultrafine carbide grade specially developed for machining hardened steels
  - Adapted rake angle for safe milling up to 70 HRC
  - Defined cutting edge preparation for homogeneous wear
- Long version for deeper cavities
- 4 cutting edges to the center
  - Radius tolerance  $r \leq 2$  mm:  $\pm 0.003$  mm
  - Radius tolerance  $r > 2$  mm:  $\pm 0.005$  mm



| Roughing                                                                         |  |  |  |  | Finishing                                                                          |  |  |  |  |
|----------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |  |  |  |  | inappropriate                                                                      |  |  |  |  |
| optimal                                                                          |  |  |  |  | optimal                                                                            |  |  |  |  |

| K203343 | <br>mm<br>ø | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>mm | <br>° | <br>° |
|---------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 2/3     | 2.0                                                                                            | 4.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 4                                                                                        | 1.00                                                                                       | 30                                                                                         | 8                                                                                          |
| 2/6     | 2.0                                                                                            | 4.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 4                                                                                        | 1.00                                                                                       | 30                                                                                         | 12                                                                                         |
| 2,5/6   | 2.5                                                                                            | 5.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 4                                                                                        | 1.25                                                                                       | 30                                                                                         | 12                                                                                         |
| 3/3     | 3.0                                                                                            | 5.0                                                                                       | 75.0                                                                                      | 3.0                                                                                            | 4                                                                                        | 1.50                                                                                       | 30                                                                                         |                                                                                            |
| 3/6     | 3.0                                                                                            | 5.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 4                                                                                        | 1.50                                                                                       | 30                                                                                         | 12                                                                                         |
| 4/4     | 4.0                                                                                            | 8.0                                                                                       | 75.0                                                                                      | 4.0                                                                                            | 4                                                                                        | 2.00                                                                                       | 30                                                                                         |                                                                                            |
| 4/6     | 4.0                                                                                            | 8.0                                                                                       | 80.0                                                                                      | 6.0                                                                                            | 4                                                                                        | 2.00                                                                                       | 30                                                                                         | 12                                                                                         |
| 5/5     | 5.0                                                                                            | 9.0                                                                                       | 75.0                                                                                      | 5.0                                                                                            | 4                                                                                        | 2.50                                                                                       | 30                                                                                         |                                                                                            |
| 5/6     | 5.0                                                                                            | 9.0                                                                                       | 100.0                                                                                     | 6.0                                                                                            | 4                                                                                        | 2.50                                                                                       | 30                                                                                         | 12                                                                                         |
| 6/6     | 6.0                                                                                            | 10.0                                                                                      | 100.0                                                                                     | 6.0                                                                                            | 4                                                                                        | 3.00                                                                                       | 30                                                                                         |                                                                                            |
| 8/8     | 8.0                                                                                            | 12.0                                                                                      | 100.0                                                                                     | 8.0                                                                                            | 4                                                                                        | 4.00                                                                                       | 30                                                                                         |                                                                                            |
| 10/10   | 10.0                                                                                           | 14.0                                                                                      | 100.0                                                                                     | 10.0                                                                                           | 4                                                                                        | 5.00                                                                                       | 30                                                                                         |                                                                                            |
| 12/12   | 12.0                                                                                           | 16.0                                                                                      | 100.0                                                                                     | 12.0                                                                                           | 4                                                                                        | 6.00                                                                                       | 30                                                                                         |                                                                                            |
| 14/14   | 14.0                                                                                           | 18.0                                                                                      | 100.0                                                                                     | 14.0                                                                                           | 4                                                                                        | 7.00                                                                                       | 30                                                                                         |                                                                                            |
| 16/16   | 16.0                                                                                           | 22.0                                                                                      | 150.0                                                                                     | 16.0                                                                                           | 4                                                                                        | 8.00                                                                                       | 30                                                                                         |                                                                                            |
| 20/20   | 20.0                                                                                           | 26.0                                                                                      | 150.0                                                                                     | 20.0                                                                                           | 4                                                                                        | 10.00                                                                                      | 30                                                                                         |                                                                                            |

| Dimension    | Ø2                                                                                  | Ø2,5                                                                                | Ø3                                                                                  | Ø4                                                                                  | Ø5                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 | Ø14                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            |
| Application  |  |  |  |  |  |  |  |  |  |  |

| Material |                | Hardness in HRC | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz   |
|----------|----------------|-----------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| H        | HARDENED STEEL |                 | Vc (m/min)  |       |       |       |       |       |       |       |       |      |
| 1.1      |                | 46-55           | 145         | 0,03  | 0,031 | 0,034 | 0,045 | 0,06  | 0,07  | 0,09  | 0,1   | 0,12 |
| 1.2      |                | 56-60           | 115         | 0,029 | 0,03  | 0,033 | 0,042 | 0,058 | 0,068 | 0,085 | 0,095 | 0,11 |
| 1.3      |                | 60-65           | 100         | 0,028 | 0,029 | 0,032 | 0,04  | 0,055 | 0,065 | 0,08  | 0,09  | 0,1  |
| 1.4      |                | 66-70           | 75          | 0,024 | 0,025 | 0,028 | 0,035 | 0,05  | 0,06  | 0,07  | 0,08  | 0,09 |

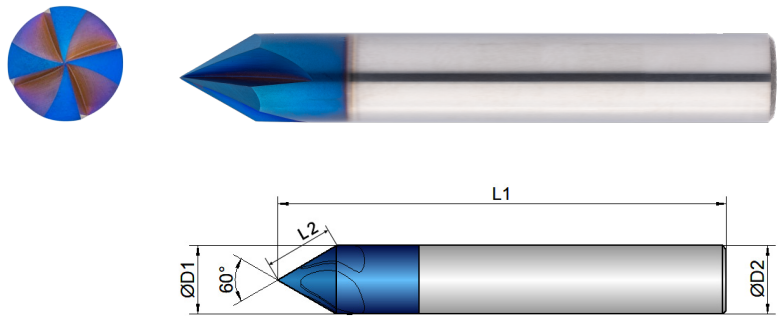
| Dimension    | Ø16                                                                                 | Ø20                                                                                 |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm | ae= 0,05xD<br>ap= 0,05xD                                                            | ae= 0,05xD<br>ap= 0,05xD                                                            |
| Application  |  |  |

| Material |                | Hardness in HRC | Feed (mm/Z) | fz    | fz   |
|----------|----------------|-----------------|-------------|-------|------|
| H        | HARDENED STEEL |                 | Vc (m/min)  |       |      |
| 1.1      |                | 46-55           | 145         | 0,125 | 0,15 |
| 1.2      |                | 56-60           | 115         | 0,115 | 0,14 |
| 1.3      |                | 60-65           | 100         | 0,105 | 0,12 |
| 1.4      |                | 66-70           | 75          | 0,095 | 0,11 |

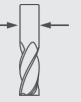
|           |                                                                                   |
|-----------|-----------------------------------------------------------------------------------|
| Cooling   |  |
| Tolerance | -                                                                                 |
| Coating   | AlphaDura Navy                                                                    |

|             |                                                                                     |
|-------------|-------------------------------------------------------------------------------------|
| Strategy    |  |
| Application |    |
| Features    |   |

- Ultrafine carbide grade specially developed for machining hardened steels
- Defined cutting edge preparation for homogeneous wear
- Specially for deburring hardened steels



| Roughing                                                                                           | Finishing                                                                                          |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
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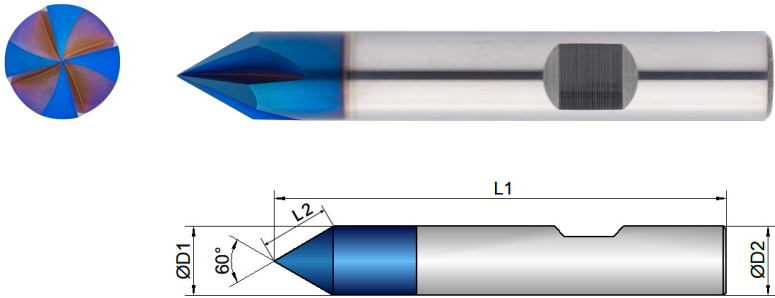
| K205153 | D1<br><br>mm<br>ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># |
|---------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 3       | 3.0                                                                                                 | 2.9                                                                                            | 50.0                                                                                           | 3.0                                                                                                   | 3                                                                                              |
| 4       | 4.0                                                                                                 | 3.9                                                                                            | 50.0                                                                                           | 4.0                                                                                                   | 4                                                                                              |
| 6       | 6.0                                                                                                 | 5.9                                                                                            | 50.0                                                                                           | 6.0                                                                                                   | 4                                                                                              |
| 8       | 8.0                                                                                                 | 7.9                                                                                            | 59.0                                                                                           | 8.0                                                                                                   | 4                                                                                              |
| 10      | 10.0                                                                                                | 9.9                                                                                            | 66.0                                                                                           | 10.0                                                                                                  | 4                                                                                              |
| 12      | 12.0                                                                                                | 11.9                                                                                           | 73.0                                                                                           | 12.0                                                                                                  | 4                                                                                              |

|     |          |            | Dimension          | Ø3                            | Ø4                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 |
|-----|----------|------------|--------------------|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|     |          |            | Infeed<br>in mm    | ae=<br>0.1xD<br>ap=<br>L2 max | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>0.1xD<br>ap=<br>L2 max                                                       |
|     |          |            |                    | Application                   |  |  |  |  |  |
|     |          |            | Hardness<br>in HRC | Feed (mm/Z)                   | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H   | MATERIAL | Vc (m/min) |                    |                               |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1 | 46-55    | 105        | 0.02               | 0.025                         | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                | 0.06                                                                                |                                                                                     |
| 1.2 | 56-60    | 95         | 0.015              | 0.02                          | 0.025                                                                               | 0.035                                                                               | 0.045                                                                               | 0.055                                                                               |                                                                                     |
| 1.3 | 60-65    | 70         | 0.012              | 0.018                         | 0.022                                                                               | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                |                                                                                     |
| 1.4 | 66-70    | 45         | 0.01               | 0.015                         | 0.018                                                                               | 0.02                                                                                | 0.03                                                                                | 0.04                                                                                |                                                                                     |

|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | -                                                                                                                                                                   |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                      |                                                                                     |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                      |  |
| Application |                                                                                     |                                                                                     |
| Features    |   |  |

- Ultrafine carbide grade specially developed for machining hardened steels
- Defined cutting edge preparation for homogeneous wear
- Specially for deburring hardened steels



| Roughing                                                                                           | Finishing                                                                                          |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
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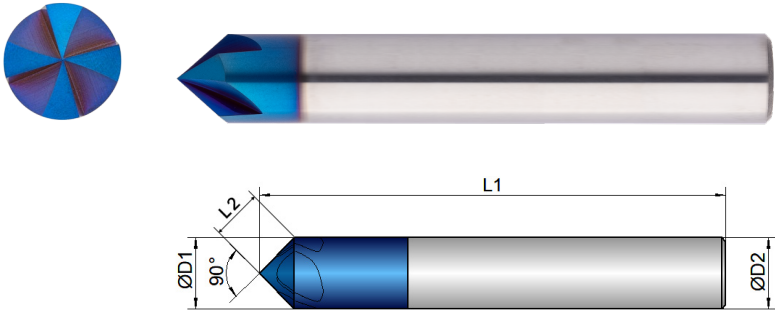
|         | D1<br><br>mm<br>ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># |
|---------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| K205154 |                                                                                                     |                                                                                                |                                                                                                |                                                                                                       |                                                                                                |
| 6       | 6.0                                                                                                 | 5.9                                                                                            | 50.0                                                                                           | 6.0                                                                                                   | 4                                                                                              |
| 8       | 8.0                                                                                                 | 7.9                                                                                            | 59.0                                                                                           | 8.0                                                                                                   | 4                                                                                              |
| 10      | 10.0                                                                                                | 9.9                                                                                            | 66.0                                                                                           | 10.0                                                                                                  | 4                                                                                              |
| 12      | 12.0                                                                                                | 11.9                                                                                           | 73.0                                                                                           | 12.0                                                                                                  | 4                                                                                              |

|              |                 | Dimension   | Ø 6                                                                                 | Ø 8                                                                                 | Ø 10                                                                                | Ø 12                                                                                |
|--------------|-----------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm |                 |             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             |
| Application  |                 |             |  |  |  |  |
| Material     | Hardness in HRC | Feed (mm/Z) | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H            | HARDENED STEEL  | Vc (m/min)  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1          | 46-55           | 105         | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                | 0.06                                                                                |
| 1.2          | 56-60           | 95          | 0.025                                                                               | 0.035                                                                               | 0.045                                                                               | 0.055                                                                               |
| 1.3          | 60-65           | 70          | 0.022                                                                               | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                |
| 1.4          | 66-70           | 45          | 0.018                                                                               | 0.02                                                                                | 0.03                                                                                | 0.04                                                                                |

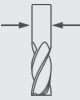
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | -                                                                                                                                                                   |
| Coating   | AlphaDura Navy                                                                                                                                                      |

|             |                                                                                                                                                                      |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy    |                                                                                   |
| Application |                                                                                     |
| Features    |   |

- Ultrafine carbide grade specially developed for machining hardened steels
- Defined cutting edge preparation for homogeneous wear
- Specially for deburring hardened steels



| Roughing                                                                                           | Finishing                                                                                          |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <div><div></div><div></div><div></div><div></div><div></div></div> <div>inappropriateoptimal</div> | <div><div></div><div></div><div></div><div></div><div></div></div> <div>inappropriateoptimal</div> |

| K205163 | D1<br><br>mm<br>ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># |
|---------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 3       | 3.0                                                                                                 | 2.1                                                                                            | 50.0                                                                                           | 3.0                                                                                                   | 3                                                                                              |
| 4       | 4.0                                                                                                 | 2.8                                                                                            | 50.0                                                                                           | 4.0                                                                                                   | 4                                                                                              |
| 6       | 6.0                                                                                                 | 4.2                                                                                            | 50.0                                                                                           | 6.0                                                                                                   | 4                                                                                              |
| 8       | 8.0                                                                                                 | 5.6                                                                                            | 59.0                                                                                           | 8.0                                                                                                   | 4                                                                                              |
| 10      | 10.0                                                                                                | 7.0                                                                                            | 66.0                                                                                           | 10.0                                                                                                  | 4                                                                                              |
| 12      | 12.0                                                                                                | 8.5                                                                                            | 73.0                                                                                           | 12.0                                                                                                  | 4                                                                                              |

|              |                 | Dimension   | Ø3                                                                                  | Ø4                                                                                  | Ø6                                                                                  | Ø8                                                                                  | Ø10                                                                                 | Ø12                                                                                 |
|--------------|-----------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm |                 |             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             |
| Application  |                 |             |  |  |  |  |  |  |
| Material     | Hardness in HRC | Feed (mm/Z) | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H            | HARDENED STEEL  | Vc (m/min)  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1          | 46-55           | 105         | 0.02                                                                                | 0.025                                                                               | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                | 0.06                                                                                |
| 1.2          | 56-60           | 95          | 0.015                                                                               | 0.02                                                                                | 0.025                                                                               | 0.035                                                                               | 0.045                                                                               | 0.055                                                                               |
| 1.3          | 60-65           | 70          | 0.012                                                                               | 0.018                                                                               | 0.022                                                                               | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                |
| 1.4          | 66-70           | 45          | 0.01                                                                                | 0.015                                                                               | 0.018                                                                               | 0.02                                                                                | 0.03                                                                                | 0.04                                                                                |

Cooling



Tolerance

-

Coating

AlphaDura Navy

Strategy



Application

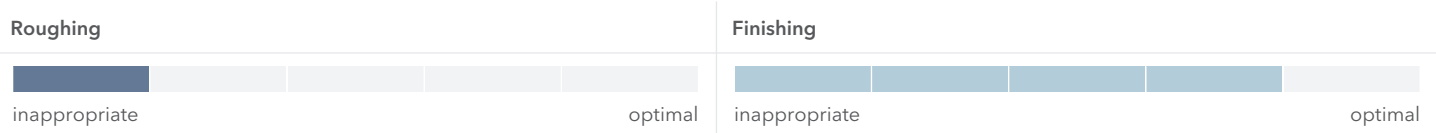
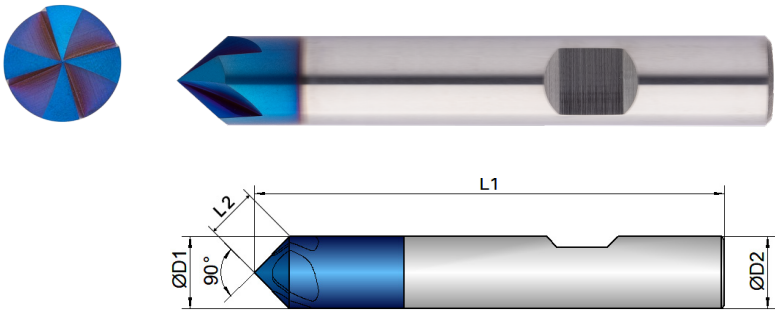


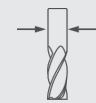
Features





- Ultrafine carbide grade specially developed for machining hardened steels
- Defined cutting edge preparation for homogeneous wear
- Specially for deburring hardened steels



|         | D1<br><br>mm<br>ø | L2<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># |
|---------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| K205164 |                                                                                                     |                                                                                                |                                                                                                |                                                                                                      |                                                                                                |
| 6       | 6.0                                                                                                 | 4.2                                                                                            | 50.0                                                                                           | 6.0                                                                                                  | 4                                                                                              |
| 8       | 8.0                                                                                                 | 5.6                                                                                            | 59.0                                                                                           | 8.0                                                                                                  | 4                                                                                              |
| 10      | 10.0                                                                                                | 7.0                                                                                            | 66.0                                                                                           | 10.0                                                                                                 | 4                                                                                              |
| 12      | 12.0                                                                                                | 8.5                                                                                            | 73.0                                                                                           | 12.0                                                                                                 | 4                                                                                              |

|              |                 | Dimension   | Ø 6                                                                                 | Ø 8                                                                                 | Ø 10                                                                                | Ø 12                                                                                |
|--------------|-----------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Infeed in mm |                 |             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             | ae= 0.1xD<br>ap= L2 max                                                             |
| Application  |                 |             |  |  |  |  |
| Material     | Hardness in HRC | Feed (mm/Z) | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H            | HARDENED STEEL  | Vc (m/min)  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1          | 46-55           | 105         | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                | 0.06                                                                                |
| 1.2          | 56-60           | 95          | 0.025                                                                               | 0.035                                                                               | 0.045                                                                               | 0.055                                                                               |
| 1.3          | 60-65           | 70          | 0.022                                                                               | 0.03                                                                                | 0.04                                                                                | 0.05                                                                                |
| 1.4          | 66-70           | 45          | 0.018                                                                               | 0.02                                                                                | 0.03                                                                                | 0.04                                                                                |

STILL CAN'T FIND A SUITABLE MILLING CUTTER?

No problem – simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

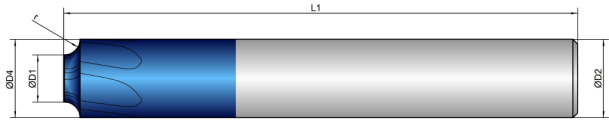
WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST



|           |                                                                                                                                                                                                                                                                                                                                         |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |     |
| Tolerance | V1                                                                                                                                                                                                                                                                                                                                      |
| Coating   | AlphaDura Navy                                                                                                                                                                                                                                                                                                                          |

|             |                                                                                   |                                                                                     |
|-------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Strategy    |  |  |
| Application |  |                                                                                     |
| Features    | HA                                                                                |  |

- Ultrafine carbide grade specially developed for machining hardened steels
- Defined cutting edge preparation for homogeneous wear
- For the attachment of radii to components



| Roughing                                                                                           | Finishing                                                                                          |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <div><div></div><div></div><div></div><div></div><div></div></div> <div>inappropriateoptimal</div> | <div><div></div><div></div><div></div><div></div><div></div></div> <div>inappropriateoptimal</div> |

| K204108 | D5<br><br>mm<br>ø | D4<br><br>mm<br>ø | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm |
|---------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 3/0,5   | 3                                                                                                   | 4                                                                                                   | 50.0                                                                                           | 4.0                                                                                                 | 6                                                                                              | 0.50                                                                                            |
| 3,2/0,4 | 3.2                                                                                                 | 4                                                                                                   | 50.0                                                                                           | 4.0                                                                                                 | 6                                                                                              | 0.40                                                                                            |
| 3,4/0,3 | 3.4                                                                                                 | 4                                                                                                   | 50.0                                                                                           | 4.0                                                                                                 | 6                                                                                              | 0.30                                                                                            |
| 3,6/0,2 | 3.6                                                                                                 | 4                                                                                                   | 50.0                                                                                           | 4.0                                                                                                 | 6                                                                                              | 0.20                                                                                            |
| 4/1     | 4                                                                                                   | 6                                                                                                   | 50.0                                                                                           | 6.0                                                                                                 | 6                                                                                              | 1.00                                                                                            |
| 4,4/0,8 | 4.4                                                                                                 | 6                                                                                                   | 50.0                                                                                           | 6.0                                                                                                 | 6                                                                                              | 0.80                                                                                            |
| 4,8/0,6 | 4.8                                                                                                 | 6                                                                                                   | 50.0                                                                                           | 6.0                                                                                                 | 6                                                                                              | 0.60                                                                                            |
| 5/10    | 5                                                                                                   | 25                                                                                                  | 100.0                                                                                          | 25.0                                                                                                | 6                                                                                              | 10.00                                                                                           |
| 6/2     | 6                                                                                                   | 10                                                                                                  | 66.0                                                                                           | 10.0                                                                                                | 6                                                                                              | 2.00                                                                                            |
| 6/3     | 6                                                                                                   | 12                                                                                                  | 73.0                                                                                           | 12.0                                                                                                | 6                                                                                              | 3.00                                                                                            |
| 7/1,5   | 7                                                                                                   | 10                                                                                                  | 66.0                                                                                           | 10.0                                                                                                | 6                                                                                              | 1.50                                                                                            |
| 7/2,5   | 7                                                                                                   | 12                                                                                                  | 73.0                                                                                           | 12.0                                                                                                | 6                                                                                              | 2.50                                                                                            |
| 7/4,5   | 7                                                                                                   | 16                                                                                                  | 80.0                                                                                           | 16.0                                                                                                | 6                                                                                              | 4.50                                                                                            |
| 8/4     | 8                                                                                                   | 16                                                                                                  | 80.0                                                                                           | 16.0                                                                                                | 6                                                                                              | 4.00                                                                                            |
| 8/6     | 8                                                                                                   | 20                                                                                                  | 93.0                                                                                           | 20.0                                                                                                | 6                                                                                              | 6.00                                                                                            |
| 9/3,5   | 9                                                                                                   | 16                                                                                                  | 80.0                                                                                           | 16.0                                                                                                | 6                                                                                              | 3.50                                                                                            |
| 9/8     | 9                                                                                                   | 25                                                                                                  | 100.0                                                                                          | 25.0                                                                                                | 6                                                                                              | 8.00                                                                                            |
| 10/5    | 10                                                                                                  | 20                                                                                                  | 93.0                                                                                           | 20.0                                                                                                | 6                                                                                              | 5.00                                                                                            |

|          |                 | Dimension    | Ø3.6 R0.2                                                                           | Ø3.4 R0.3                                                                           | Ø3.2 R0.4                                                                           | Ø3 R0.5                                                                             | Ø4.8 R0.6                                                                           | Ø4.4 R0.8                                                                           | Ø4 R1                                                                               | Ø7 R1.5                                                                             | Ø6 R2                                                                               | Ø7 R2.5                                                                             |
|----------|-----------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                 | Infeed in mm | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                | ae= rmax<br>ap= rmax                                                                |
|          |                 | Application  |  |  |  |  |  |  |  |  |  |  |
| Material | Hardness in HRC | Feed (mm/Z)  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL  | Vc (m/min)   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55           | 50           | 0.02                                                                                | 0.02                                                                                | 0.02                                                                                | 0.02                                                                                | 0.024                                                                               | 0.024                                                                               | 0.024                                                                               | 0.026                                                                               | 0.03                                                                                | 0.034                                                                               |
| 1.2      | 56-60           | 45           | 0.018                                                                               | 0.018                                                                               | 0.018                                                                               | 0.018                                                                               | 0.022                                                                               | 0.022                                                                               | 0.022                                                                               | 0.024                                                                               | 0.028                                                                               | 0.032                                                                               |
| 1.3      | 60-65           | 40           | 0.016                                                                               | 0.016                                                                               | 0.016                                                                               | 0.016                                                                               | 0.02                                                                                | 0.02                                                                                | 0.02                                                                                | 0.022                                                                               | 0.026                                                                               | 0.03                                                                                |
| 1.4      | 66-70           | 30           | 0.01                                                                                | 0.01                                                                                | 0.01                                                                                | 0.01                                                                                | 0.012                                                                               | 0.012                                                                               | 0.012                                                                               | 0.014                                                                               | 0.018                                                                               | 0.022                                                                               |

|     |                                 | Strength (N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|---------------------------------|------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                 | Vc (m/min)       |             |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic            | <850             | 95          | 0.03  | 0.03  | 0.03  | 0.03  | 0.035 | 0.035 | 0.035 | 0.035 | 0.045 |
| 2.1 | austenitic                      | <650             | 85          | 0.028 | 0.028 | 0.028 | 0.028 | 0.033 | 0.033 | 0.033 | 0.033 | 0.042 |
| 2.2 | austenitic                      | <750             | 80          | 0.026 | 0.026 | 0.026 | 0.026 | 0.031 | 0.031 | 0.031 | 0.031 | 0.04  |
| 3.1 | DUPLEX STEEL   super austenitic | <1100            | 60          | 0.02  | 0.02  | 0.02  | 0.02  | 0.022 | 0.022 | 0.022 | 0.022 | 0.03  |

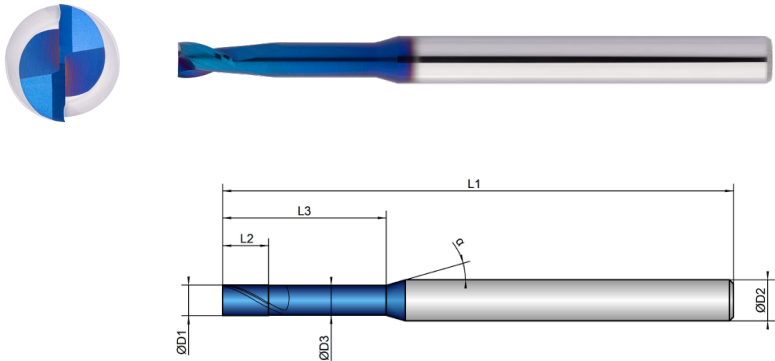
|          |                 | Dimension    | Ø6 R3                                                                                 | Ø9 R3.5                                                                               | Ø8 R4                                                                                 | Ø7 R4.5                                                                               | Ø10 R5                                                                                | Ø8 R6                                                                                 | Ø9 R8                                                                                 | Ø5 R10                                                                                |
|----------|-----------------|--------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|          |                 | Infeed in mm | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  | ae= rmax<br>ap= rmax                                                                  |
|          |                 | Application  |  |  |  |  |  |  |  |  |
| Material | Hardness in HRC | Feed (mm/Z)  | fz                                                                                    | fz                                                                                    | fz                                                                                    | fz                                                                                    | fz                                                                                    | fz                                                                                    | fz                                                                                    | fz                                                                                    |
| H        | HARDENED STEEL  | Vc (m/min)   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
| 1.1      | 46-55           | 50           | 0.034                                                                                 | 0.036                                                                                 | 0.036                                                                                 | 0.036                                                                                 | 0.038                                                                                 | 0.038                                                                                 | 0.042                                                                                 | 0.042                                                                                 |
| 1.2      | 56-60           | 45           | 0.032                                                                                 | 0.034                                                                                 | 0.034                                                                                 | 0.034                                                                                 | 0.036                                                                                 | 0.036                                                                                 | 0.04                                                                                  | 0.04                                                                                  |
| 1.3      | 60-65           | 40           | 0.03                                                                                  | 0.032                                                                                 | 0.032                                                                                 | 0.032                                                                                 | 0.034                                                                                 | 0.034                                                                                 | 0.038                                                                                 | 0.038                                                                                 |
| 1.4      | 66-70           | 30           | 0.022                                                                                 | 0.022                                                                                 | 0.022                                                                                 | 0.022                                                                                 | 0.024                                                                                 | 0.024                                                                                 | 0.028                                                                                 | 0.028                                                                                 |

|                                                                                                                                                                                                                                                                            |                                 | Strength (N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------|-------------|-------|-------|-------|-------|-------|-------|-------|
| M                                                                                                                                                                                                                                                                          | STAINLESS STEEL                 | Vc (m/min)       |             |       |       |       |       |       |       |       |
| 1.1                                                                                                                                                                                                                                                                        | ferritic/martensitic            | <850             | 95          | 0.05  | 0.055 | 0.055 | 0.055 | 0.06  | 0.06  | 0.065 |
| 2.1                                                                                                                                                                                                                                                                        | austenitic                      | <650             | 85          | 0.048 | 0.053 | 0.053 | 0.053 | 0.058 | 0.058 | 0.063 |
| 2.2                                                                                                                                                                                                                                                                        | austenitic                      | <750             | 80          | 0.045 | 0.05  | 0.05  | 0.05  | 0.055 | 0.055 | 0.06  |
| 3.1                                                                                                                                                                                                                                                                        | DUPLEX STEEL   super austenitic | <1100            | 60          | 0.035 | 0.04  | 0.04  | 0.04  | 0.045 | 0.045 | 0.05  |
| <b>ADVICE  </b> The values marked in turquoise are side applications!<br>Please use the arithmetic average from D2 and D1 to calculate cutting datas.<br>For example tool Ø5 R10, D1=Ø5; R=10 calculated diameter = Ø15    Formula: D1+R= Result<br>Example: 5mm+10mm=15mm |                                 |                  |             |       |       |       |       |       |       |       |

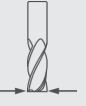
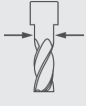
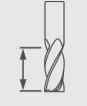
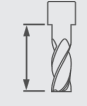
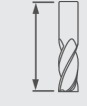
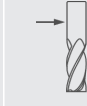
|           |                                                                                                                                                                     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |   |
| Tolerance | d04                                                                                                                                                                 |
| Coating   | AlphaDura Navy                                                                                                                                                      |

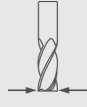
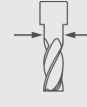
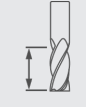
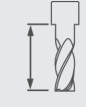
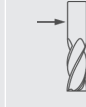
|             |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                               |                                                                                               |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Strategy    |                                                                                                                                                                                                                                                            |     | <br>Expert |
| Application |     |                                                                                                                                                                                                                                                            |            |
| Features    |     |                                                                                                                                                                                                                                                            |                                                                                               |

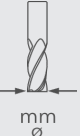
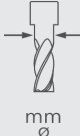
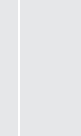
- Ultrafine carbide grade developed for machining hardened steels
- Optimized face geometry for long tool life and highest dimensional accuracy
- Reinforced core for milling up to 70 HRC
- Tolerance D1: -0.001/-0.006 mm
- Tolerance D3: 0/-0.02 mm



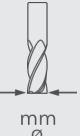
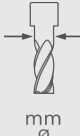
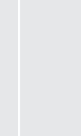
| Roughing                                                                                           | Finishing                                                                                          |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <div><div></div><div></div><div></div><div></div><div></div></div> <div>inappropriateoptimal</div> | <div><div></div><div></div><div></div><div></div><div></div></div> <div>inappropriateoptimal</div> |

| K201122 | <br>D1<br>mm<br>ø | <br>D3<br>mm<br>ø | <br>L2<br>mm | <br>L3<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>° | <br>α<br>° |
|---------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 0,2X0,5 | 0.2                                                                                                 | 0.18                                                                                                | 0.3                                                                                            | 0.5                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,2X1   | 0.2                                                                                                 | 0.18                                                                                                | 0.3                                                                                            | 1.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,2X1,5 | 0.2                                                                                                 | 0.18                                                                                                | 0.3                                                                                            | 1.5                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X1   | 0.3                                                                                                 | 0.28                                                                                                | 0.4                                                                                            | 1.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X2   | 0.3                                                                                                 | 0.28                                                                                                | 0.4                                                                                            | 2.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X3   | 0.3                                                                                                 | 0.28                                                                                                | 0.4                                                                                            | 3.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X6   | 0.3                                                                                                 | 0.28                                                                                                | 0.4                                                                                            | 6.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X9   | 0.3                                                                                                 | 0.28                                                                                                | 0.4                                                                                            | 9.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,4X2   | 0.4                                                                                                 | 0.38                                                                                                | 0.6                                                                                            | 2.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,4X3   | 0.4                                                                                                 | 0.38                                                                                                | 0.6                                                                                            | 3.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,4X4   | 0.4                                                                                                 | 0.38                                                                                                | 0.6                                                                                            | 4.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,4X5   | 0.4                                                                                                 | 0.38                                                                                                | 0.6                                                                                            | 5.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,4X8   | 0.4                                                                                                 | 0.38                                                                                                | 0.6                                                                                            | 8.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,4X12  | 0.4                                                                                                 | 0.38                                                                                                | 0.6                                                                                            | 12.0                                                                                           | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,5X2   | 0.5                                                                                                 | 0.48                                                                                                | 0.7                                                                                            | 2.0                                                                                            | 45.0                                                                                           | 4.0                                                                                                 | 2                                                                                             | 30                                                                                        | 16                                                                                             |

| K201122 | <br>D1<br>mm<br>ø | <br>D3<br>mm<br>ø | <br>L2<br>mm | <br>L3<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>° | <br>α<br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 0,5X4   | 0.5                                                                                                  | 0.48                                                                                                 | 0.7                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,5X6   | 0.5                                                                                                  | 0.48                                                                                                 | 0.7                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,5X8   | 0.5                                                                                                  | 0.48                                                                                                 | 0.7                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,5X10  | 0.5                                                                                                  | 0.48                                                                                                 | 0.7                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,5X15  | 0.5                                                                                                  | 0.48                                                                                                 | 0.7                                                                                             | 15.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X2   | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 2.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X4   | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X6   | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X8   | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X10  | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X12  | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 12.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,6X18  | 0.6                                                                                                  | 0.58                                                                                                 | 0.9                                                                                             | 18.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,7X2   | 0.7                                                                                                  | 0.68                                                                                                 | 1.0                                                                                             | 2.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,7X4   | 0.7                                                                                                  | 0.68                                                                                                 | 1.0                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,7X6   | 0.7                                                                                                  | 0.68                                                                                                 | 1.0                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,7X8   | 0.7                                                                                                  | 0.68                                                                                                 | 1.0                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,7X10  | 0.7                                                                                                  | 0.68                                                                                                 | 1.0                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X4   | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X6   | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X8   | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X10  | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X12  | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 12.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X16  | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,8X24  | 0.8                                                                                                  | 0.78                                                                                                 | 1.2                                                                                             | 24.0                                                                                            | 60.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,9X4   | 0.9                                                                                                  | 0.88                                                                                                 | 1.3                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,9X6   | 0.9                                                                                                  | 0.88                                                                                                 | 1.3                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,9X8   | 0.9                                                                                                  | 0.88                                                                                                 | 1.3                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,9X10  | 0.9                                                                                                  | 0.88                                                                                                 | 1.3                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 0,9X15  | 0.9                                                                                                  | 0.88                                                                                                 | 1.3                                                                                             | 15.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |

| K201122 | <br>D1<br>mm<br>ø | <br>D3<br>mm<br>ø | <br>L2<br>mm | <br>L3<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>° | <br>α<br>° |
|---------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1X4     | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 4.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X6     | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X8     | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X10    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 10.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X12    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 12.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X14    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 14.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X16    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 16.0                                                                                          | 50.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X20    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 20.0                                                                                          | 54.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X25    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 25.0                                                                                          | 70.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1X30    | 1.0                                                                                                | 0.95                                                                                               | 1.5                                                                                           | 30.0                                                                                          | 70.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,2X6   | 1.2                                                                                                | 1.14                                                                                               | 1.8                                                                                           | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,2X8   | 1.2                                                                                                | 1.14                                                                                               | 1.8                                                                                           | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,2X10  | 1.2                                                                                                | 1.14                                                                                               | 1.8                                                                                           | 10.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,2X12  | 1.2                                                                                                | 1.14                                                                                               | 1.8                                                                                           | 12.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,2X16  | 1.2                                                                                                | 1.14                                                                                               | 1.8                                                                                           | 16.0                                                                                          | 50.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,2X20  | 1.2                                                                                                | 1.14                                                                                               | 1.8                                                                                           | 20.0                                                                                          | 60.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X6   | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X8   | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X10  | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 10.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X12  | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 12.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X14  | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 14.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X16  | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 16.0                                                                                          | 50.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,4X22  | 1.4                                                                                                | 1.34                                                                                               | 2.1                                                                                           | 22.0                                                                                          | 54.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,5X6   | 1.5                                                                                                | 1.44                                                                                               | 2.3                                                                                           | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,5X8   | 1.5                                                                                                | 1.44                                                                                               | 2.3                                                                                           | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,5X10  | 1.5                                                                                                | 1.44                                                                                               | 2.3                                                                                           | 10.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,5X12  | 1.5                                                                                                | 1.44                                                                                               | 2.3                                                                                           | 12.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,5X14  | 1.5                                                                                                | 1.44                                                                                               | 2.3                                                                                           | 14.0                                                                                          | 50.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |
| 1,5X16  | 1.5                                                                                                | 1.44                                                                                               | 2.3                                                                                           | 16.0                                                                                          | 50.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 30                                                                                       | 16                                                                                            |

| K201122 | <br>D1<br>mm<br>ø | <br>D3<br>mm<br>ø | <br>L2<br>mm | <br>L3<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>° | <br>α<br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1,5X18  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 18.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,5X20  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 20.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,5X25  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 25.0                                                                                            | 70.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,5X30  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 30.0                                                                                            | 70.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,5X35  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 35.0                                                                                            | 70.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,5X40  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 40.0                                                                                            | 80.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,5X45  | 1.5                                                                                                  | 1.44                                                                                                 | 2.3                                                                                             | 45.0                                                                                            | 80.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X6   | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X8   | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X10  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X12  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X14  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X16  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X18  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 18.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X20  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 20.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,6X26  | 1.6                                                                                                  | 1.51                                                                                                 | 2.4                                                                                             | 26.0                                                                                            | 60.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X6   | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X8   | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X10  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X12  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X14  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X16  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X18  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 18.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X20  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 20.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 1,8X25  | 1.8                                                                                                  | 1.71                                                                                                 | 2.7                                                                                             | 25.0                                                                                            | 60.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 2X6     | 2.0                                                                                                  | 1.91                                                                                                 | 3.0                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 2X8     | 2.0                                                                                                  | 1.91                                                                                                 | 3.0                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 2X10    | 2.0                                                                                                  | 1.91                                                                                                 | 3.0                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |
| 2X12    | 2.0                                                                                                  | 1.91                                                                                                 | 3.0                                                                                             | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 30                                                                                       | 16                                                                                            |

| K201122 | D1                                                                                           | D3                                                                                           | L2                                                                                      | L3                                                                                      | L1                                                                                      | D2                                                                                           | z                                                                                       |                                                                                          | α                                                                                        |
|---------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
|         | <br>mm<br>ø | <br>mm<br>ø | <br>mm | <br>mm | <br>mm | <br>mm<br>ø | <br># | <br>° | <br>° |
| 2X14    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 14.0                                                                                    | 50.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X16    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 16.0                                                                                    | 50.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X18    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 18.0                                                                                    | 54.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X20    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 20.0                                                                                    | 54.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X25    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 25.0                                                                                    | 60.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X30    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 30.0                                                                                    | 70.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X35    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 35.0                                                                                    | 80.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X40    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 40.0                                                                                    | 90.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X50    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 50.0                                                                                    | 100.0                                                                                   | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2X60    | 2.0                                                                                          | 1.91                                                                                         | 3.0                                                                                     | 60.0                                                                                    | 110.0                                                                                   | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X8   | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 8.0                                                                                     | 45.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X10  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 10.0                                                                                    | 45.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X12  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 12.0                                                                                    | 45.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X14  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 14.0                                                                                    | 50.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X16  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 16.0                                                                                    | 50.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X18  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 18.0                                                                                    | 54.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X20  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 20.0                                                                                    | 54.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X25  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 25.0                                                                                    | 60.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X30  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 30.0                                                                                    | 70.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X40  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 40.0                                                                                    | 90.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 2,5X50  | 2.5                                                                                          | 2.41                                                                                         | 3.7                                                                                     | 50.0                                                                                    | 100.0                                                                                   | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 3X8     | 3.0                                                                                          | 2.92                                                                                         | 4.5                                                                                     | 8.0                                                                                     | 45.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 3X12    | 3.0                                                                                          | 2.92                                                                                         | 4.5                                                                                     | 12.0                                                                                    | 45.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 3X16    | 3.0                                                                                          | 2.92                                                                                         | 4.5                                                                                     | 16.0                                                                                    | 50.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |
| 3X20    | 3.0                                                                                          | 2.92                                                                                         | 4.5                                                                                     | 20.0                                                                                    | 54.0                                                                                    | 4.0                                                                                          | 2                                                                                       | 30                                                                                       | 16                                                                                       |

|     | Material       | Hardness<br>in HRC | Dimension       | Ø0.2x0.5                                                                            |                                                                                     | Ø0.2x1.5                                                                            |                                                                                     | Ø0.3x1                                                                              |                                                                                     | Ø0.3x9                                                                              |                                                                                     | Ø0.4x2                                                                              |                                                                                     | Ø0.4x12                                                                             |                                                                                     |
|-----|----------------|--------------------|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|     |                |                    | Infeed<br>in mm | ae=1xD<br>ap=0.05xD                                                                 | ae=0.1xD<br>ap=L2 max                                                               | ae=1xD<br>ap=0.04xD                                                                 | ae=0.07xD<br>ap=L2 max                                                              | ae=1xD<br>ap=0.05xD                                                                 | ae=0.1xD<br>ap=L2 max                                                               | ae=1xD<br>ap=0.003xD                                                                | ae=0.006xD<br>ap=L2 max                                                             | ae=1xD<br>ap=0.05xD                                                                 | ae=0.1xD<br>ap=L2 max                                                               | ae=1xD<br>ap=0.003xD                                                                | ae=0.006xD<br>ap=L2 max                                                             |
|     |                |                    | Application     |  |  |  |  |  |  |  |  |  |  |  |  |
|     |                |                    | Feed (mm/Z)     | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H   | HARDENED STEEL |                    | Vc (m/min)      |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1 |                | 46-55              | 110             | 0.005                                                                               | 0.009                                                                               | 0.005                                                                               | 0.009                                                                               | 0.008                                                                               | 0.012                                                                               | 0.003                                                                               | 0.005                                                                               | 0.008                                                                               | 0.012                                                                               | 0.003                                                                               | 0.005                                                                               |
| 1.2 |                | 56-60              | 70              | 0.004                                                                               | 0.008                                                                               | 0.004                                                                               | 0.008                                                                               | 0.007                                                                               | 0.011                                                                               | 0.003                                                                               | 0.005                                                                               | 0.007                                                                               | 0.011                                                                               | 0.003                                                                               | 0.005                                                                               |
| 1.3 |                | 60-65              | 50              | 0.003                                                                               | 0.008                                                                               | 0.003                                                                               | 0.008                                                                               | 0.006                                                                               | 0.01                                                                                | 0.002                                                                               | 0.002                                                                               | 0.006                                                                               | 0.01                                                                                | 0.002                                                                               | 0.002                                                                               |
| 1.4 |                | 66-70              | 40              | 0.002                                                                               | 0.007                                                                               | 0.002                                                                               | 0.007                                                                               | 0.005                                                                               | 0.009                                                                               | 0.001                                                                               | 0.001                                                                               | 0.005                                                                               | 0.009                                                                               | 0.001                                                                               | 0.001                                                                               |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |                                    |                     |             |       |       |       |       |       |       |       |       |       |       |       |       |
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.006 | 0.01  | 0.006 | 0.01  | 0.009 | 0.013 | 0.004 | 0.006 | 0.009 | 0.013 | 0.004 | 0.006 |
| 2.1 | austenitic                         | <650                | 75          | 0.005 | 0.009 | 0.005 | 0.009 | 0.008 | 0.012 | 0.003 | 0.005 | 0.008 | 0.012 | 0.003 | 0.005 |
| 2.2 | austenitic                         | <750                | 70          | 0.004 | 0.008 | 0.004 | 0.008 | 0.007 | 0.011 | 0.002 | 0.003 | 0.007 | 0.011 | 0.002 | 0.003 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.003 | 0.007 | 0.003 | 0.007 | 0.006 | 0.01  | 0.001 | 0.002 | 0.006 | 0.01  | 0.001 | 0.002 |

| N | COPPER                |      | Vc (m/min) |       |      |       |      |       |       |       |       |       |       |       |       |
|---|-----------------------|------|------------|-------|------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700 | 110        | 0.006 | 0.01 | 0.006 | 0.01 | 0.009 | 0.013 | 0.004 | 0.006 | 0.009 | 0.013 | 0.004 | 0.006 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.008 | 0.012 | 0.008 | 0.012 | 0.011 | 0.015 | 0.006 | 0.008 | 0.011 | 0.015 | 0.006 | 0.008 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.008 | 0.012 | 0.008 | 0.012 | 0.011 | 0.015 | 0.006 | 0.008 | 0.011 | 0.015 | 0.006 | 0.008 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.007 | 0.011 | 0.007 | 0.011 | 0.01  | 0.014 | 0.005 | 0.007 | 0.01  | 0.014 | 0.005 | 0.007 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.007 | 0.011 | 0.007 | 0.011 | 0.01  | 0.014 | 0.005 | 0.007 | 0.01  | 0.014 | 0.005 | 0.007 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.006 | 0.01  | 0.006 | 0.01  | 0.009 | 0.013 | 0.004 | 0.006 | 0.009 | 0.013 | 0.004 | 0.006 |
| 3.3     | high-alloyed | <1400 | 130        | 0.005 | 0.009 | 0.005 | 0.009 | 0.008 | 0.012 | 0.003 | 0.005 | 0.008 | 0.012 | 0.003 | 0.005 |

| K       | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000 | 190        | 0.008 | 0.012 | 0.008 | 0.012 | 0.011 | 0.015 | 0.006 | 0.008 | 0.011 | 0.015 | 0.006 | 0.008 |
| 2.1-2.2 | Modular cast iron   | <850  | 180        | 0.007 | 0.011 | 0.007 | 0.011 | 0.01  | 0.014 | 0.005 | 0.007 | 0.01  | 0.014 | 0.005 | 0.007 |
| 3.1-3.2 | Malleable cast iron | <800  | 170        | 0.007 | 0.011 | 0.007 | 0.011 | 0.01  | 0.014 | 0.005 | 0.007 | 0.01  | 0.014 | 0.005 | 0.007 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

| Material | Hardness<br>in HRC | Dimension<br>Infeed<br>in mm<br><br>Application | Ø 0.5x2                                                                           |                               | Ø 0.5x15                                                                          |                                 | Ø 0.6x2                                                                           |                               | Ø 0.6x18                                                                           |                                 | Ø 0.7x2                                                                             |                               | Ø 0.7x10                                                                            |                                |
|----------|--------------------|-------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|--------------------------------|
|          |                    |                                                 | ae=<br>1xD<br>ap=<br>0.05xD                                                       | ae=<br>0.1xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.003xD                                                      | ae=<br>0.006xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.05xD                                                       | ae=<br>0.1xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.003xD                                                       | ae=<br>0.006xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.018xD                                                        | ae=<br>0.05xD<br>ap=<br>L2 max |
|          |                    |                                                 |  |                               |  |                                 |  |                               |  |                                 |  |                               |  |                                |
|          |                    |                                                 | Feed (mm/Z)                                                                       | fz                            | fz                                                                                | fz                              | fz                                                                                | fz                            | fz                                                                                 | fz                              | fz                                                                                  | fz                            | fz                                                                                  | fz                             |
| H        | HARDENED STEEL     | Vc (m/min)                                      |                                                                                   |                               |                                                                                   |                                 |                                                                                   |                               |                                                                                    |                                 |                                                                                     |                               |                                                                                     |                                |
| 1.1      | 46-55              | 110                                             | 0.012                                                                             | 0.015                         | 0.004                                                                             | 0.006                           | 0.012                                                                             | 0.015                         | 0.004                                                                              | 0.006                           | 0.012                                                                               | 0.015                         | 0.008                                                                               | 0.012                          |
| 1.2      | 56-60              | 70                                              | 0.011                                                                             | 0.014                         | 0.004                                                                             | 0.006                           | 0.011                                                                             | 0.014                         | 0.004                                                                              | 0.006                           | 0.011                                                                               | 0.014                         | 0.007                                                                               | 0.011                          |
| 1.3      | 60-65              | 50                                              | 0.01                                                                              | 0.013                         | 0.003                                                                             | 0.005                           | 0.01                                                                              | 0.013                         | 0.003                                                                              | 0.005                           | 0.01                                                                                | 0.013                         | 0.006                                                                               | 0.01                           |
| 1.4      | 66-70              | 40                                              | 0.009                                                                             | 0.012                         | 0.002                                                                             | 0.004                           | 0.009                                                                             | 0.012                         | 0.002                                                                              | 0.004                           | 0.009                                                                               | 0.012                         | 0.005                                                                               | 0.009                          |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.013 | 0.016 | 0.005 | 0.006 | 0.013 | 0.016 | 0.005 | 0.007 | 0.013 | 0.016 | 0.009 | 0.013 |
| 2.1 | austenitic                         | <650                | 75          | 0.012 | 0.015 | 0.004 | 0.005 | 0.012 | 0.015 | 0.004 | 0.006 | 0.012 | 0.015 | 0.008 | 0.012 |
| 2.2 | austenitic                         | <750                | 70          | 0.011 | 0.014 | 0.003 | 0.004 | 0.011 | 0.014 | 0.003 | 0.005 | 0.011 | 0.014 | 0.007 | 0.011 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.01  | 0.013 | 0.002 | 0.003 | 0.01  | 0.013 | 0.002 | 0.004 | 0.01  | 0.013 | 0.006 | 0.01  |

| N | COPPER                     | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|----------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 | 110        | 0.013 | 0.016 | 0.005 | 0.006 | 0.013 | 0.016 | 0.005 | 0.007 | 0.013 | 0.016 | 0.009 | 0.013 |

| P       | STEEL        | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500       | 190 | 0.015 | 0.02  | 0.007 | 0.009 | 0.015 | 0.02  | 0.007 | 0.009 | 0.015 | 0.02  | 0.011 | 0.017 |
| 1.2-1.5 | unalloyed    | <1100      | 180 | 0.015 | 0.02  | 0.007 | 0.009 | 0.015 | 0.02  | 0.007 | 0.009 | 0.015 | 0.02  | 0.011 | 0.017 |
| 2.1-2.2 | low-alloyed  | <950       | 170 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.01  | 0.015 |
| 2.3-2.4 | low-alloyed  | <1300      | 150 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.01  | 0.015 |
| 3.1-3.2 | high-alloyed | <1100      | 150 | 0.013 | 0.016 | 0.005 | 0.007 | 0.013 | 0.016 | 0.005 | 0.007 | 0.013 | 0.016 | 0.009 | 0.013 |
| 3.3     | high-alloyed | <1400      | 130 | 0.012 | 0.015 | 0.004 | 0.006 | 0.012 | 0.015 | 0.004 | 0.006 | 0.012 | 0.015 | 0.008 | 0.012 |

| K       | CASTINGS            | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|---------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000      | 190 | 0.015 | 0.02  | 0.007 | 0.009 | 0.015 | 0.02  | 0.007 | 0.009 | 0.015 | 0.02  | 0.011 | 0.017 |
| 2.1-2.2 | Modular cast iron   | <850       | 180 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.01  | 0.015 |
| 3.1-3.2 | Malleable cast iron | <800       | 170 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.006 | 0.008 | 0.014 | 0.018 | 0.01  | 0.015 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

| Material | Hardness<br>in HRC | Dimension<br>Infeed<br>in mm<br><br>Application | Ø0.8x4                                                                              |                               | Ø0.8x24                                                                             |                                 | Ø0.9x4                                                                              |                               | Ø0.9x15                                                                             |                                 |
|----------|--------------------|-------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|---------------------------------|
|          |                    |                                                 | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.003xD                                                        | ae=<br>0.006xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max | ae=<br>1xD<br>ap=<br>0.008xD                                                        | ae=<br>0.015xD<br>ap=<br>L2 max |
|          |                    |                                                 |  |                               |  |                                 |  |                               |  |                                 |
|          |                    |                                                 | Feed (mm/Z)                                                                         | fz                            | fz                                                                                  | fz                              | fz                                                                                  | fz                            | fz                                                                                  | fz                              |
| H        | HARDENED STEEL     | Vc (m/min)                                      |                                                                                     |                               |                                                                                     |                                 |                                                                                     |                               |                                                                                     |                                 |
| 1.1      | 46-55              | 110                                             | 0.014                                                                               | 0.017                         | 0.006                                                                               | 0.01                            | 0.014                                                                               | 0.017                         | 0.01                                                                                | 0.012                           |
| 1.2      | 56-60              | 70                                              | 0.013                                                                               | 0.016                         | 0.005                                                                               | 0.009                           | 0.013                                                                               | 0.016                         | 0.009                                                                               | 0.011                           |
| 1.3      | 60-65              | 50                                              | 0.012                                                                               | 0.015                         | 0.004                                                                               | 0.008                           | 0.012                                                                               | 0.015                         | 0.008                                                                               | 0.01                            |
| 1.4      | 66-70              | 40                                              | 0.011                                                                               | 0.014                         | 0.003                                                                               | 0.007                           | 0.011                                                                               | 0.014                         | 0.007                                                                               | 0.009                           |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | f <sub>z</sub> | f <sub>z</sub> | f <sub>z</sub> | f <sub>z</sub> | f <sub>z</sub> | f <sub>z</sub> | f <sub>z</sub> | f <sub>z</sub> |
|-----|------------------------------------|---------------------|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |                |                |                |                |                |                |                |                |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.015          | 0.018          | 0.007          | 0.011          | 0.015          | 0.018          | 0.011          | 0.013          |
| 2.1 | austenitic                         | <650                | 75          | 0.014          | 0.017          | 0.006          | 0.01           | 0.014          | 0.017          | 0.01           | 0.012          |
| 2.2 | austenitic                         | <750                | 70          | 0.013          | 0.016          | 0.005          | 0.009          | 0.013          | 0.016          | 0.009          | 0.011          |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.012          | 0.015          | 0.004          | 0.008          | 0.012          | 0.015          | 0.008          | 0.01           |

| N | COPPER                     | Vc (m/min) |       |       |       |       |       |       |       |       |
|---|----------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 | 110        | 0.015 | 0.018 | 0.007 | 0.011 | 0.015 | 0.018 | 0.011 | 0.013 |

| P       | STEEL        | Vc (m/min) |     |       |       |       |       |       |       |       |       |
|---------|--------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500       | 190 | 0.017 | 0.022 | 0.009 | 0.014 | 0.017 | 0.022 | 0.013 | 0.016 |
| 1.2-1.5 | unalloyed    | <1100      | 180 | 0.017 | 0.022 | 0.009 | 0.014 | 0.017 | 0.022 | 0.013 | 0.016 |
| 2.1-2.2 | low-alloyed  | <950       | 170 | 0.016 | 0.02  | 0.008 | 0.013 | 0.016 | 0.02  | 0.012 | 0.015 |
| 2.3-2.4 | low-alloyed  | <1300      | 150 | 0.016 | 0.02  | 0.008 | 0.013 | 0.016 | 0.02  | 0.012 | 0.015 |
| 3.1-3.2 | high-alloyed | <1100      | 150 | 0.015 | 0.018 | 0.007 | 0.011 | 0.015 | 0.018 | 0.011 | 0.013 |
| 3.3     | high-alloyed | <1400      | 130 | 0.014 | 0.017 | 0.006 | 0.01  | 0.014 | 0.017 | 0.01  | 0.012 |

| K       | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |
|---------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000 | 190        | 0.017 | 0.022 | 0.009 | 0.014 | 0.017 | 0.022 | 0.013 | 0.016 |
| 2.1-2.2 | Modular cast iron   | <850  | 180        | 0.016 | 0.02  | 0.008 | 0.013 | 0.016 | 0.02  | 0.012 | 0.015 |
| 3.1-3.2 | Malleable cast iron | <800  | 170        | 0.016 | 0.02  | 0.008 | 0.013 | 0.016 | 0.02  | 0.012 | 0.015 |

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Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

| Material | Hardness<br>in HRC | Dimension<br><br>Infeed<br>in mm<br><br>Application | Ø1x4                                                                              |                                                                                   | Ø1x30                                                                             |                                                                                   | Ø1.2x6                                                                            |                                                                                   | Ø1.2x20                                                                            |                                                                                     | Ø1.4x6                                                                              |                                                                                     | Ø1.4x22                                                                             |                                                                                     |
|----------|--------------------|-----------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                    |                                                     | ae=<br>1xD<br>ap=<br>0.05xD                                                       | ae=<br>0.1xD<br>ap=<br>L2 max                                                     | ae=<br>1xD<br>ap=<br>0.003xD                                                      | ae=<br>0.006xD<br>ap=<br>L2 max                                                   | ae=<br>1xD<br>ap=<br>0.05xD                                                       | ae=<br>0.1xD<br>ap=<br>L2 max                                                     | ae=<br>1xD<br>ap=<br>0.008xD                                                       | ae=<br>0.015xD<br>ap=<br>L2 max                                                     | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>1xD<br>ap=<br>0.008xD                                                        | ae=<br>0.015xD<br>ap=<br>L2 max                                                     |
|          |                    |                                                     |  |  |  |  |  |  |  |  |  |  |  |  |
|          |                    |                                                     | Feed (mm/Z)                                                                       | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL     | Vc (m/min)                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55              | 110                                                 | 0.015                                                                             | 0.02                                                                              | 0.006                                                                             | 0.01                                                                              | 0.015                                                                             | 0.02                                                                              | 0.01                                                                               | 0.015                                                                               | 0.017                                                                               | 0.022                                                                               | 0.012                                                                               | 0.017                                                                               |
| 1.2      | 56-60              | 70                                                  | 0.014                                                                             | 0.019                                                                             | 0.005                                                                             | 0.009                                                                             | 0.014                                                                             | 0.019                                                                             | 0.009                                                                              | 0.014                                                                               | 0.016                                                                               | 0.021                                                                               | 0.011                                                                               | 0.016                                                                               |
| 1.3      | 60-65              | 50                                                  | 0.012                                                                             | 0.017                                                                             | 0.004                                                                             | 0.008                                                                             | 0.012                                                                             | 0.017                                                                             | 0.007                                                                              | 0.012                                                                               | 0.014                                                                               | 0.019                                                                               | 0.009                                                                               | 0.014                                                                               |
| 1.4      | 66-70              | 40                                                  | 0.011                                                                             | 0.016                                                                             | 0.003                                                                             | 0.007                                                                             | 0.011                                                                             | 0.016                                                                             | 0.006                                                                              | 0.011                                                                               | 0.012                                                                               | 0.018                                                                               | 0.008                                                                               | 0.013                                                                               |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.016 | 0.021 | 0.007 | 0.011 | 0.016 | 0.021 | 0.011 | 0.016 | 0.018 | 0.023 | 0.013 | 0.018 |
| 2.1 | austenitic                         | <650                | 75          | 0.015 | 0.02  | 0.006 | 0.01  | 0.015 | 0.02  | 0.01  | 0.015 | 0.017 | 0.022 | 0.012 | 0.017 |
| 2.2 | austenitic                         | <750                | 70          | 0.013 | 0.018 | 0.005 | 0.009 | 0.013 | 0.018 | 0.008 | 0.013 | 0.015 | 0.02  | 0.01  | 0.015 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.012 | 0.017 | 0.004 | 0.008 | 0.012 | 0.017 | 0.007 | 0.012 | 0.014 | 0.019 | 0.009 | 0.014 |

| N | COPPER                     | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|----------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 | 110        | 0.016 | 0.021 | 0.007 | 0.011 | 0.016 | 0.021 | 0.011 | 0.016 | 0.018 | 0.023 | 0.013 | 0.018 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.018 | 0.025 | 0.009 | 0.013 | 0.019 | 0.025 | 0.013 | 0.018 | 0.021 | 0.027 | 0.015 | 0.021 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.018 | 0.025 | 0.009 | 0.013 | 0.019 | 0.025 | 0.013 | 0.018 | 0.021 | 0.027 | 0.015 | 0.021 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.017 | 0.023 | 0.008 | 0.012 | 0.018 | 0.023 | 0.012 | 0.017 | 0.02  | 0.025 | 0.014 | 0.02  |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.017 | 0.023 | 0.008 | 0.012 | 0.018 | 0.023 | 0.012 | 0.017 | 0.02  | 0.025 | 0.014 | 0.02  |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.016 | 0.021 | 0.007 | 0.011 | 0.016 | 0.021 | 0.011 | 0.016 | 0.018 | 0.023 | 0.013 | 0.018 |
| 3.3     | high-alloyed | <1400 | 130        | 0.015 | 0.02  | 0.006 | 0.01  | 0.015 | 0.02  | 0.01  | 0.015 | 0.017 | 0.022 | 0.012 | 0.017 |

| K       | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000 | 190        | 0.018 | 0.025 | 0.009 | 0.013 | 0.019 | 0.025 | 0.013 | 0.018 | 0.021 | 0.027 | 0.015 | 0.021 |
| 2.1-2.2 | Modular cast iron   | <850  | 180        | 0.017 | 0.023 | 0.008 | 0.012 | 0.018 | 0.023 | 0.012 | 0.017 | 0.02  | 0.025 | 0.014 | 0.02  |
| 3.1-3.2 | Malleable cast iron | <800  | 170        | 0.017 | 0.023 | 0.008 | 0.012 | 0.018 | 0.023 | 0.012 | 0.017 | 0.02  | 0.025 | 0.014 | 0.02  |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

| Material | Hardness<br>in HRC | Dimension<br><br>Infeed<br>in mm<br><br>Application | Ø1.5x6                                                                              |                                                                                     | Ø1.5x45                                                                             |                                                                                     | Ø1.6x6                                                                              |                                                                                     | Ø1.6x26                                                                             |                                                                                     | Ø1.8x6                                                                              |                                                                                     | Ø1.8x25                                                                             |                                                                                     |
|----------|--------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                    |                                                     | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>1xD<br>ap=<br>0.003xD                                                        | ae=<br>0.006xD<br>ap=<br>L2 max                                                     | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>1xD<br>ap=<br>0.01xD                                                         | ae=<br>0.02xD<br>ap=<br>L2 max                                                      | ae=<br>1xD<br>ap=<br>0.05xD                                                         | ae=<br>0.1xD<br>ap=<br>L2 max                                                       | ae=<br>1xD<br>ap=<br>0.018xD                                                        | ae=<br>0.035xD<br>ap=<br>L2 max                                                     |
|          |                    |                                                     |  |  |  |  |  |  |  |  |  |  |  |  |
|          |                    |                                                     | Feed (mm/Z)                                                                         | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL     | Vc (m/min)                                          |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55              | 110                                                 | 0.02                                                                                | 0.025                                                                               | 0.011                                                                               | 0.016                                                                               | 0.025                                                                               | 0.03                                                                                | 0.018                                                                               | 0.023                                                                               | 0.025                                                                               | 0.03                                                                                | 0.018                                                                               | 0.023                                                                               |
| 1.2      | 56-60              | 70                                                  | 0.019                                                                               | 0.024                                                                               | 0.01                                                                                | 0.015                                                                               | 0.023                                                                               | 0.028                                                                               | 0.016                                                                               | 0.021                                                                               | 0.023                                                                               | 0.028                                                                               | 0.016                                                                               | 0.021                                                                               |
| 1.3      | 60-65              | 50                                                  | 0.017                                                                               | 0.022                                                                               | 0.008                                                                               | 0.013                                                                               | 0.021                                                                               | 0.026                                                                               | 0.014                                                                               | 0.019                                                                               | 0.021                                                                               | 0.026                                                                               | 0.014                                                                               | 0.019                                                                               |
| 1.4      | 66-70              | 40                                                  | 0.016                                                                               | 0.021                                                                               | 0.007                                                                               | 0.012                                                                               | 0.019                                                                               | 0.025                                                                               | 0.012                                                                               | 0.017                                                                               | 0.019                                                                               | 0.025                                                                               | 0.012                                                                               | 0.017                                                                               |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.021 | 0.026 | 0.012 | 0.017 | 0.026 | 0.031 | 0.019 | 0.024 | 0.026 | 0.031 | 0.019 | 0.024 |
| 2.1 | austenitic                         | <650                | 75          | 0.02  | 0.025 | 0.011 | 0.016 | 0.024 | 0.029 | 0.017 | 0.022 | 0.024 | 0.029 | 0.017 | 0.022 |
| 2.2 | austenitic                         | <750                | 70          | 0.018 | 0.023 | 0.009 | 0.014 | 0.022 | 0.027 | 0.015 | 0.02  | 0.022 | 0.027 | 0.015 | 0.02  |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.017 | 0.022 | 0.008 | 0.013 | 0.02  | 0.026 | 0.013 | 0.018 | 0.02  | 0.025 | 0.013 | 0.018 |

| N | COPPER                     | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|----------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 | 110        | 0.021 | 0.026 | 0.012 | 0.017 | 0.026 | 0.031 | 0.019 | 0.024 | 0.026 | 0.031 | 0.019 | 0.024 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.025 | 0.03  | 0.014 | 0.019 | 0.03  | 0.037 | 0.021 | 0.027 | 0.03  | 0.037 | 0.022 | 0.028 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.025 | 0.03  | 0.014 | 0.019 | 0.03  | 0.037 | 0.021 | 0.027 | 0.03  | 0.037 | 0.022 | 0.028 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.023 | 0.028 | 0.013 | 0.018 | 0.028 | 0.035 | 0.02  | 0.026 | 0.028 | 0.035 | 0.02  | 0.026 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.023 | 0.028 | 0.013 | 0.018 | 0.028 | 0.035 | 0.02  | 0.026 | 0.028 | 0.035 | 0.02  | 0.026 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.021 | 0.026 | 0.12  | 0.017 | 0.026 | 0.032 | 0.019 | 0.024 | 0.026 | 0.032 | 0.019 | 0.024 |
| 3.3     | high-alloyed | <1400 | 130        | 0.02  | 0.025 | 0.011 | 0.016 | 0.025 | 0.03  | 0.018 | 0.023 | 0.025 | 0.03  | 0.018 | 0.023 |

| K       | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000 | 190        | 0.025 | 0.03  | 0.014 | 0.019 | 0.03  | 0.037 | 0.021 | 0.027 | 0.03  | 0.037 | 0.022 | 0.028 |
| 2.1-2.2 | Modular cast iron   | <850  | 180        | 0.023 | 0.028 | 0.013 | 0.018 | 0.028 | 0.035 | 0.02  | 0.026 | 0.028 | 0.035 | 0.02  | 0.026 |
| 3.1-3.2 | Malleable cast iron | <800  | 170        | 0.023 | 0.028 | 0.013 | 0.018 | 0.028 | 0.035 | 0.02  | 0.026 | 0.028 | 0.035 | 0.02  | 0.026 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.



|                                                                                                                                                                                                                                 |                                 | Dimension        | Ø2x6                                                                              |                                                                                   | Ø2x60                                                                             |                                                                                   | Ø2.5x8                                                                            |                                                                                   | Ø2.5x50                                                                            |                                                                                     | Ø3x8                                                                                |                                                                                     | Ø3x20                                                                               |                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                 |                                 | Infeed in mm     | ae=1xD<br>ap=0.05xD                                                               | ae=0.1xD<br>ap=L2 max                                                             | ae=1xD<br>ap=0.006xD<br>ap=L2 max                                                 | ae=0.006xD<br>ap=L2 max                                                           | ae=1xD<br>ap=0.05xD<br>ap=L2 max                                                  | ae=0.1xD<br>ap=L2 max                                                             | ae=1xD<br>ap=0.004xD<br>ap=L2 max                                                  | ae=0.01xD<br>ap=L2 max                                                              | ae=1xD<br>ap=0.05xD<br>ap=L2 max                                                    | ae=0.1xD<br>ap=L2 max                                                               | ae=1xD<br>ap=0.04xD<br>ap=L2 max                                                    | ae=0.07xD<br>ap=L2 max                                                              |
|                                                                                                                                                                                                                                 |                                 | Application      |  |  |  |  |  |  |  |  |  |  |  |  |
| Material                                                                                                                                                                                                                        | Hardness in HRC                 | Feed (mm/Z)      | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H HARDENED STEEL                                                                                                                                                                                                                |                                 | Vc (m/min)       |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1                                                                                                                                                                                                                             | 46-55                           | 110              | 0.025                                                                             | 0.03                                                                              | 0.015                                                                             | 0.025                                                                             | 0.027                                                                             | 0.032                                                                             | 0.015                                                                              | 0.025                                                                               | 0.027                                                                               | 0.032                                                                               | 0.025                                                                               | 0.03                                                                                |
| 1.2                                                                                                                                                                                                                             | 56-60                           | 70               | 0.023                                                                             | 0.028                                                                             | 0.013                                                                             | 0.023                                                                             | 0.025                                                                             | 0.03                                                                              | 0.013                                                                              | 0.023                                                                               | 0.025                                                                               | 0.03                                                                                | 0.023                                                                               | 0.028                                                                               |
| 1.3                                                                                                                                                                                                                             | 60-65                           | 50               | 0.021                                                                             | 0.026                                                                             | 0.011                                                                             | 0.021                                                                             | 0.023                                                                             | 0.028                                                                             | 0.011                                                                              | 0.021                                                                               | 0.023                                                                               | 0.028                                                                               | 0.021                                                                               | 0.026                                                                               |
| 1.4                                                                                                                                                                                                                             | 66-70                           | 40               | 0.019                                                                             | 0.025                                                                             | 0.009                                                                             | 0.019                                                                             | 0.021                                                                             | 0.026                                                                             | 0.009                                                                              | 0.019                                                                               | 0.021                                                                               | 0.026                                                                               | 0.019                                                                               | 0.024                                                                               |
| M STAINLESS STEEL                                                                                                                                                                                                               |                                 | Strength (N/mm²) | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| 1.1                                                                                                                                                                                                                             | ferritic/martensitic            | <850             | 0.026                                                                             | 0.031                                                                             | 0.016                                                                             | 0.026                                                                             | 0.028                                                                             | 0.033                                                                             | 0.016                                                                              | 0.026                                                                               | 0.028                                                                               | 0.033                                                                               | 0.026                                                                               | 0.032                                                                               |
| 2.1                                                                                                                                                                                                                             | austenitic                      | <650             | 0.024                                                                             | 0.029                                                                             | 0.014                                                                             | 0.024                                                                             | 0.026                                                                             | 0.031                                                                             | 0.014                                                                              | 0.024                                                                               | 0.026                                                                               | 0.031                                                                               | 0.024                                                                               | 0.03                                                                                |
| 2.2                                                                                                                                                                                                                             | austenitic                      | <750             | 0.022                                                                             | 0.027                                                                             | 0.012                                                                             | 0.022                                                                             | 0.024                                                                             | 0.029                                                                             | 0.012                                                                              | 0.022                                                                               | 0.024                                                                               | 0.029                                                                               | 0.022                                                                               | 0.028                                                                               |
| 3.1                                                                                                                                                                                                                             | DUPLEX STEEL   super austenitic | <1100            | 0.02                                                                              | 0.025                                                                             | 0.01                                                                              | 0.02                                                                              | 0.02                                                                              | 0.027                                                                             | 0.01                                                                               | 0.02                                                                                | 0.022                                                                               | 0.027                                                                               | 0.02                                                                                | 0.026                                                                               |
| N COPPER                                                                                                                                                                                                                        |                                 | Vc (m/min)       |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|                                                                                                                                                                                                                                 | Tungsten Copper (WCu) <700      | 110              | 0.026                                                                             | 0.031                                                                             | 0.016                                                                             | 0.026                                                                             | 0.028                                                                             | 0.033                                                                             | 0.016                                                                              | 0.026                                                                               | 0.028                                                                               | 0.033                                                                               | 0.026                                                                               | 0.032                                                                               |
| P STEEL                                                                                                                                                                                                                         |                                 | Vc (m/min)       |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1                                                                                                                                                                                                                             | unalloyed                       | <500             | 0.03                                                                              | 0.037                                                                             | 0.018                                                                             | 0.028                                                                             | 0.032                                                                             | 0.039                                                                             | 0.018                                                                              | 0.03                                                                                | 0.032                                                                               | 0.04                                                                                | 0.03                                                                                | 0.037                                                                               |
| 1.2-1.5                                                                                                                                                                                                                         | unalloyed                       | <1100            | 0.03                                                                              | 0.037                                                                             | 0.018                                                                             | 0.028                                                                             | 0.032                                                                             | 0.039                                                                             | 0.018                                                                              | 0.03                                                                                | 0.032                                                                               | 0.04                                                                                | 0.03                                                                                | 0.037                                                                               |
| 2.1-2.2                                                                                                                                                                                                                         | low-alloyed                     | <950             | 0.028                                                                             | 0.035                                                                             | 0.017                                                                             | 0.027                                                                             | 0.03                                                                              | 0.037                                                                             | 0.017                                                                              | 0.028                                                                               | 0.03                                                                                | 0.037                                                                               | 0.028                                                                               | 0.035                                                                               |
| 2.3-2.4                                                                                                                                                                                                                         | low-alloyed                     | <1300            | 0.028                                                                             | 0.035                                                                             | 0.017                                                                             | 0.027                                                                             | 0.03                                                                              | 0.037                                                                             | 0.017                                                                              | 0.028                                                                               | 0.03                                                                                | 0.037                                                                               | 0.028                                                                               | 0.035                                                                               |
| 3.1-3.2                                                                                                                                                                                                                         | high-alloyed                    | <1100            | 0.026                                                                             | 0.032                                                                             | 0.016                                                                             | 0.026                                                                             | 0.028                                                                             | 0.034                                                                             | 0.016                                                                              | 0.026                                                                               | 0.028                                                                               | 0.034                                                                               | 0.026                                                                               | 0.032                                                                               |
| 3.3                                                                                                                                                                                                                             | high-alloyed                    | <1400            | 0.025                                                                             | 0.03                                                                              | 0.015                                                                             | 0.025                                                                             | 0.027                                                                             | 0.032                                                                             | 0.015                                                                              | 0.025                                                                               | 0.027                                                                               | 0.032                                                                               | 0.025                                                                               | 0.03                                                                                |
| K CASTINGS                                                                                                                                                                                                                      |                                 | Vc (m/min)       |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1-1.2                                                                                                                                                                                                                         | Grey cast iron                  | <1000            | 0.03                                                                              | 0.037                                                                             | 0.018                                                                             | 0.028                                                                             | 0.032                                                                             | 0.039                                                                             | 0.018                                                                              | 0.03                                                                                | 0.032                                                                               | 0.04                                                                                | 0.03                                                                                | 0.037                                                                               |
| 2.1-2.2                                                                                                                                                                                                                         | Modular cast iron               | <850             | 0.028                                                                             | 0.035                                                                             | 0.017                                                                             | 0.027                                                                             | 0.03                                                                              | 0.037                                                                             | 0.017                                                                              | 0.028                                                                               | 0.03                                                                                | 0.037                                                                               | 0.028                                                                               | 0.035                                                                               |
| 3.1-3.2                                                                                                                                                                                                                         | Malleable cast iron             | <800             | 0.028                                                                             | 0.035                                                                             | 0.017                                                                             | 0.027                                                                             | 0.03                                                                              | 0.037                                                                             | 0.017                                                                              | 0.028                                                                               | 0.03                                                                                | 0.037                                                                               | 0.028                                                                               | 0.035                                                                               |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values. |                                 |                  |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

DO YOU HAVE BLUNT MILLING CUTTERS THAT URGENTLY NEED REGRINDING?



➔ DISCOVER OUR H&V REGRINDING SERVICE

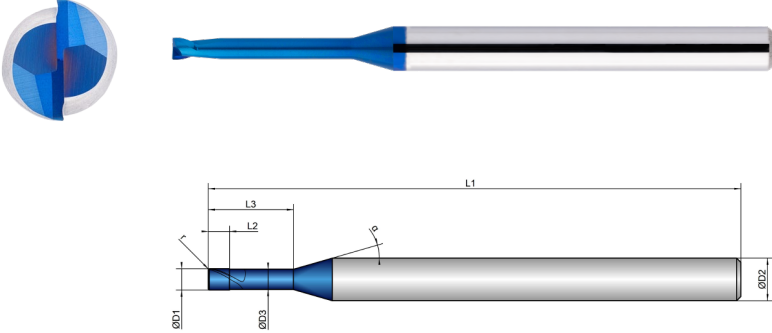
... and have your tools reconditioned to their original state!

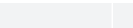
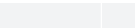
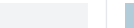


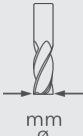
|           |                                                                                                                                                                                                                                                                                                                                         |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling   |     |
| Tolerance | d04                                                                                                                                                                                                                                                                                                                                     |
| Coating   | AlphaDura Navy                                                                                                                                                                                                                                                                                                                          |

|             |                                                                                              |                                                                                              |                                                                                                |                                                                                                |                                                                                                |  |  |                                                                                                                  |
|-------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--|--|------------------------------------------------------------------------------------------------------------------|
| Strategy    | <div>HSC</div>                                                                               | <div>HPC</div>                                                                               |                                                                                                |                                                                                                |                                                                                                |  |  | <div></div> <div>Expert</div> |
| Application | <div></div> | <div></div> | <div></div> | <div></div> | <div></div> |  |  |                                                                                                                  |
| Features    | <div>HA</div>                                                                                | <div></div> | <div></div> |                                                                                                |                                                                                                |  |  |                                                                                                                  |

- Ultrafine carbide grade developed for machining hardened steels
  - Optimized face geometry for long tool life and highest dimensional accuracy
  - Reinforced core for milling up to 70 HRC
- 
- Multipass milling of 3D contours
- 
- Tolerance D1: -0.001/-0.006 mm
  - Tolerance D3: 0/-0.02 mm
  - Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



| Roughing                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   | Finishing                                                                         |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |  |
| inappropriate                                                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   | inappropriate                                                                     |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| optimal                                                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   | optimal                                                                           |                                                                                    |                                                                                     |                                                                                     |                                                                                     |

| K202082 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 0,4X1   | 0.4                                                                                                  | 0.38                                                                                                 | 0.4                                                                                             | 1.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,4X1,5 | 0.4                                                                                                  | 0.38                                                                                                 | 0.4                                                                                             | 1.5                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,4X2   | 0.4                                                                                                  | 0.38                                                                                                 | 0.4                                                                                             | 2.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,4X3   | 0.4                                                                                                  | 0.38                                                                                                 | 0.4                                                                                             | 3.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,4X4   | 0.4                                                                                                  | 0.38                                                                                                 | 0.4                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,5X1   | 0.5                                                                                                  | 0.48                                                                                                 | 0.5                                                                                             | 1.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,5X2   | 0.5                                                                                                  | 0.48                                                                                                 | 0.5                                                                                             | 2.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,5X3   | 0.5                                                                                                  | 0.48                                                                                                 | 0.5                                                                                             | 3.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,5X4   | 0.5                                                                                                  | 0.48                                                                                                 | 0.5                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,5X5   | 0.5                                                                                                  | 0.48                                                                                                 | 0.5                                                                                             | 5.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,5X6   | 0.5                                                                                                  | 0.48                                                                                                 | 0.5                                                                                             | 6.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |
| 0,6X2   | 0.6                                                                                                  | 0.58                                                                                                 | 0.6                                                                                             | 2.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                              | 0.10                                                                                             | 30                                                                                         | 16                                                                                              |

| K202082 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 0,6X3   | 0.6                                                                                                  | 0.58                                                                                                 | 0.6                                                                                             | 3.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X4   | 0.6                                                                                                  | 0.58                                                                                                 | 0.6                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X6   | 0.6                                                                                                  | 0.58                                                                                                 | 0.6                                                                                             | 6.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X8   | 0.6                                                                                                  | 0.58                                                                                                 | 0.6                                                                                             | 8.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,7X4   | 0.7                                                                                                  | 0.68                                                                                                 | 0.7                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,7X6   | 0.7                                                                                                  | 0.68                                                                                                 | 0.7                                                                                             | 6.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X4   | 0.8                                                                                                  | 0.78                                                                                                 | 0.8                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X6   | 0.8                                                                                                  | 0.78                                                                                                 | 0.8                                                                                             | 6.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X2     | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 2.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X4     | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X6     | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 6.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X8     | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 8.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X10    | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X12    | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 12.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X16    | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 16.0                                                                                            | 60.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X20    | 1.0                                                                                                  | 0.95                                                                                                 | 1.0                                                                                             | 20.0                                                                                            | 60.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X4     | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 4.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X6     | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 6.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X8     | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 8.0                                                                                             | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X10    | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 10.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X12    | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 12.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X16    | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 16.0                                                                                            | 54.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X20    | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 20.0                                                                                            | 60.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X26    | 2.0                                                                                                  | 1.91                                                                                                 | 2.0                                                                                             | 26.0                                                                                            | 70.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.10                                                                                           | 30                                                                                       | 16                                                                                            |

|     | Material       | Hardness<br>in HRC | Dimension       |             |       | Ø0.4x1 |       |       | Ø0.4x4 |       |       | Ø0.5x1 |       |       | Ø0.5x6 |    |    |
|-----|----------------|--------------------|-----------------|-------------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|--------|----|----|
|     |                |                    | Infeed<br>in mm | Feed (mm/Z) | fz    | fz     | fz    | fz    | fz     | fz    | fz    | fz     | fz    | fz    | fz     | fz | fz |
|     |                |                    |                 |             |       |        |       |       |        |       |       |        |       |       |        |    |    |
|     |                |                    |                 |             |       |        |       |       |        |       |       |        |       |       |        |    |    |
| H   | HARDENED STEEL |                    | Vc (m/min)      |             |       |        |       |       |        |       |       |        |       |       |        |    |    |
| 1.1 |                | 46-55              | 110             | 0.008       | 0.012 | 0.014  | 0.004 | 0.009 | 0.011  | 0.012 | 0.015 | 0.017  | 0.009 | 0.012 | 0.014  |    |    |
| 1.2 |                | 56-60              | 70              | 0.007       | 0.011 | 0.013  | 0.004 | 0.008 | 0.01   | 0.011 | 0.014 | 0.016  | 0.008 | 0.011 | 0.013  |    |    |
| 1.3 |                | 60-65              | 50              | 0.006       | 0.01  | 0.012  | 0.003 | 0.007 | 0.009  | 0.01  | 0.013 | 0.015  | 0.007 | 0.01  | 0.012  |    |    |
| 1.4 |                | 66-70              | 40              | 0.005       | 0.009 | 0.011  | 0.002 | 0.006 | 0.008  | 0.009 | 0.012 | 0.014  | 0.006 | 0.009 | 0.011  |    |    |

|     | Material                        | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|---------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |                                 |                     |             |       |       |       |       |       |       |       |       |       |       |       |
| M   | STAINLESS STEEL                 |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic            | <850                | 90          | 0.009 | 0.013 | 0.015 | 0.005 | 0.01  | 0.012 | 0.013 | 0.016 | 0.018 | 0.01  | 0.013 |
| 2.1 | austenitic                      | <650                | 75          | 0.008 | 0.012 | 0.014 | 0.004 | 0.009 | 0.011 | 0.012 | 0.015 | 0.017 | 0.009 | 0.012 |
| 2.2 | austenitic                      | <750                | 70          | 0.007 | 0.011 | 0.013 | 0.003 | 0.008 | 0.01  | 0.011 | 0.014 | 0.016 | 0.008 | 0.011 |
| 3.1 | DUPLEX STEEL   super austenitic | <1100               | 50          | 0.006 | 0.01  | 0.012 | 0.002 | 0.007 | 0.009 | 0.01  | 0.013 | 0.015 | 0.007 | 0.01  |

|   |                            |     |            |       |       |       |      |       |       |       |       |      |       |       |
|---|----------------------------|-----|------------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|-------|
| N | COPPER                     |     | Vc (m/min) |       |       |       |      |       |       |       |       |      |       |       |
|   | Tungsten Copper (WCu) <700 | 110 | 0.009      | 0.013 | 0.015 | 0.005 | 0.01 | 0.012 | 0.013 | 0.016 | 0.018 | 0.01 | 0.013 | 0.015 |

|         |              |       |            |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |
| 1.1     | unalloyed    | <500  | 190        | 0.011 | 0.015 | 0.017 | 0.007 | 0.012 | 0.014 | 0.015 | 0.02  | 0.022 | 0.012 | 0.017 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.011 | 0.015 | 0.017 | 0.007 | 0.012 | 0.014 | 0.015 | 0.02  | 0.022 | 0.012 | 0.017 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.01  | 0.014 | 0.016 | 0.006 | 0.011 | 0.013 | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.01  | 0.014 | 0.016 | 0.006 | 0.011 | 0.013 | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.009 | 0.013 | 0.015 | 0.005 | 0.01  | 0.012 | 0.013 | 0.016 | 0.018 | 0.01  | 0.013 |
| 3.3     | high-alloyed | <1400 | 130        | 0.008 | 0.012 | 0.014 | 0.004 | 0.009 | 0.011 | 0.012 | 0.015 | 0.017 | 0.009 | 0.012 |

|                                                                                                                                                                                                                                                                                                                                                     |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| K                                                                                                                                                                                                                                                                                                                                                   | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                             | Grey cast iron      | <1000 | 190        | 0.011 | 0.015 | 0.017 | 0.007 | 0.012 | 0.014 | 0.015 | 0.02  | 0.022 | 0.012 | 0.017 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                             | Modular cast iron   | <850  | 180        | 0.01  | 0.014 | 0.016 | 0.006 | 0.011 | 0.013 | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                             | Malleable cast iron | <800  | 170        | 0.01  | 0.014 | 0.015 | 0.006 | 0.011 | 0.013 | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max)= 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |

|     | Material       | Hardness<br>in HRC | Dimension       |             |       | Ø0.6x2 |       |       | Ø0.6x8 |       |       | Ø0.7x6 |       |       | Ø0.8x6 |    |    |
|-----|----------------|--------------------|-----------------|-------------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|--------|----|----|
|     |                |                    | Infeed<br>in mm | Feed (mm/Z) | fz    | fz     | fz    | fz    | fz     | fz    | fz    | fz     | fz    | fz    | fz     | fz | fz |
|     |                |                    |                 |             |       |        |       |       |        |       |       |        |       |       |        |    |    |
|     |                |                    |                 |             |       |        |       |       |        |       |       |        |       |       |        |    |    |
| H   | HARDENED STEEL |                    | Vc (m/min)      |             |       |        |       |       |        |       |       |        |       |       |        |    |    |
| 1.1 |                | 46-55              | 110             | 0.012       | 0.015 | 0.017  | 0.009 | 0.012 | 0.014  | 0.012 | 0.015 | 0.017  | 0.014 | 0.017 | 0.019  |    |    |
| 1.2 |                | 56-60              | 70              | 0.011       | 0.014 | 0.016  | 0.008 | 0.011 | 0.013  | 0.011 | 0.014 | 0.016  | 0.013 | 0.016 | 0.018  |    |    |
| 1.3 |                | 60-65              | 50              | 0.01        | 0.013 | 0.015  | 0.007 | 0.01  | 0.012  | 0.01  | 0.013 | 0.015  | 0.012 | 0.015 | 0.017  |    |    |
| 1.4 |                | 66-70              | 40              | 0.009       | 0.012 | 0.014  | 0.006 | 0.009 | 0.011  | 0.009 | 0.012 | 0.014  | 0.011 | 0.014 | 0.016  |    |    |

|     | Material                        | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|---------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |                                 |                     |             |       |       |       |       |       |       |       |       |       |       |       |
| M   | STAINLESS STEEL                 |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic            | <850                | 90          | 0.013 | 0.016 | 0.018 | 0.01  | 0.013 | 0.015 | 0.013 | 0.016 | 0.018 | 0.015 | 0.018 |
| 2.1 | austenitic                      | <650                | 75          | 0.012 | 0.015 | 0.017 | 0.009 | 0.012 | 0.014 | 0.012 | 0.015 | 0.017 | 0.014 | 0.017 |
| 2.2 | austenitic                      | <750                | 70          | 0.011 | 0.014 | 0.016 | 0.008 | 0.011 | 0.013 | 0.011 | 0.014 | 0.016 | 0.013 | 0.016 |
| 3.1 | DUPLEX STEEL   super austenitic | <1100               | 50          | 0.01  | 0.013 | 0.015 | 0.007 | 0.01  | 0.012 | 0.01  | 0.013 | 0.015 | 0.012 | 0.015 |

|   |                            |     |            |       |       |      |       |       |       |       |       |       |       |      |
|---|----------------------------|-----|------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|
| N | COPPER                     |     | Vc (m/min) |       |       |      |       |       |       |       |       |       |       |      |
|   | Tungsten Copper (WCu) <700 | 110 | 0.013      | 0.016 | 0.018 | 0.01 | 0.013 | 0.015 | 0.013 | 0.016 | 0.018 | 0.015 | 0.018 | 0.02 |

|         |              |       |            |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |
| 1.1     | unalloyed    | <500  | 190        | 0.015 | 0.02  | 0.022 | 0.012 | 0.017 | 0.019 | 0.015 | 0.02  | 0.022 | 0.017 | 0.022 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.015 | 0.02  | 0.022 | 0.012 | 0.017 | 0.019 | 0.015 | 0.02  | 0.022 | 0.017 | 0.022 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 | 0.017 | 0.014 | 0.018 | 0.02  | 0.016 | 0.02  |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 | 0.017 | 0.014 | 0.018 | 0.02  | 0.016 | 0.02  |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.013 | 0.016 | 0.018 | 0.01  | 0.013 | 0.015 | 0.013 | 0.016 | 0.018 | 0.015 | 0.018 |
| 3.3     | high-alloyed | <1400 | 130        | 0.012 | 0.015 | 0.017 | 0.009 | 0.012 | 0.014 | 0.012 | 0.015 | 0.017 | 0.014 | 0.017 |

|                                                                                                                                                                                                                                                                                                                                                       |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| K                                                                                                                                                                                                                                                                                                                                                     | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                               | Grey cast iron      | <1000 | 190        | 0.015 | 0.02  | 0.022 | 0.012 | 0.017 | 0.019 | 0.015 | 0.02  | 0.022 | 0.017 | 0.022 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                               | Modular cast iron   | <850  | 180        | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 | 0.017 | 0.014 | 0.018 | 0.02  | 0.016 | 0.02  |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                               | Malleable cast iron | <800  | 170        | 0.014 | 0.018 | 0.02  | 0.011 | 0.015 | 0.017 | 0.014 | 0.018 | 0.02  | 0.016 | 0.02  |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max)= 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |

|          |                | Hardness<br>in HRC | Dimension       | Ø1x2        |           |          | Ø1x20      |           |           | Ø2x4      |           |          | Ø2x26     |           |           |
|----------|----------------|--------------------|-----------------|-------------|-----------|----------|------------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|
|          |                |                    | Infeed<br>in mm | ae=1xD      | ae=0.1xD  | ae=0.1xD | ae=1xD     | ae=0.01xD | ae=0.01xD | ae=1xD    | ae=0.1xD  | ae=0.1xD | ae=1xD    | ae=0.06xD | ae=0.05xD |
|          |                |                    |                 | ap=0.05xD   | ap=L2 max | ap=0.1xD | ap=0.005xD | ap=L2 max | ap=0.01xD | ap=0.05xD | ap=L2 max | ap=0.1xD | ap=0.03xD | ap=L2 max | ap=0.05xD |
|          |                |                    |                 | Application |           |          |            |           |           |           |           |          |           |           |           |
| Material | Feed (mm/Z)    | fz                 | fz              | fz          | fz        | fz       | fz         | fz        | fz        | fz        | fz        | fz       | fz        | fz        |           |
| H        | HARDENED STEEL | Vc (m/min)         |                 |             |           |          |            |           |           |           |           |          |           |           |           |
| 1.1      | 46-55          | 110                | 0.015           | 0.02        | 0.022     | 0.007    | 0.01       | 0.012     | 0.025     | 0.03      | 0.032     | 0.02     | 0.025     | 0.027     |           |
| 1.2      | 56-60          | 70                 | 0.014           | 0.019       | 0.021     | 0.006    | 0.009      | 0.011     | 0.023     | 0.028     | 0.03      | 0.019    | 0.024     | 0.026     |           |
| 1.3      | 60-65          | 50                 | 0.012           | 0.017       | 0.019     | 0.005    | 0.008      | 0.01      | 0.021     | 0.026     | 0.028     | 0.018    | 0.023     | 0.025     |           |
| 1.4      | 66-70          | 40                 | 0.011           | 0.016       | 0.018     | 0.004    | 0.007      | 0.009     | 0.019     | 0.025     | 0.027     | 0.017    | 0.022     | 0.024     |           |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |
| 2.1 | austenitic                         | <650                | 75          | 0.015 | 0.02  | 0.022 | 0.005 | 0.01  | 0.012 | 0.024 | 0.029 | 0.031 | 0.019 | 0.025 | 0.027 |
| 2.2 | austenitic                         | <750                | 70          | 0.013 | 0.018 | 0.02  | 0.004 | 0.008 | 0.01  | 0.022 | 0.027 | 0.029 | 0.017 | 0.024 | 0.026 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.012 | 0.017 | 0.019 | 0.003 | 0.007 | 0.009 | 0.02  | 0.025 | 0.027 | 0.015 | 0.023 | 0.025 |

| N | COPPER                |      | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|-----------------------|------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700 | 110        | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.017 | 0.023 | 0.024 | 0.007 | 0.013 | 0.015 | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.017 | 0.023 | 0.024 | 0.007 | 0.013 | 0.015 | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 | 0.026 | 0.032 | 0.034 | 0.021 | 0.027 | 0.029 |
| 3.3     | high-alloyed | <1400 | 130        | 0.015 | 0.02  | 0.022 | 0.005 | 0.01  | 0.012 | 0.025 | 0.03  | 0.032 | 0.02  | 0.025 | 0.027 |

| K                                                                                                                                                                                                                                                                        | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                  | Grey cast iron      | <1000 | 190        | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2                                                                                                                                                                                                                                                                  | Modular cast iron   | <850  | 180        | 0.017 | 0.023 | 0.025 | 0.007 | 0.013 | 0.015 | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2                                                                                                                                                                                                                                                                  | Malleable cast iron | <800  | 170        | 0.017 | 0.023 | 0.025 | 0.007 | 0.013 | 0.015 | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| <b>ADVICE  </b> The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max) = 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |

Cooling

Tolerance

d04

Coating

AlphaDura Navy

Strategy

HSC

HPC

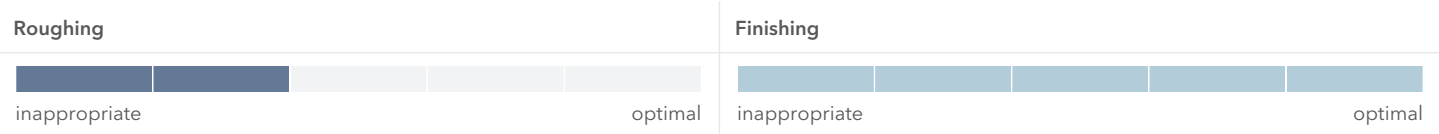
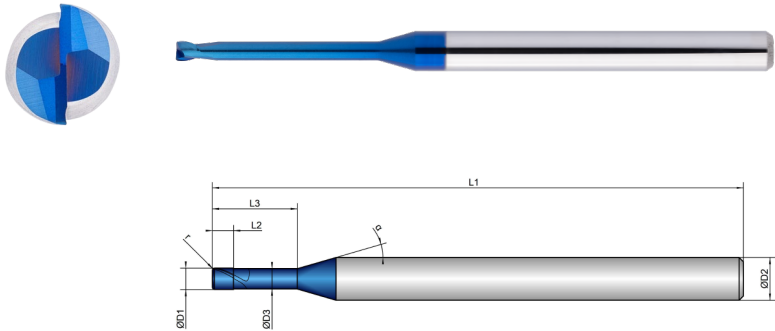
Application

Features

HA

Expert

- Ultrafine carbide grade developed for machining hardened steels
  - Optimized face geometry for long tool life and highest dimensional accuracy
  - Reinforced core for milling up to 70 HRC
- 
- Multipass milling of 3D contours
- 
- Tolerance D1: -0.001/-0.006 mm
  - Tolerance D3: 0/-0.02 mm
  - Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



| K202092 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|-------------------|-------------------|--------------|--------------|--------------|-------------------|------------|-------------|-------|------------|
| 0,8X4   | 0.8               | 0.78              | 0.8          | 4.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 0,8X6   | 0.8               | 0.78              | 0.8          | 6.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X2     | 1.0               | 0.95              | 1.0          | 2.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X4     | 1.0               | 0.95              | 1.0          | 4.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X6     | 1.0               | 0.95              | 1.0          | 6.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X8     | 1.0               | 0.95              | 1.0          | 8.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X10    | 1.0               | 0.95              | 1.0          | 10.0         | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X12    | 1.0               | 0.95              | 1.0          | 12.0         | 54.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X16    | 1.0               | 0.95              | 1.0          | 16.0         | 60.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1X20    | 1.0               | 0.95              | 1.0          | 20.0         | 60.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,2X6   | 1.2               | 1.14              | 1.2          | 6.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |

| K202092 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|-------------------|-------------------|--------------|--------------|--------------|-------------------|------------|-------------|-------|------------|
| 1,2X12  | 1.2               | 1.14              | 1.2          | 12.0         | 54.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,2X20  | 1.2               | 1.14              | 1.2          | 20.0         | 60.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X4   | 1.5               | 1.44              | 1.5          | 4.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X6   | 1.5               | 1.44              | 1.5          | 6.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X8   | 1.5               | 1.44              | 1.5          | 8.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X10  | 1.5               | 1.44              | 1.5          | 10.0         | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X12  | 1.5               | 1.44              | 1.5          | 12.0         | 54.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X16  | 1.5               | 1.44              | 1.5          | 16.0         | 54.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 1,5X20  | 1.5               | 1.44              | 1.5          | 20.0         | 60.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X4     | 2.0               | 1.91              | 2.0          | 4.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X6     | 2.0               | 1.91              | 2.0          | 6.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X8     | 2.0               | 1.91              | 2.0          | 8.0          | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X10    | 2.0               | 1.91              | 2.0          | 10.0         | 50.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X12    | 2.0               | 1.91              | 2.0          | 12.0         | 54.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X16    | 2.0               | 1.91              | 2.0          | 16.0         | 54.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X20    | 2.0               | 1.91              | 2.0          | 20.0         | 60.0         | 4.0               | 2          | 0.20        | 30    | 16         |
| 2X26    | 2.0               | 1.91              | 2.0          | 26.0         | 70.0         | 4.0               | 2          | 0.20        | 30    | 16         |

|     | Material       | Hardness<br>in HRC | Dimension       |             |            | Ø0.8x4 |       |       | Ø0.8x6 |       |       | Ø1x2  |       |       | Ø1x20 |    |    |
|-----|----------------|--------------------|-----------------|-------------|------------|--------|-------|-------|--------|-------|-------|-------|-------|-------|-------|----|----|
|     |                |                    | Infeed<br>in mm | Feed (mm/Z) | Vc (m/min) | fz     | fz    | fz    | fz     | fz    | fz    | fz    | fz    | fz    | fz    | fz | fz |
|     |                |                    |                 |             |            |        |       |       |        |       |       |       |       |       |       |    |    |
|     |                |                    |                 |             |            |        |       |       |        |       |       |       |       |       |       |    |    |
| H   | HARDENED STEEL |                    |                 |             |            |        |       |       |        |       |       |       |       |       |       |    |    |
| 1.1 |                | 46-55              | 110             | 0.014       | 0.017      | 0.019  | 0.014 | 0.017 | 0.019  | 0.015 | 0.02  | 0.022 | 0.007 | 0.01  | 0.012 |    |    |
| 1.2 |                | 56-60              | 70              | 0.013       | 0.016      | 0.018  | 0.013 | 0.016 | 0.018  | 0.014 | 0.019 | 0.021 | 0.006 | 0.009 | 0.011 |    |    |
| 1.3 |                | 60-65              | 50              | 0.012       | 0.015      | 0.017  | 0.012 | 0.015 | 0.017  | 0.012 | 0.017 | 0.019 | 0.005 | 0.008 | 0.01  |    |    |
| 1.4 |                | 66-70              | 40              | 0.011       | 0.014      | 0.016  | 0.011 | 0.014 | 0.016  | 0.011 | 0.016 | 0.018 | 0.004 | 0.007 | 0.009 |    |    |

|     | Material             | Strength<br>(N/mm <sup>2</sup> ) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|----------------------|----------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL      |                                  | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic | <850                             | 90          | 0.015 | 0.018 | 0.02  | 0.015 | 0.018 | 0.02  | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 |
| 2.1 | austenitic           | <650                             | 75          | 0.014 | 0.017 | 0.019 | 0.014 | 0.017 | 0.019 | 0.015 | 0.02  | 0.022 | 0.005 | 0.01  | 0.012 |
| 2.2 | austenitic           | <750                             | 70          | 0.013 | 0.016 | 0.018 | 0.013 | 0.016 | 0.018 | 0.013 | 0.018 | 0.02  | 0.004 | 0.008 | 0.01  |
| 3.1 | super austenitic     | <1100                            | 50          | 0.012 | 0.015 | 0.017 | 0.012 | 0.015 | 0.017 | 0.012 | 0.017 | 0.019 | 0.003 | 0.007 | 0.009 |

| N | COPPER                     | Vc (m/min) |       |       |      |       |       |      |       |       |       |       |       |       |  |
|---|----------------------------|------------|-------|-------|------|-------|-------|------|-------|-------|-------|-------|-------|-------|--|
|   | Tungsten Copper (WCu) <700 | 110        | 0.015 | 0.018 | 0.02 | 0.015 | 0.018 | 0.02 | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 |  |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.017 | 0.022 | 0.024 | 0.017 | 0.022 | 0.024 | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.017 | 0.022 | 0.024 | 0.017 | 0.022 | 0.024 | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.016 | 0.02  | 0.022 | 0.016 | 0.02  | 0.022 | 0.017 | 0.023 | 0.024 | 0.007 | 0.013 | 0.015 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.016 | 0.02  | 0.022 | 0.016 | 0.02  | 0.022 | 0.017 | 0.023 | 0.024 | 0.007 | 0.013 | 0.015 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.015 | 0.018 | 0.02  | 0.015 | 0.018 | 0.02  | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 |
| 3.3     | high-alloyed | <1400 | 130        | 0.014 | 0.017 | 0.019 | 0.014 | 0.017 | 0.019 | 0.015 | 0.02  | 0.022 | 0.005 | 0.01  | 0.012 |

| K                                                                                                                                                                                                                                                                                                                                                   | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                             | Grey cast iron      | <1000 | 190        | 0.017 | 0.022 | 0.024 | 0.017 | 0.022 | 0.024 | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                             | Modular cast iron   | <850  | 180        | 0.016 | 0.02  | 0.022 | 0.016 | 0.02  | 0.022 | 0.017 | 0.023 | 0.025 | 0.007 | 0.013 | 0.015 |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                             | Malleable cast iron | <800  | 170        | 0.016 | 0.02  | 0.022 | 0.016 | 0.02  | 0.022 | 0.017 | 0.023 | 0.025 | 0.007 | 0.013 | 0.015 |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max)= 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |

|     | Material       | Hardness<br>in HRC | Dimension       |             |            | Ø1.2x6 |       |       | Ø1.2x20 |       |       | Ø1.5x4 |       |       | Ø1.5x20 |    |    |
|-----|----------------|--------------------|-----------------|-------------|------------|--------|-------|-------|---------|-------|-------|--------|-------|-------|---------|----|----|
|     |                |                    | Infeed<br>in mm | Feed (mm/Z) | Vc (m/min) | fz     | fz    | fz    | fz      | fz    | fz    | fz     | fz    | fz    | fz      | fz | fz |
|     |                |                    |                 |             |            |        |       |       |         |       |       |        |       |       |         |    |    |
|     |                |                    |                 |             |            |        |       |       |         |       |       |        |       |       |         |    |    |
| H   | HARDENED STEEL |                    |                 |             |            |        |       |       |         |       |       |        |       |       |         |    |    |
| 1.1 |                | 46-55              | 110             | 0.015       | 0.02       | 0.022  | 0.01  | 0.015 | 0.017   | 0.017 | 0.022 | 0.024  | 0.01  | 0.015 | 0.017   |    |    |
| 1.2 |                | 56-60              | 70              | 0.014       | 0.019      | 0.021  | 0.009 | 0.014 | 0.016   | 0.016 | 0.021 | 0.022  | 0.009 | 0.014 | 0.016   |    |    |
| 1.3 |                | 60-65              | 50              | 0.012       | 0.017      | 0.019  | 0.007 | 0.012 | 0.014   | 0.014 | 0.019 | 0.02   | 0.007 | 0.012 | 0.014   |    |    |
| 1.4 |                | 66-70              | 40              | 0.011       | 0.016      | 0.018  | 0.006 | 0.011 | 0.013   | 0.013 | 0.018 | 0.019  | 0.006 | 0.011 | 0.013   |    |    |

|     | Material             | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|----------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL      |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic | <850                | 90          | 0.016 | 0.021 | 0.023 | 0.011 | 0.016 | 0.018 | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 |
| 2.1 | austenitic           | <650                | 75          | 0.015 | 0.02  | 0.022 | 0.01  | 0.015 | 0.017 | 0.017 | 0.022 | 0.024 | 0.01  | 0.015 | 0.017 |
| 2.2 | austenitic           | <750                | 70          | 0.013 | 0.018 | 0.02  | 0.008 | 0.013 | 0.015 | 0.015 | 0.02  | 0.022 | 0.008 | 0.013 | 0.015 |
| 3.1 | super austenitic     | <1100               | 50          | 0.012 | 0.017 | 0.019 | 0.007 | 0.012 | 0.014 | 0.014 | 0.019 | 0.021 | 0.007 | 0.012 | 0.014 |

| N | COPPER                     | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|----------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 | 110        | 0.016 | 0.021 | 0.023 | 0.011 | 0.016 | 0.018 | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.02  | 0.025 | 0.027 | 0.015 | 0.02  | 0.022 | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.02  | 0.025 | 0.027 | 0.015 | 0.02  | 0.022 | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.016 | 0.021 | 0.023 | 0.011 | 0.016 | 0.018 | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 |
| 3.3     | high-alloyed | <1400 | 130        | 0.015 | 0.02  | 0.022 | 0.01  | 0.015 | 0.017 | 0.017 | 0.022 | 0.024 | 0.01  | 0.015 | 0.017 |

| K                                                                                                                                                                                                                                                                                                                                                            | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                                      | Grey cast iron      | <1000 | 190        | 0.02  | 0.025 | 0.027 | 0.015 | 0.02  | 0.022 | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                                      | Modular cast iron   | <850  | 180        | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                                      | Malleable cast iron | <800  | 170        | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  |
| <b>ADVICE  </b> The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max)= 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |

|          | Material       | Hardness<br>in HRC | Dimension         | Ø2x4          |               |              | Ø2x26         |               |               |
|----------|----------------|--------------------|-------------------|---------------|---------------|--------------|---------------|---------------|---------------|
|          |                |                    | Infeed<br>in mm   | ae=<br>1xD    | ae=<br>0.1xD  | ae=<br>0.1xD | ae=<br>1xD    | ae=<br>0.06xD | ae=<br>0.05xD |
|          |                |                    |                   | ap=<br>0.05xD | ap=<br>L2 max | ap=<br>0.1xD | ap=<br>0.03xD | ap=<br>L2 max | ap=<br>0.05xD |
|          |                |                    | Application       |               |               |              |               |               |               |
|          |                |                    | Feed (mm/Z)       | fz            | fz            | fz           | fz            | fz            | fz            |
| <b>H</b> | HARDENED STEEL |                    | <b>Vc (m/min)</b> |               |               |              |               |               |               |
| 1.1      |                | 46-55              | 110               | 0.025         | 0.03          | 0.032        | 0.02          | 0.025         | 0.027         |
| 1.2      |                | 56-60              | 70                | 0.023         | 0.028         | 0.03         | 0.019         | 0.024         | 0.026         |
| 1.3      |                | 60-65              | 50                | 0.021         | 0.026         | 0.028        | 0.018         | 0.023         | 0.025         |
| 1.4      |                | 66-70              | 40                | 0.019         | 0.025         | 0.027        | 0.017         | 0.022         | 0.024         |

|          | Material                           | Strength<br>(N/mm²) | Feed (mm/Z)       | fz    | fz    | fz    | fz    | fz    | fz    |
|----------|------------------------------------|---------------------|-------------------|-------|-------|-------|-------|-------|-------|
| <b>M</b> | STAINLESS STEEL                    |                     | <b>Vc (m/min)</b> |       |       |       |       |       |       |
| 1.1      | ferritic/martensitic               | <850                | 90                | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |
| 2.1      | austenitic                         | <650                | 75                | 0.024 | 0.029 | 0.031 | 0.019 | 0.025 | 0.027 |
| 2.2      | austenitic                         | <750                | 70                | 0.022 | 0.027 | 0.029 | 0.017 | 0.024 | 0.026 |
| 3.1      | DUPLEX STEEL  <br>super austenitic | <1100               | 50                | 0.02  | 0.025 | 0.027 | 0.015 | 0.023 | 0.025 |

|          |                       |      |                   |       |       |       |       |       |       |
|----------|-----------------------|------|-------------------|-------|-------|-------|-------|-------|-------|
| <b>N</b> | COPPER                |      | <b>Vc (m/min)</b> |       |       |       |       |       |       |
|          | Tungsten Copper (WCu) | <700 | 110               | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |

|          |              |       |                   |       |       |       |       |       |       |
|----------|--------------|-------|-------------------|-------|-------|-------|-------|-------|-------|
| <b>P</b> | STEEL        |       | <b>Vc (m/min)</b> |       |       |       |       |       |       |
| 1.1      | unalloyed    | <500  | 190               | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 1.2-1.5  | unalloyed    | <1100 | 180               | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2  | low-alloyed  | <950  | 170               | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 2.3-2.4  | low-alloyed  | <1300 | 150               | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2  | high-alloyed | <1100 | 150               | 0.026 | 0.032 | 0.034 | 0.021 | 0.027 | 0.029 |
| 3.3      | high-alloyed | <1400 | 130               | 0.025 | 0.03  | 0.032 | 0.02  | 0.025 | 0.027 |

|                                                                                                                                                                                                                                                                            |                     |       |                   |       |       |       |       |       |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|-------------------|-------|-------|-------|-------|-------|-------|
| <b>K</b>                                                                                                                                                                                                                                                                   | CASTINGS            |       | <b>Vc (m/min)</b> |       |       |       |       |       |       |
| 1.1-1.2                                                                                                                                                                                                                                                                    | Grey cast iron      | <1000 | 190               | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2                                                                                                                                                                                                                                                                    | Modular cast iron   | <850  | 180               | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2                                                                                                                                                                                                                                                                    | Malleable cast iron | <800  | 170               | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| <b>ADVICE  </b> The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.<br>ae/ap(max) = 0.5x corner radius! |                     |       |                   |       |       |       |       |       |       |

Cooling

Tolerance

d04

Coating

AlphaDura Navy

Strategy

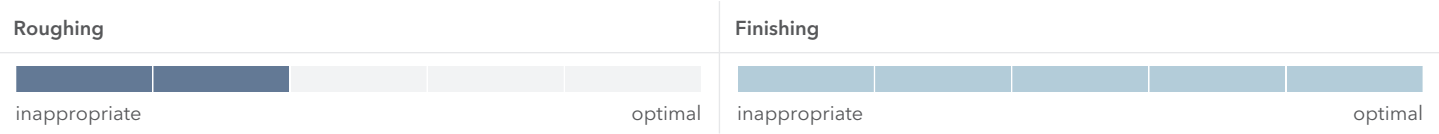
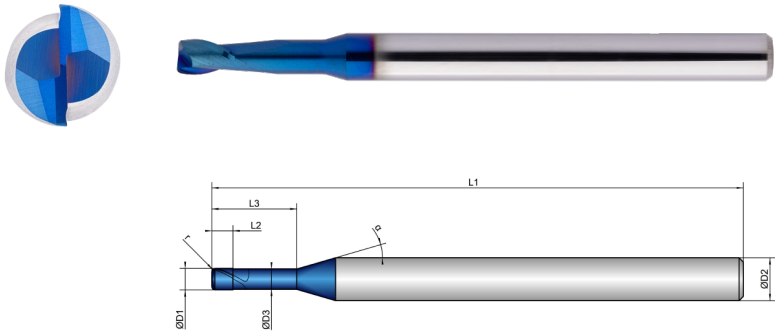
HSCHPC

Application

Features

HA

- Ultrafine carbide grade developed for machining hardened steels
  - Optimized face geometry for long tool life and highest dimensional accuracy
  - Reinforced core for milling up to 70 HRC
- 
- Multipass milling of 3D contours
- 
- Tolerance D1: -0.001/-0.006 mm
  - Tolerance D3: 0/-0.02 mm
  - Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



| K202102 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|-------------------|-------------------|--------------|--------------|--------------|-------------------|------------|-------------|-------|------------|
| 1X2     | 1.0               | 0.95              | 1.0          | 2.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X4     | 1.0               | 0.95              | 1.0          | 4.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X6     | 1.0               | 0.95              | 1.0          | 6.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X8     | 1.0               | 0.95              | 1.0          | 8.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X10    | 1.0               | 0.95              | 1.0          | 10.0         | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X12    | 1.0               | 0.95              | 1.0          | 12.0         | 54.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X16    | 1.0               | 0.95              | 1.0          | 16.0         | 60.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1X20    | 1.0               | 0.95              | 1.0          | 20.0         | 60.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,2X6   | 1.2               | 1.14              | 1.2          | 6.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,2X12  | 1.2               | 1.14              | 1.2          | 12.0         | 54.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,2X20  | 1.2               | 1.14              | 1.2          | 20.0         | 60.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,5X4   | 1.5               | 1.44              | 1.5          | 4.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |

| K202102 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|-------------------|-------------------|--------------|--------------|--------------|-------------------|------------|-------------|-------|------------|
| 1,5X6   | 1.5               | 1.44              | 1.5          | 6.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,5X8   | 1.5               | 1.44              | 1.5          | 8.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,5X10  | 1.5               | 1.44              | 1.5          | 10.0         | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,5X12  | 1.5               | 1.44              | 1.5          | 12.0         | 54.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,5X16  | 1.5               | 1.44              | 1.5          | 16.0         | 54.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 1,5X20  | 1.5               | 1.44              | 1.5          | 20.0         | 60.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X4     | 2.0               | 1.91              | 2.0          | 4.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X6     | 2.0               | 1.91              | 2.0          | 6.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X8     | 2.0               | 1.91              | 2.0          | 8.0          | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X10    | 2.0               | 1.91              | 2.0          | 10.0         | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X12    | 2.0               | 1.91              | 2.0          | 12.0         | 54.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X16    | 2.0               | 1.91              | 2.0          | 16.0         | 54.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X20    | 2.0               | 1.91              | 2.0          | 20.0         | 60.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2X26    | 2.0               | 1.91              | 2.0          | 26.0         | 70.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2,5X10  | 2.5               | 2.41              | 2.5          | 10.0         | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2,5X12  | 2.5               | 2.41              | 2.5          | 12.0         | 60.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 2,5X30  | 2.5               | 2.41              | 2.5          | 30.0         | 70.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 3X10    | 3.0               | 2.92              | 4.5          | 10.0         | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 3X12    | 3.0               | 2.92              | 4.5          | 12.0         | 50.0         | 4.0               | 2          | 0.30        | 30    | 16         |
| 3X30    | 3.0               | 2.92              | 4.5          | 30.0         | 70.0         | 4.0               | 2          | 0.30        | 30    | 16         |

|          |                | Hardness<br>in HRC | Dimension       | Ø1x2        |                                                                                   |                                                                                   | Ø1x20                                                                             |                                                                                   |                                                                                   | Ø1.2x6                                                                            |                                                                                   |                                                                                   | Ø1.2x20                                                                           |                                                                                   |                                                                                   |
|----------|----------------|--------------------|-----------------|-------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|          |                |                    | Infeed<br>in mm | ae=1xD      | ae=0.1xD                                                                          | ae=0.1xD                                                                          | ae=1xD                                                                            | ae=0.01xD                                                                         | ae=0.01xD                                                                         | ae=1xD                                                                            | ae=0.1xD                                                                          | ae=0.1xD                                                                          | ae=1xD                                                                            | ae=0.02xD                                                                         | ae=0.015xD                                                                        |
|          |                |                    |                 | ap=0.05xD   | ap=L2 max                                                                         | ap=0.1xD                                                                          | ap=0.005xD                                                                        | ap=L2 max                                                                         | ap=0.01xD                                                                         | ap=0.05xD                                                                         | ap=L2 max                                                                         | ap=0.1xD                                                                          | ap=0.008xD                                                                        | ap=L2 max                                                                         | ap=0.015xD                                                                        |
|          |                |                    |                 | Application |  |  |  |  |  |  |  |  |  |  |  |
| Material | Feed (mm/Z)    | fz                 | fz              | fz          | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                |                                                                                   |                                                                                   |
| H        | HARDENED STEEL | Vc (m/min)         |                 |             |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
| 1.1      | 46-55          | 110                | 0.015           | 0.02        | 0.022                                                                             | 0.007                                                                             | 0.01                                                                              | 0.012                                                                             | 0.015                                                                             | 0.02                                                                              | 0.022                                                                             | 0.01                                                                              | 0.015                                                                             | 0.017                                                                             |                                                                                   |
| 1.2      | 56-60          | 70                 | 0.014           | 0.019       | 0.021                                                                             | 0.006                                                                             | 0.009                                                                             | 0.011                                                                             | 0.014                                                                             | 0.019                                                                             | 0.021                                                                             | 0.009                                                                             | 0.014                                                                             | 0.016                                                                             |                                                                                   |
| 1.3      | 60-65          | 50                 | 0.012           | 0.017       | 0.019                                                                             | 0.005                                                                             | 0.008                                                                             | 0.01                                                                              | 0.012                                                                             | 0.017                                                                             | 0.019                                                                             | 0.007                                                                             | 0.012                                                                             | 0.014                                                                             |                                                                                   |
| 1.4      | 66-70          | 40                 | 0.011           | 0.016       | 0.018                                                                             | 0.004                                                                             | 0.007                                                                             | 0.009                                                                             | 0.011                                                                             | 0.016                                                                             | 0.018                                                                             | 0.006                                                                             | 0.011                                                                             | 0.013                                                                             |                                                                                   |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 | 0.016 | 0.021 | 0.023 | 0.011 | 0.016 | 0.018 |
| 2.1 | austenitic                         | <650                | 75          | 0.015 | 0.02  | 0.022 | 0.005 | 0.01  | 0.012 | 0.015 | 0.02  | 0.022 | 0.01  | 0.015 | 0.017 |
| 2.2 | austenitic                         | <750                | 70          | 0.013 | 0.018 | 0.02  | 0.004 | 0.008 | 0.01  | 0.013 | 0.018 | 0.02  | 0.008 | 0.013 | 0.015 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.012 | 0.017 | 0.019 | 0.003 | 0.007 | 0.009 | 0.012 | 0.017 | 0.019 | 0.007 | 0.012 | 0.014 |

| N | COPPER                |      | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|-----------------------|------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700 | 110        | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 | 0.016 | 0.021 | 0.023 | 0.011 | 0.016 | 0.018 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 | 0.02  | 0.025 | 0.027 | 0.015 | 0.02  | 0.022 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 | 0.02  | 0.025 | 0.027 | 0.015 | 0.02  | 0.022 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.017 | 0.023 | 0.024 | 0.007 | 0.013 | 0.015 | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.017 | 0.023 | 0.024 | 0.007 | 0.013 | 0.015 | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.016 | 0.021 | 0.023 | 0.006 | 0.011 | 0.013 | 0.016 | 0.021 | 0.023 | 0.011 | 0.016 | 0.018 |
| 3.3     | high-alloyed | <1400 | 130        | 0.015 | 0.02  | 0.022 | 0.005 | 0.01  | 0.012 | 0.015 | 0.02  | 0.022 | 0.01  | 0.015 | 0.017 |

| K                                                                                                                                                                                                                                                                                                                                                    | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                              | Grey cast iron      | <1000 | 190        | 0.018 | 0.025 | 0.027 | 0.008 | 0.015 | 0.017 | 0.02  | 0.025 | 0.027 | 0.015 | 0.02  | 0.022 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                              | Modular cast iron   | <850  | 180        | 0.017 | 0.023 | 0.025 | 0.007 | 0.013 | 0.015 | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                              | Malleable cast iron | <800  | 170        | 0.017 | 0.023 | 0.025 | 0.007 | 0.013 | 0.015 | 0.018 | 0.023 | 0.025 | 0.013 | 0.018 | 0.02  |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max) = 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |

|             | Material       | Hardness<br>in HRC | Dimension       | Ø1.5x4        |                                                                                     |                                                                                     | Ø1.5x20                                                                             |                                                                                     |                                                                                     | Ø2x4                                                                                |                                                                                     |                                                                                     | Ø2x26                                                                               |                                                                                     |                                                                                     |
|-------------|----------------|--------------------|-----------------|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|             |                |                    | Infeed<br>in mm | ae=<br>1xD    | ae=<br>0.1xD                                                                        | ae=<br>0.1xD                                                                        | ae=<br>1xD                                                                          | ae=<br>0.04xD                                                                       | ae=<br>0.04xD                                                                       | ae=<br>1xD                                                                          | ae=<br>0.1xD                                                                        | ae=<br>0.1xD                                                                        | ae=<br>1xD                                                                          | ae=<br>0.06xD                                                                       | ae=<br>0.05xD                                                                       |
|             |                |                    |                 | ap=<br>0.05xD | ap=<br>L2 max                                                                       | ap=<br>0.1xD                                                                        | ap=<br>0.02xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.04xD                                                                       | ap=<br>0.05xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.1xD                                                                        | ap=<br>0.03xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.05xD                                                                       |
|             |                |                    |                 | Application   |  |  |  |  |  |  |  |  |  |  |  |
| Feed (mm/Z) | fz             | fz                 | fz              | fz            | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |                                                                                     |                                                                                     |
| H           | HARDENED STEEL |                    | Vc (m/min)      |               |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1         |                | 46-55              | 110             | 0.017         | 0.022                                                                               | 0.024                                                                               | 0.01                                                                                | 0.015                                                                               | 0.017                                                                               | 0.025                                                                               | 0.03                                                                                | 0.032                                                                               | 0.02                                                                                | 0.025                                                                               | 0.027                                                                               |
| 1.2         |                | 56-60              | 70              | 0.016         | 0.021                                                                               | 0.022                                                                               | 0.009                                                                               | 0.014                                                                               | 0.016                                                                               | 0.023                                                                               | 0.028                                                                               | 0.03                                                                                | 0.019                                                                               | 0.024                                                                               | 0.026                                                                               |
| 1.3         |                | 60-65              | 50              | 0.014         | 0.019                                                                               | 0.02                                                                                | 0.007                                                                               | 0.012                                                                               | 0.014                                                                               | 0.021                                                                               | 0.026                                                                               | 0.028                                                                               | 0.018                                                                               | 0.023                                                                               | 0.025                                                                               |
| 1.4         |                | 66-70              | 40              | 0.013         | 0.018                                                                               | 0.019                                                                               | 0.006                                                                               | 0.011                                                                               | 0.013                                                                               | 0.019                                                                               | 0.025                                                                               | 0.027                                                                               | 0.017                                                                               | 0.022                                                                               | 0.024                                                                               |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |
| 2.1 | austenitic                         | <650                | 75          | 0.017 | 0.022 | 0.024 | 0.01  | 0.015 | 0.017 | 0.024 | 0.029 | 0.031 | 0.019 | 0.025 | 0.027 |
| 2.2 | austenitic                         | <750                | 70          | 0.015 | 0.02  | 0.022 | 0.008 | 0.013 | 0.015 | 0.022 | 0.027 | 0.029 | 0.017 | 0.024 | 0.026 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.014 | 0.019 | 0.021 | 0.007 | 0.012 | 0.014 | 0.02  | 0.025 | 0.027 | 0.015 | 0.023 | 0.025 |

| N | COPPER                |      | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---|-----------------------|------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700 | 110        | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 | 0.026 | 0.032 | 0.034 | 0.021 | 0.027 | 0.029 |
| 3.3     | high-alloyed | <1400 | 130        | 0.017 | 0.022 | 0.024 | 0.01  | 0.015 | 0.017 | 0.025 | 0.03  | 0.032 | 0.02  | 0.025 | 0.027 |

| K                                                                                                                                                                                                                                                                                                                                                      | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                                | Grey cast iron      | <1000 | 190        | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                                | Modular cast iron   | <850  | 180        | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                                | Malleable cast iron | <800  | 170        | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max) = 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |

|          |                | Hardness<br>in HRC | Dimension       | Ø2.5x10       |                                                                                   |                                                                                   | Ø2.5x30                                                                           |                                                                                   |                                                                                   | Ø3x10                                                                             |                                                                                   |                                                                                     | Ø3x30                                                                               |                                                                                     |                                                                                     |
|----------|----------------|--------------------|-----------------|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                |                    | Infeed<br>in mm | ae=<br>1xD    | ae=<br>0.1xD                                                                      | ae=<br>0.1xD                                                                      | ae=<br>1xD                                                                        | ae=<br>0.04xD                                                                     | ae=<br>0.04xD                                                                     | ae=<br>1xD                                                                        | ae=<br>0.1xD                                                                      | ae=<br>0.1xD                                                                        | ae=<br>1xD                                                                          | ae=<br>0.05xD                                                                       | ae=<br>0.05xD                                                                       |
|          |                |                    |                 | ap=<br>0.05xD | ap=<br>L2 max                                                                     | ap=<br>0.1xD                                                                      | ap=<br>0.02xD                                                                     | ap=<br>L2 max                                                                     | ap=<br>0.04xD                                                                     | ap=<br>0.05xD                                                                     | ap=<br>L2 max                                                                     | ap=<br>0.1xD                                                                        | ap=<br>0.03xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.05xD                                                                       |
|          |                |                    |                 | Application   |  |  |  |  |  |  |  |  |  |  |  |
| Material | Feed (mm/Z)    | fz                 | fz              | fz            | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                  | fz                                                                                  | fz                                                                                  |                                                                                     |
| H        | HARDENED STEEL | Vc (m/min)         |                 |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55          | 110                | 0.025           | 0.03          | 0.032                                                                             | 0.02                                                                              | 0.025                                                                             | 0.027                                                                             | 0.027                                                                             | 0.032                                                                             | 0.034                                                                             | 0.017                                                                               | 0.022                                                                               | 0.024                                                                               |                                                                                     |
| 1.2      | 56-60          | 70                 | 0.023           | 0.028         | 0.03                                                                              | 0.019                                                                             | 0.024                                                                             | 0.026                                                                             | 0.025                                                                             | 0.03                                                                              | 0.032                                                                             | 0.015                                                                               | 0.02                                                                                | 0.022                                                                               |                                                                                     |
| 1.3      | 60-65          | 50                 | 0.021           | 0.026         | 0.028                                                                             | 0.018                                                                             | 0.023                                                                             | 0.025                                                                             | 0.023                                                                             | 0.028                                                                             | 0.03                                                                              | 0.013                                                                               | 0.018                                                                               | 0.02                                                                                |                                                                                     |
| 1.4      | 66-70          | 40                 | 0.019           | 0.025         | 0.027                                                                             | 0.017                                                                             | 0.022                                                                             | 0.024                                                                             | 0.021                                                                             | 0.026                                                                             | 0.028                                                                             | 0.011                                                                               | 0.016                                                                               | 0.018                                                                               |                                                                                     |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) |       |       |       |       |       |       |       |       |       |       |       |       |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |                                    |                     |             | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 | 0.028 | 0.033 | 0.034 | 0.018 | 0.023 | 0.025 |
| 2.1 | austenitic                         | <650                | 75          | 0.024 | 0.029 | 0.031 | 0.019 | 0.024 | 0.026 | 0.026 | 0.031 | 0.033 | 0.016 | 0.021 | 0.023 |
| 2.2 | austenitic                         | <750                | 70          | 0.022 | 0.027 | 0.029 | 0.017 | 0.022 | 0.024 | 0.024 | 0.029 | 0.031 | 0.014 | 0.019 | 0.021 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.02  | 0.026 | 0.028 | 0.016 | 0.02  | 0.022 | 0.022 | 0.027 | 0.029 | 0.012 | 0.017 | 0.019 |

|   |                       |      |            |       |       |       |       |       |       |       |       |       |       |       |       |
|---|-----------------------|------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| N | COPPER                |      | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
|   | Tungsten Copper (WCu) | <700 | 110        | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 | 0.028 | 0.033 | 0.034 | 0.018 | 0.023 | 0.025 |

|         |              |       |            |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1     | unalloyed    | <500  | 190        | 0.03  | 0.036 | 0.038 | 0.025 | 0.031 | 0.033 | 0.032 | 0.038 | 0.04  | 0.022 | 0.028 | 0.03  |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.03  | 0.036 | 0.038 | 0.025 | 0.031 | 0.033 | 0.032 | 0.038 | 0.04  | 0.022 | 0.028 | 0.03  |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.026 | 0.028 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.026 | 0.028 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 | 0.028 | 0.033 | 0.035 | 0.018 | 0.023 | 0.025 |
| 3.3     | high-alloyed | <1400 | 130        | 0.025 | 0.03  | 0.032 | 0.02  | 0.025 | 0.027 | 0.027 | 0.032 | 0.034 | 0.017 | 0.022 | 0.024 |

|                                                                                                                                                                                                                                                                                                                                                             |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| K                                                                                                                                                                                                                                                                                                                                                           | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                                     | Grey cast iron      | <1000 | 190        | 0.03  | 0.036 | 0.038 | 0.025 | 0.031 | 0.033 | 0.032 | 0.038 | 0.04  | 0.022 | 0.028 | 0.03  |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                                     | Modular cast iron   | <850  | 180        | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.028 | 0.028 |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                                     | Malleable cast iron | <800  | 170        | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.026 | 0.028 |
| <b>ADVICE</b>   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max) = 0.5x corner radius! |                     |       |            |       |       |       |       |       |       |       |       |       |       |       |       |



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**No problem** – simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST



Cooling

Tolerance

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AlphaDura Navy

Strategy

HSC

HPC

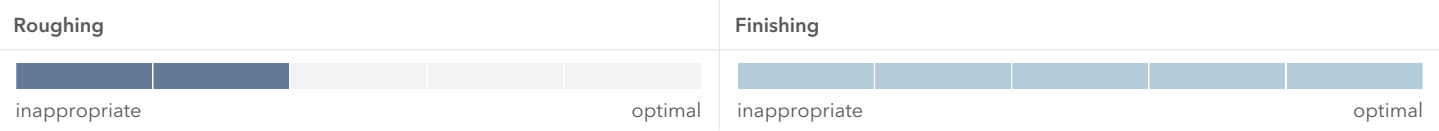
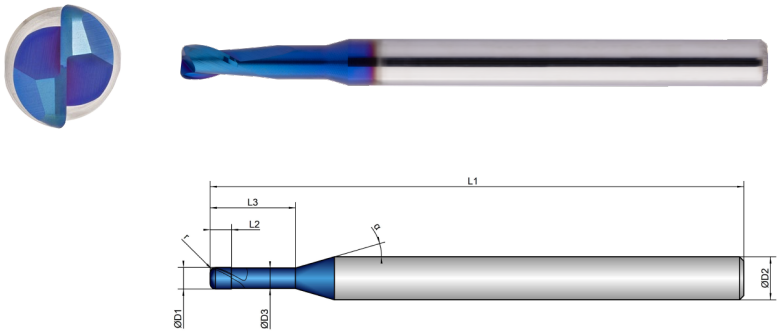
Application

Features

HA

Expert

- Ultrafine carbide grade developed for machining hardened steels
  - Optimized face geometry for long tool life and highest dimensional accuracy
  - Reinforced core for milling up to 70 HRC
- 
- Multipass milling of 3D contours
- 
- Tolerance D1: -0.001/-0.006 mm
  - Tolerance D3: 0/-0.02 mm
  - Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



| K202112 | <br>mm<br>Ø | <br>mm<br>Ø | <br>mm | <br>mm | <br>mm | <br>mm<br>Ø | <br># | <br>mm | <br>° | <br>° |
|---------|-------------|-------------|--------|--------|--------|-------------|-------|--------|-------|-------|
| 1,5X4   | 1.5         | 1.44        | 1.5    | 4.0    | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 1,5X6   | 1.5         | 1.44        | 1.5    | 6.0    | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 1,5X8   | 1.5         | 1.44        | 1.5    | 8.0    | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 1,5X10  | 1.5         | 1.44        | 1.5    | 10.0   | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 1,5X12  | 1.5         | 1.44        | 1.5    | 12.0   | 54.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 1,5X16  | 1.5         | 1.44        | 1.5    | 16.0   | 54.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 1,5X20  | 1.5         | 1.44        | 1.5    | 20.0   | 60.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X4     | 2.0         | 1.91        | 2.0    | 4.0    | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X6     | 2.0         | 1.91        | 2.0    | 6.0    | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X8     | 2.0         | 1.91        | 2.0    | 8.0    | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X10    | 2.0         | 1.91        | 2.0    | 10.0   | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |

| K202112 | <br>mm<br>Ø | <br>mm<br>Ø | <br>mm | <br>mm | <br>mm | <br>mm<br>Ø | <br># | <br>mm | <br>° | <br>° |
|---------|-------------|-------------|--------|--------|--------|-------------|-------|--------|-------|-------|
| 2X12    | 2.0         | 1.91        | 2.0    | 12.0   | 54.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X16    | 2.0         | 1.91        | 2.0    | 16.0   | 54.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X20    | 2.0         | 1.91        | 2.0    | 20.0   | 60.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2X26    | 2.0         | 1.91        | 2.0    | 26.0   | 70.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2,5X10  | 2.5         | 2.41        | 2.5    | 10.0   | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2,5X12  | 2.5         | 2.41        | 2.5    | 12.0   | 60.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 2,5X30  | 2.5         | 2.41        | 2.5    | 30.0   | 70.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 3X10    | 3.0         | 2.91        | 4.5    | 10.0   | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 3X12    | 3.0         | 2.91        | 4.5    | 12.0   | 50.0   | 4.0         | 2     | 0.50   | 30    | 16    |
| 3X30    | 3.0         | 2.91        | 4.5    | 30.0   | 70.0   | 4.0         | 2     | 0.50   | 30    | 16    |

|          |                | Hardness<br>in HRC | Dimension       | Ø1.5x4      |           |          | Ø1.5x20                                                                           |                                                                                   |                                                                                   | Ø2x4                                                                              |                                                                                   |                                                                                   | Ø2x26                                                                              |                                                                                     |                                                                                     |
|----------|----------------|--------------------|-----------------|-------------|-----------|----------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                |                    | Infeed<br>in mm | ae=1xD      | ae=0.1xD  | ae=0.1xD | ae=1xD                                                                            | ae=0.04xD                                                                         | ae=0.04xD                                                                         | ae=1xD                                                                            | ae=0.1xD                                                                          | ae=0.1xD                                                                          | ae=1xD                                                                             | ae=0.05xD                                                                           | ae=0.05xD                                                                           |
|          |                |                    |                 | ap=0.05xD   | ap=L2 max | ap=0.1xD | ap=0.02xD                                                                         | ap=L2 max                                                                         | ap=0.04xD                                                                         | ap=0.05xD                                                                         | ap=L2 max                                                                         | ap=0.1xD                                                                          | ap=0.03xD                                                                          | ap=L2 max                                                                           | ap=0.05xD                                                                           |
|          |                |                    |                 | Application |           |          |  |  |  |  |  |  |  |  |  |
| Material | Feed (mm/Z)    | fz                 | fz              | fz          | fz        | fz       | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  |                                                                                     |
| H        | HARDENED STEEL | Vc (m/min)         |                 |             |           |          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 1.1      | 46-55          | 110                | 0.017           | 0.022       | 0.024     | 0.01     | 0.015                                                                             | 0.017                                                                             | 0.025                                                                             | 0.03                                                                              | 0.032                                                                             | 0.02                                                                              | 0.025                                                                              | 0.027                                                                               |                                                                                     |
| 1.2      | 56-60          | 70                 | 0.016           | 0.021       | 0.022     | 0.009    | 0.014                                                                             | 0.016                                                                             | 0.023                                                                             | 0.028                                                                             | 0.03                                                                              | 0.019                                                                             | 0.024                                                                              | 0.026                                                                               |                                                                                     |
| 1.3      | 60-65          | 50                 | 0.014           | 0.019       | 0.02      | 0.007    | 0.012                                                                             | 0.014                                                                             | 0.021                                                                             | 0.026                                                                             | 0.028                                                                             | 0.018                                                                             | 0.023                                                                              | 0.025                                                                               |                                                                                     |
| 1.4      | 66-70          | 40                 | 0.013           | 0.018       | 0.019     | 0.006    | 0.011                                                                             | 0.013                                                                             | 0.019                                                                             | 0.025                                                                             | 0.027                                                                             | 0.017                                                                             | 0.022                                                                              | 0.024                                                                               |                                                                                     |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    | Vc (m/min)          |             |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |
| 2.1 | austenitic                         | <650                | 75          | 0.017 | 0.022 | 0.024 | 0.01  | 0.015 | 0.017 | 0.024 | 0.029 | 0.031 | 0.019 | 0.025 | 0.027 |
| 2.2 | austenitic                         | <750                | 70          | 0.015 | 0.02  | 0.022 | 0.008 | 0.013 | 0.015 | 0.022 | 0.027 | 0.029 | 0.017 | 0.024 | 0.026 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.014 | 0.019 | 0.021 | 0.007 | 0.012 | 0.014 | 0.02  | 0.025 | 0.027 | 0.015 | 0.023 | 0.025 |

| N | COPPER                | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|---|-----------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700       | 110 | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 |

| P       | STEEL        | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500       | 190 | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 1.2-1.5 | unalloyed    | <1100      | 180 | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2 | low-alloyed  | <950       | 170 | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 2.3-2.4 | low-alloyed  | <1300      | 150 | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2 | high-alloyed | <1100      | 150 | 0.018 | 0.023 | 0.025 | 0.011 | 0.016 | 0.018 | 0.026 | 0.032 | 0.034 | 0.021 | 0.027 | 0.029 |
| 3.3     | high-alloyed | <1400      | 130 | 0.017 | 0.022 | 0.024 | 0.01  | 0.015 | 0.017 | 0.025 | 0.03  | 0.032 | 0.02  | 0.025 | 0.027 |

| K                                                                                                                                                                                                                                                                                                                                                   | CASTINGS            | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                             | Grey cast iron      | <1000      | 190 | 0.022 | 0.027 | 0.029 | 0.015 | 0.02  | 0.022 | 0.03  | 0.037 | 0.039 | 0.025 | 0.032 | 0.034 |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                             | Modular cast iron   | <850       | 180 | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                             | Malleable cast iron | <800       | 170 | 0.02  | 0.025 | 0.027 | 0.013 | 0.018 | 0.02  | 0.028 | 0.035 | 0.037 | 0.023 | 0.03  | 0.032 |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max)= 0.5x corner radius! |                     |            |     |       |       |       |       |       |       |       |       |       |       |       |       |

|          |                | Hardness<br>in HRC | Dimension       | Ø2.5x10       |                                                                                     |                                                                                     | Ø2.5x30                                                                             |                                                                                     |                                                                                     | Ø3x10                                                                               |                                                                                     |                                                                                     | Ø3x30                                                                               |                                                                                     |                                                                                     |
|----------|----------------|--------------------|-----------------|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                |                    | Infeed<br>in mm | ae=<br>1xD    | ae=<br>0.1xD                                                                        | ae=<br>0.1xD                                                                        | ae=<br>1xD                                                                          | ae=<br>0.04xD                                                                       | ae=<br>0.04xD                                                                       | ae=<br>1xD                                                                          | ae=<br>0.1xD                                                                        | ae=<br>0.1xD                                                                        | ae=<br>1xD                                                                          | ae=<br>0.05xD                                                                       | ae=<br>0.05xD                                                                       |
|          |                |                    |                 | ap=<br>0.05xD | ap=<br>L2 max                                                                       | ap=<br>0.1xD                                                                        | ap=<br>0.02xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.04xD                                                                       | ap=<br>0.05xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.1xD                                                                        | ap=<br>0.03xD                                                                       | ap=<br>L2 max                                                                       | ap=<br>0.05xD                                                                       |
|          |                |                    |                 | Application   |  |  |  |  |  |  |  |  |  |  |  |
| Material | Feed (mm/Z)    | fz                 | fz              | fz            | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |                                                                                     |
| H        | HARDENED STEEL | Vc (m/min)         |                 |               |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55          | 110                | 0.025           | 0.03          | 0.032                                                                               | 0.02                                                                                | 0.025                                                                               | 0.027                                                                               | 0.027                                                                               | 0.032                                                                               | 0.034                                                                               | 0.017                                                                               | 0.022                                                                               | 0.024                                                                               |                                                                                     |
| 1.2      | 56-60          | 70                 | 0.023           | 0.028         | 0.03                                                                                | 0.019                                                                               | 0.024                                                                               | 0.026                                                                               | 0.025                                                                               | 0.03                                                                                | 0.032                                                                               | 0.015                                                                               | 0.02                                                                                | 0.022                                                                               |                                                                                     |
| 1.3      | 60-65          | 50                 | 0.021           | 0.026         | 0.028                                                                               | 0.018                                                                               | 0.023                                                                               | 0.025                                                                               | 0.023                                                                               | 0.028                                                                               | 0.03                                                                                | 0.013                                                                               | 0.018                                                                               | 0.02                                                                                |                                                                                     |
| 1.4      | 66-70          | 40                 | 0.019           | 0.025         | 0.027                                                                               | 0.017                                                                               | 0.022                                                                               | 0.024                                                                               | 0.021                                                                               | 0.026                                                                               | 0.028                                                                               | 0.011                                                                               | 0.016                                                                               | 0.018                                                                               |                                                                                     |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 | 0.028 | 0.033 | 0.034 | 0.018 | 0.023 | 0.025 |
| 2.1 | austenitic                         | <650                | 75          | 0.024 | 0.029 | 0.031 | 0.019 | 0.024 | 0.026 | 0.026 | 0.031 | 0.033 | 0.016 | 0.021 | 0.023 |
| 2.2 | austenitic                         | <750                | 70          | 0.022 | 0.027 | 0.029 | 0.017 | 0.022 | 0.024 | 0.024 | 0.029 | 0.031 | 0.014 | 0.019 | 0.021 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.02  | 0.026 | 0.028 | 0.016 | 0.02  | 0.022 | 0.022 | 0.027 | 0.029 | 0.012 | 0.017 | 0.019 |

| N | COPPER                | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|---|-----------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700       | 110 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 | 0.028 | 0.033 | 0.034 | 0.018 | 0.023 | 0.025 |

| P       | STEEL        | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500       | 190 | 0.03  | 0.036 | 0.038 | 0.025 | 0.031 | 0.033 | 0.032 | 0.038 | 0.04  | 0.022 | 0.028 | 0.03  |
| 1.2-1.5 | unalloyed    | <1100      | 180 | 0.03  | 0.036 | 0.038 | 0.025 | 0.031 | 0.033 | 0.032 | 0.038 | 0.04  | 0.022 | 0.028 | 0.03  |
| 2.1-2.2 | low-alloyed  | <950       | 170 | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.026 | 0.028 |
| 2.3-2.4 | low-alloyed  | <1300      | 150 | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.026 | 0.028 |
| 3.1-3.2 | high-alloyed | <1100      | 150 | 0.026 | 0.031 | 0.033 | 0.021 | 0.026 | 0.028 | 0.028 | 0.033 | 0.035 | 0.018 | 0.023 | 0.025 |
| 3.3     | high-alloyed | <1400      | 130 | 0.025 | 0.03  | 0.032 | 0.02  | 0.025 | 0.027 | 0.027 | 0.032 | 0.034 | 0.017 | 0.022 | 0.024 |

| K                                                                                                                                                                                                                                                                                                                                                     | CASTINGS            | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |       |       |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2                                                                                                                                                                                                                                                                                                                                               | Grey cast iron      | <1000      | 190 | 0.03  | 0.036 | 0.038 | 0.025 | 0.031 | 0.033 | 0.032 | 0.038 | 0.04  | 0.022 | 0.028 | 0.03  |
| 2.1-2.2                                                                                                                                                                                                                                                                                                                                               | Modular cast iron   | <850       | 180 | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.028 | 0.028 |
| 3.1-3.2                                                                                                                                                                                                                                                                                                                                               | Malleable cast iron | <800       | 170 | 0.028 | 0.034 | 0.036 | 0.023 | 0.029 | 0.031 | 0.03  | 0.036 | 0.038 | 0.02  | 0.026 | 0.028 |
| ADVICE   The values marked in turquoise are side applications!<br>Values in the table are the shortest and the longest overhang length (L3) of each dimension;<br>Please calculate fz, ap and ae depending on the given values.  ae/ap(max)= 0.5x corner radius! |                     |            |     |       |       |       |       |       |       |       |       |       |       |       |       |

Cooling

Tolerance

d04

Coating

AlphaDura Navy

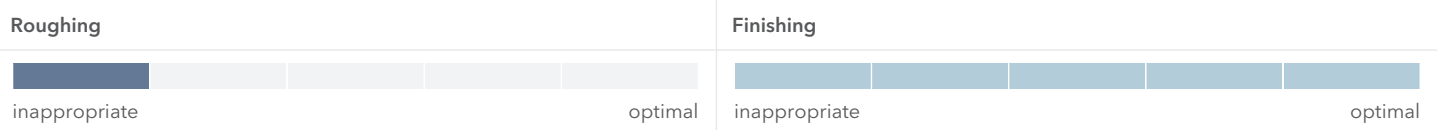
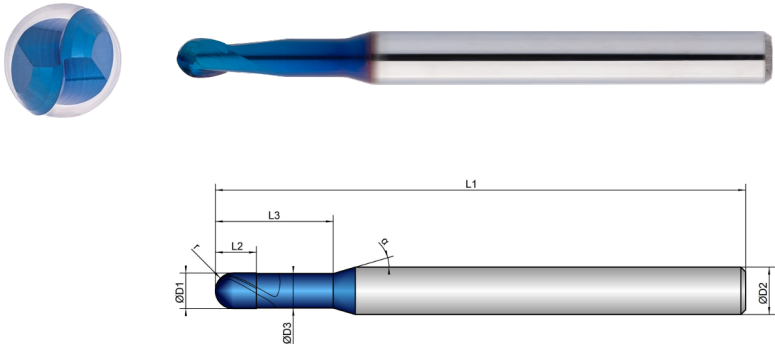
Strategy

HSC

Application

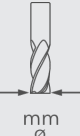
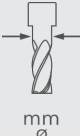
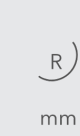
Features

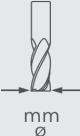
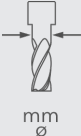
- Ultrafine carbide grade developed for machining hardened steels
  - Optimized face geometry for long tool life and highest dimensional accuracy
  - Reinforced core for milling up to 70 HRC
- Tolerance D1: -0.001/-0.006 mm
  - Tolerance D3: 0/-0.02 mm
  - Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



| K203206  | mm<br>Ø | mm<br>Ø | mm   | mm   | mm   | mm<br>Ø | # | mm   | °  | °  |
|----------|---------|---------|------|------|------|---------|---|------|----|----|
| 0,2X0,3  | 0.2     | 0.17    | 0.16 | 0.3  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X0,5  | 0.2     | 0.17    | 0.16 | 0.5  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X0,75 | 0.2     | 0.17    | 0.16 | 0.75 | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X1    | 0.2     | 0.17    | 0.16 | 1.0  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X1,25 | 0.2     | 0.17    | 0.16 | 1.25 | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X1,5  | 0.2     | 0.17    | 0.16 | 1.5  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X1,75 | 0.2     | 0.17    | 0.16 | 1.75 | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X2    | 0.2     | 0.17    | 0.16 | 2.0  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X2,5  | 0.2     | 0.17    | 0.16 | 2.5  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,2X3    | 0.2     | 0.17    | 0.16 | 3.0  | 45.0 | 4.0     | 2 | 0.10 | 30 | 16 |
| 0,3X0,5  | 0.3     | 0.27    | 0.24 | 0.5  | 45.0 | 4.0     | 2 | 0.15 | 30 | 16 |
| 0,3X0,75 | 0.3     | 0.27    | 0.24 | 0.75 | 45.0 | 4.0     | 2 | 0.15 | 30 | 16 |
| 0,3X1    | 0.3     | 0.27    | 0.24 | 1.0  | 45.0 | 4.0     | 2 | 0.15 | 30 | 16 |
| 0,3X1,25 | 0.3     | 0.27    | 0.24 | 1.25 | 45.0 | 4.0     | 2 | 0.15 | 30 | 16 |

| K203206  | mm<br>Ø | mm<br>Ø | mm   | mm   | mm   | mm<br>Ø | # | mm   | °  | °  |
|----------|---------|---------|------|------|------|---------|---|------|----|----|
| 0,3X1,5  | 0.3     | 0.27    | 0.24 | 1.5  | 45.0 | 4.0     | 2 | 0.15 | 30 | 16 |
| 0,4X0,5  | 0.4     | 0.34    | 0.32 | 0.5  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X0,75 | 0.4     | 0.34    | 0.32 | 0.75 | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X1    | 0.4     | 0.34    | 0.32 | 1.0  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X1,5  | 0.4     | 0.34    | 0.32 | 1.5  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X2    | 0.4     | 0.34    | 0.32 | 2.0  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X2,5  | 0.4     | 0.34    | 0.32 | 2.5  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X3    | 0.4     | 0.34    | 0.32 | 3.0  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X3,5  | 0.4     | 0.34    | 0.32 | 3.5  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X4    | 0.4     | 0.34    | 0.32 | 4.0  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X4,5  | 0.4     | 0.34    | 0.32 | 4.5  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X5    | 0.4     | 0.34    | 0.32 | 5.0  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X5,5  | 0.4     | 0.34    | 0.32 | 5.5  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,4X6    | 0.4     | 0.34    | 0.32 | 6.0  | 45.0 | 4.0     | 2 | 0.20 | 30 | 16 |
| 0,5X1    | 0.5     | 0.47    | 0.4  | 1.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X1,5  | 0.5     | 0.47    | 0.4  | 1.5  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X2    | 0.5     | 0.47    | 0.4  | 2.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X2,5  | 0.5     | 0.47    | 0.4  | 2.5  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X3    | 0.5     | 0.47    | 0.4  | 3.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X3,5  | 0.5     | 0.47    | 0.4  | 3.5  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X4    | 0.5     | 0.47    | 0.4  | 4.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X4,5  | 0.5     | 0.47    | 0.4  | 4.5  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X5    | 0.5     | 0.47    | 0.4  | 5.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X5,5  | 0.5     | 0.47    | 0.4  | 5.5  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X6    | 0.5     | 0.47    | 0.4  | 6.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X7    | 0.5     | 0.47    | 0.4  | 7.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |
| 0,5X8    | 0.5     | 0.47    | 0.4  | 8.0  | 45.0 | 4.0     | 2 | 0.25 | 30 | 16 |

|         | <br>D1<br>mm<br>ø | <br>D3<br>mm<br>ø | <br>L2<br>mm | <br>L3<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>r<br>mm | <br>° | <br>α<br>° |
|---------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| K203206 |                                                                                                    |                                                                                                    |                                                                                               |                                                                                               |                                                                                               |                                                                                                    |                                                                                              |                                                                                                |                                                                                          |                                                                                               |
| 0,5X9   | 0.5                                                                                                | 0.47                                                                                               | 0.4                                                                                           | 9.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.25                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X1   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 1.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X2   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 2.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X3   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 3.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X4   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 4.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X5   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 5.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X6   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,6X8   | 0.6                                                                                                | 0.57                                                                                               | 0.48                                                                                          | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.30                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X2   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 2.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X3   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 3.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X4   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 4.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X5   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 5.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X6   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X7   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 7.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X8   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 0,8X9   | 0.8                                                                                                | 0.77                                                                                               | 0.64                                                                                          | 9.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X2,5   | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 2.5                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X3     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 3.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X4     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 4.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X5     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 5.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X6     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X7     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 7.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X8     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 8.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X9     | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 9.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X10    | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 10.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X12    | 1.0                                                                                                | 0.96                                                                                               | 0.8                                                                                           | 12.0                                                                                          | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,2X6   | 1.2                                                                                                | 1.16                                                                                               | 0.96                                                                                          | 6.0                                                                                           | 45.0                                                                                          | 4.0                                                                                                | 2                                                                                            | 0.60                                                                                           | 30                                                                                       | 16                                                                                            |

|         | <br>D1<br>mm<br>ø | <br>D3<br>mm<br>ø | <br>L2<br>mm | <br>L3<br>mm | <br>L1<br>mm | <br>D2<br>mm<br>ø | <br>z<br># | <br>r<br>mm | <br>° | <br>α<br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| K203206 |                                                                                                      |                                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                      |                                                                                               |                                                                                                |                                                                                          |                                                                                               |
| 1,2X8   | 1.2                                                                                                  | 1.16                                                                                                 | 0.96                                                                                            | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.60                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,2X10  | 1.2                                                                                                  | 1.16                                                                                                 | 0.96                                                                                            | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.60                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,2X12  | 1.2                                                                                                  | 1.16                                                                                                 | 0.96                                                                                            | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.60                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,4X8   | 1.4                                                                                                  | 1.34                                                                                                 | 1.12                                                                                            | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.70                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,4X12  | 1.4                                                                                                  | 1.34                                                                                                 | 1.12                                                                                            | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.70                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X3   | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 3.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X4   | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X6   | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X8   | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X10  | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X12  | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,6X8   | 1.6                                                                                                  | 1.54                                                                                                 | 1.28                                                                                            | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.80                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,6X12  | 1.6                                                                                                  | 1.54                                                                                                 | 1.28                                                                                            | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.80                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,8X8   | 1.8                                                                                                  | 1.74                                                                                                 | 1.44                                                                                            | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.90                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,8X12  | 1.8                                                                                                  | 1.74                                                                                                 | 1.44                                                                                            | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.90                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X3     | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 3.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X4     | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 4.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X6     | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 6.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X8     | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X10    | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X12    | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2,5X10  | 2.5                                                                                                  | 2.41                                                                                                 | 2.0                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.25                                                                                           | 30                                                                                       | 16                                                                                            |
| 3X8     | 3.0                                                                                                  | 2.92                                                                                                 | 3.5                                                                                             | 8.0                                                                                             | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 3X10    | 3.0                                                                                                  | 2.92                                                                                                 | 3.5                                                                                             | 10.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 3X12    | 3.0                                                                                                  | 2.92                                                                                                 | 3.5                                                                                             | 12.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 3X16    | 3.0                                                                                                  | 2.92                                                                                                 | 3.5                                                                                             | 16.0                                                                                            | 45.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.50                                                                                           | 30                                                                                       | 16                                                                                            |

|     | Material       | Hardness<br>in HRC | Dimension       | Ø0.2 x0.3                                                                         | Ø0.2 x3                                                                           | Ø0.3 x0.5                                                                         | Ø0.3 x1.5                                                                         | Ø0.4 x0.5                                                                         | Ø0.4 x6                                                                            | Ø0.5 x1                                                                             | Ø0.5 x9                                                                             | Ø0.6 x1                                                                             | Ø0.6 x8                                                                             |
|-----|----------------|--------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|     |                |                    | Infeed<br>in mm | ae=<br>0.1xD<br>ap=<br>0.1xD                                                      | ae=<br>0.02xD<br>ap=<br>0.02xD                                                    | ae=<br>0.1xD<br>ap=<br>0.1xD                                                      | ae=<br>0.09xD<br>ap=<br>0.09xD                                                    | ae=<br>0.1xD<br>ap=<br>0.1xD                                                      | ae=<br>0.02xD<br>ap=<br>0.02xD                                                     | ae=<br>0.1xD<br>ap=<br>0.1xD                                                        | ae=<br>0.01xD<br>ap=<br>0.01xD                                                      | ae=<br>0.1xD<br>ap=<br>0.1xD                                                        | ae=<br>0.035xD<br>ap=<br>0.035xD                                                    |
|     |                |                    | Application     |  |  |  |  |  |  |  |  |  |  |
|     |                |                    | Feed (mm/Z)     | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H   | HARDENED STEEL |                    | Vc (m/min)      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1 |                | 46-55              | 110             | 0.019                                                                             | 0.014                                                                             | 0.021                                                                             | 0.017                                                                             | 0.023                                                                             | 0.019                                                                              | 0.024                                                                               | 0.018                                                                               | 0.026                                                                               | 0.022                                                                               |
| 1.2 |                | 56-60              | 70              | 0.018                                                                             | 0.013                                                                             | 0.02                                                                              | 0.016                                                                             | 0.022                                                                             | 0.018                                                                              | 0.023                                                                               | 0.017                                                                               | 0.025                                                                               | 0.021                                                                               |
| 1.3 |                | 60-65              | 50              | 0.017                                                                             | 0.012                                                                             | 0.019                                                                             | 0.015                                                                             | 0.021                                                                             | 0.017                                                                              | 0.022                                                                               | 0.016                                                                               | 0.024                                                                               | 0.02                                                                                |
| 1.4 |                | 66-70              | 40              | 0.014                                                                             | 0.009                                                                             | 0.016                                                                             | 0.012                                                                             | 0.018                                                                             | 0.014                                                                              | 0.019                                                                               | 0.013                                                                               | 0.021                                                                               | 0.017                                                                               |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.019 | 0.014 | 0.021 | 0.017 | 0.023 | 0.019 | 0.024 | 0.018 | 0.026 | 0.022 |
| 2.1 | austenitic                         | <650                | 75          | 0.018 | 0.013 | 0.02  | 0.016 | 0.022 | 0.018 | 0.023 | 0.017 | 0.025 | 0.021 |
| 2.2 | austenitic                         | <750                | 70          | 0.017 | 0.012 | 0.019 | 0.015 | 0.021 | 0.017 | 0.022 | 0.016 | 0.024 | 0.02  |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.014 | 0.009 | 0.016 | 0.012 | 0.018 | 0.014 | 0.019 | 0.013 | 0.021 | 0.017 |

| N | COPPER                     |  | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |
|---|----------------------------|--|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 |  | 120        | 0.019 | 0.014 | 0.021 | 0.017 | 0.023 | 0.019 | 0.024 | 0.018 | 0.026 | 0.022 |

| P   | STEEL        |              | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |
|-----|--------------|--------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     | 1.1          | unalloyed    | <500       | 190   | 0.019 | 0.014 | 0.021 | 0.017 | 0.023 | 0.019 | 0.024 | 0.018 | 0.026 |
|     | 1.2-1.5      | unalloyed    | <1100      | 180   | 0.019 | 0.014 | 0.021 | 0.017 | 0.023 | 0.019 | 0.024 | 0.018 | 0.026 |
|     | 2.1-2.2      | low-alloyed  | <950       | 170   | 0.018 | 0.013 | 0.02  | 0.016 | 0.022 | 0.018 | 0.023 | 0.017 | 0.025 |
|     | 2.3-2.4      | low-alloyed  | <1300      | 150   | 0.018 | 0.013 | 0.02  | 0.016 | 0.022 | 0.018 | 0.023 | 0.017 | 0.025 |
|     | 3.1-3.2      | high-alloyed | <1100      | 150   | 0.017 | 0.012 | 0.019 | 0.015 | 0.021 | 0.017 | 0.022 | 0.016 | 0.024 |
| 3.3 | high-alloyed | <1400        | 130        | 0.014 | 0.009 | 0.016 | 0.012 | 0.018 | 0.014 | 0.019 | 0.013 | 0.021 | 0.017 |

| K | CASTINGS |                     | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |
|---|----------|---------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | 1.1-1.2  | Grey cast iron      | <1000      | 190 | 0.019 | 0.014 | 0.021 | 0.017 | 0.023 | 0.019 | 0.024 | 0.018 | 0.026 |
|   | 2.1-2.2  | Modular cast iron   | <850       | 180 | 0.018 | 0.013 | 0.02  | 0.016 | 0.022 | 0.018 | 0.023 | 0.017 | 0.025 |
|   | 3.1-3.2  | Malleable cast iron | <800       | 170 | 0.018 | 0.013 | 0.02  | 0.016 | 0.022 | 0.018 | 0.023 | 0.017 | 0.025 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

|     | Material       | Hardness<br>in HRC | Dimension       | Ø0.8 x2                                                                             | Ø0.8 x9                                                                             | Ø1 x2.5                                                                             | Ø1 x12                                                                              | Ø1.2 x6                                                                             | Ø1.2 x12                                                                            | Ø1.4 x8                                                                             | Ø1.4 x12                                                                            | Ø1.5 x3                                                                             | Ø1.5 x12                                                                            |
|-----|----------------|--------------------|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|     |                |                    | Infeed<br>in mm | ae=<br>0.1xD<br>ap=<br>0.1xD                                                        | ae=<br>0.04xD<br>ap=<br>0.04xD                                                      | ae=<br>0.1xD<br>ap=<br>0.1xD                                                        | ae=<br>0.035xD<br>ap=<br>0.035xD                                                    | ae=<br>0.1xD<br>ap=<br>0.1xD                                                        | ae=<br>0.05xD<br>ap=<br>0.05xD                                                      | ae=<br>0.09xD<br>ap=<br>0.09xD                                                      | ae=<br>0.04xD<br>ap=<br>0.04xD                                                      | ae=<br>0.1xD<br>ap=<br>0.1xD                                                        | ae=<br>0.08xD<br>ap=<br>0.08xD                                                      |
|     |                |                    | Application     |  |  |  |  |  |  |  |  |  |  |
|     |                |                    | Feed (mm/Z)     | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H   | HARDENED STEEL |                    | Vc (m/min)      |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1 |                | 46-55              | 110             | 0.029                                                                               | 0.025                                                                               | 0.034                                                                               | 0.028                                                                               | 0.036                                                                               | 0.031                                                                               | 0.036                                                                               | 0.031                                                                               | 0.038                                                                               | 0.033                                                                               |
| 1.2 |                | 56-60              | 70              | 0.028                                                                               | 0.024                                                                               | 0.032                                                                               | 0.026                                                                               | 0.035                                                                               | 0.03                                                                                | 0.035                                                                               | 0.03                                                                                | 0.037                                                                               | 0.032                                                                               |
| 1.3 |                | 60-65              | 50              | 0.026                                                                               | 0.022                                                                               | 0.03                                                                                | 0.024                                                                               | 0.033                                                                               | 0.028                                                                               | 0.033                                                                               | 0.028                                                                               | 0.035                                                                               | 0.03                                                                                |
| 1.4 |                | 66-70              | 40              | 0.021                                                                               | 0.017                                                                               | 0.025                                                                               | 0.019                                                                               | 0.028                                                                               | 0.023                                                                               | 0.028                                                                               | 0.023                                                                               | 0.03                                                                                | 0.025                                                                               |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|-----|------------------------------------|---------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |       |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.029 | 0.025 | 0.034 | 0.028 | 0.036 | 0.031 | 0.036 | 0.031 | 0.038 | 0.033 |
| 2.1 | austenitic                         | <650                | 75          | 0.028 | 0.024 | 0.032 | 0.026 | 0.035 | 0.03  | 0.035 | 0.03  | 0.037 | 0.032 |
| 2.2 | austenitic                         | <750                | 70          | 0.026 | 0.022 | 0.03  | 0.024 | 0.033 | 0.028 | 0.033 | 0.028 | 0.035 | 0.03  |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.021 | 0.017 | 0.025 | 0.019 | 0.028 | 0.023 | 0.028 | 0.023 | 0.03  | 0.025 |

| N | COPPER                     |  | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |
|---|----------------------------|--|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) <700 |  | 120        | 0.029 | 0.025 | 0.034 | 0.028 | 0.036 | 0.031 | 0.036 | 0.031 | 0.038 | 0.033 |

| P   | STEEL        |              | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |
|-----|--------------|--------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     | 1.1          | unalloyed    | <500       | 190   | 0.029 | 0.025 | 0.034 | 0.028 | 0.036 | 0.031 | 0.036 | 0.031 | 0.038 |
|     | 1.2-1.5      | unalloyed    | <1100      | 180   | 0.029 | 0.025 | 0.034 | 0.028 | 0.036 | 0.031 | 0.036 | 0.031 | 0.038 |
|     | 2.1-2.2      | low-alloyed  | <950       | 170   | 0.028 | 0.024 | 0.032 | 0.026 | 0.035 | 0.03  | 0.035 | 0.03  | 0.037 |
|     | 2.3-2.4      | low-alloyed  | <1300      | 150   | 0.028 | 0.024 | 0.032 | 0.026 | 0.035 | 0.03  | 0.035 | 0.03  | 0.037 |
|     | 3.1-3.2      | high-alloyed | <1100      | 150   | 0.026 | 0.022 | 0.03  | 0.024 | 0.033 | 0.028 | 0.033 | 0.028 | 0.035 |
| 3.3 | high-alloyed | <1400        | 130        | 0.021 | 0.017 | 0.025 | 0.019 | 0.028 | 0.023 | 0.028 | 0.023 | 0.03  | 0.025 |

| K | CASTINGS |                     | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |
|---|----------|---------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   | 1.1-1.2  | Grey cast iron      | <1000      | 190 | 0.029 | 0.025 | 0.034 | 0.028 | 0.036 | 0.031 | 0.036 | 0.031 | 0.038 |
|   | 2.1-2.2  | Modular cast iron   | <850       | 180 | 0.028 | 0.024 | 0.032 | 0.026 | 0.035 | 0.03  | 0.035 | 0.03  | 0.037 |
|   | 3.1-3.2  | Malleable cast iron | <800       | 170 | 0.028 | 0.024 | 0.032 | 0.026 | 0.035 | 0.03  | 0.035 | 0.03  | 0.037 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

|          |                 |             | Dimension    | Ø1.6 x8                                                                           | Ø1.6 x12                                                                          | Ø1.8 x8                                                                           | Ø1.8 x12                                                                          | Ø2 x3                                                                             | Ø2 x12                                                                             | Ø2.5 x10                                                                            | Ø3 x8                                                                               | Ø3 x16                                                                              |
|----------|-----------------|-------------|--------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |                 |             | Infeed in mm | ae= 0.1xD<br>ap= 0.1xD                                                            | ae= 0.08xD<br>ap= 0.08xD                                                          | ae= 0.1xD<br>ap= 0.1xD                                                            | ae= 0.09xD<br>ap= 0.09xD                                                          | ae= 0.1xD<br>ap= 0.1xD                                                            | ae= 0.09xD<br>ap= 0.09xD                                                           | ae= 0.1xD<br>ap= 0.1xD                                                              | ae= 0.01xD<br>ap= 0.01xD                                                            | ae= 0.1xD<br>ap= 0.1xD                                                              |
|          |                 |             | Application  |  |  |  |  |  |  |  |  |  |
| Material | Hardness in HRC | Feed (mm/Z) | fz           | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                 | fz                                                                                  | fz                                                                                  | fz                                                                                  |
| H        | HARDENED STEEL  | Vc (m/min)  |              |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| 1.1      | 46-55           | 110         | 0.038        | 0.033                                                                             | 0.04                                                                              | 0.037                                                                             | 0.041                                                                             | 0.038                                                                             | 0.041                                                                              | 0.044                                                                               | 0.041                                                                               |                                                                                     |
| 1.2      | 56-60           | 70          | 0.037        | 0.032                                                                             | 0.039                                                                             | 0.036                                                                             | 0.04                                                                              | 0.037                                                                             | 0.04                                                                               | 0.042                                                                               | 0.039                                                                               |                                                                                     |
| 1.3      | 60-65           | 50          | 0.035        | 0.03                                                                              | 0.037                                                                             | 0.034                                                                             | 0.038                                                                             | 0.035                                                                             | 0.038                                                                              | 0.04                                                                                | 0.037                                                                               |                                                                                     |
| 1.4      | 66-70           | 40          | 0.03         | 0.025                                                                             | 0.032                                                                             | 0.029                                                                             | 0.033                                                                             | 0.03                                                                              | 0.033                                                                              | 0.035                                                                               | 0.032                                                                               |                                                                                     |

|          |                                 |       | Strength (N/mm²) | Feed (mm/Z) | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
|----------|---------------------------------|-------|------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Material |                                 |       |                  | Vc (m/min)  |       |       |       |       |       |       |       |       |
| M        | STAINLESS STEEL                 |       |                  | Vc (m/min)  |       |       |       |       |       |       |       |       |
| 1.1      | ferritic/martensitic            | <850  | 90               | 0.038       | 0.033 | 0.04  | 0.037 | 0.041 | 0.038 | 0.041 | 0.044 | 0.041 |
| 2.1      | austenitic                      | <650  | 75               | 0.037       | 0.032 | 0.039 | 0.036 | 0.04  | 0.037 | 0.04  | 0.042 | 0.039 |
| 2.2      | austenitic                      | <750  | 70               | 0.035       | 0.03  | 0.037 | 0.034 | 0.038 | 0.035 | 0.038 | 0.04  | 0.037 |
| 3.1      | DUPLEX STEEL   super austenitic | <1100 | 50               | 0.03        | 0.025 | 0.032 | 0.029 | 0.033 | 0.03  | 0.033 | 0.035 | 0.032 |

| N | COPPER                     | Vc (m/min) |       |       |      |       |       |       |       |       |       |  |
|---|----------------------------|------------|-------|-------|------|-------|-------|-------|-------|-------|-------|--|
|   | Tungsten Copper (WCu) <700 | 120        | 0.038 | 0.033 | 0.04 | 0.037 | 0.041 | 0.038 | 0.041 | 0.044 | 0.041 |  |

| P       | STEEL        | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |
|---------|--------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500       | 190 | 0.038 | 0.033 | 0.04  | 0.037 | 0.041 | 0.038 | 0.041 | 0.044 | 0.041 |
| 1.2-1.5 | unalloyed    | <1100      | 180 | 0.038 | 0.033 | 0.04  | 0.037 | 0.041 | 0.038 | 0.041 | 0.044 | 0.041 |
| 2.1-2.2 | low-alloyed  | <950       | 170 | 0.037 | 0.032 | 0.039 | 0.036 | 0.04  | 0.037 | 0.04  | 0.042 | 0.039 |
| 2.3-2.4 | low-alloyed  | <1300      | 150 | 0.037 | 0.032 | 0.039 | 0.036 | 0.04  | 0.037 | 0.04  | 0.042 | 0.039 |
| 3.1-3.2 | high-alloyed | <1100      | 150 | 0.035 | 0.03  | 0.037 | 0.034 | 0.038 | 0.035 | 0.038 | 0.04  | 0.037 |
| 3.3     | high-alloyed | <1400      | 130 | 0.03  | 0.025 | 0.032 | 0.029 | 0.033 | 0.03  | 0.033 | 0.035 | 0.032 |

| K       | CASTINGS            | Vc (m/min) |     |       |       |       |       |       |       |       |       |       |
|---------|---------------------|------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000      | 190 | 0.038 | 0.033 | 0.04  | 0.037 | 0.041 | 0.038 | 0.041 | 0.044 | 0.041 |
| 2.1-2.2 | Modular cast iron   | <850       | 180 | 0.037 | 0.032 | 0.039 | 0.036 | 0.04  | 0.037 | 0.04  | 0.042 | 0.039 |
| 3.1-3.2 | Malleable cast iron | <800       | 170 | 0.037 | 0.032 | 0.039 | 0.036 | 0.04  | 0.037 | 0.04  | 0.042 | 0.039 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

DO YOU HAVE BLUNT  
MILLING CUTTERS  
THAT URGENTLY NEED  
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REGRINDING SERVICE

... and have your tools reconditioned to their  
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Cooling

Tolerance

d04

Coating

AlphaDura Navy

Strategy

HSC

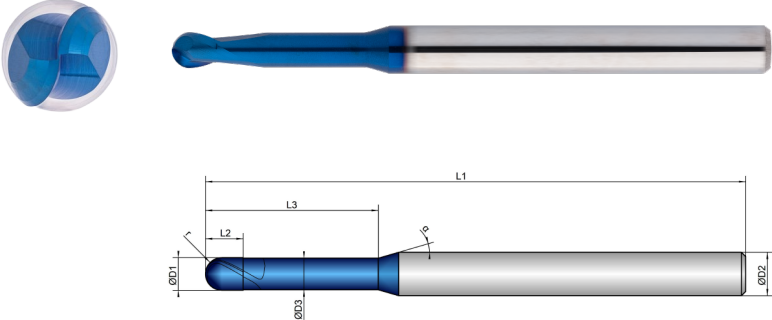
Application

Features

HA

Expert

- Ultrafine carbide grade developed for machining hardened steels
- Optimized face geometry for long tool life and highest dimensional accuracy
- Reinforced core for milling up to 70 HRC

Tolerance D1: -0.001/-0.006 mmTolerance D3: 0/-0.02 mmRadius tolerance r: 0/-0.003 mm (measured from 0-90°)

| Roughing                                                           |  |  |  |  | Finishing                                                          |  |  |  |  |
|--------------------------------------------------------------------|--|--|--|--|--------------------------------------------------------------------|--|--|--|--|
| <div><div></div><div></div><div></div><div></div><div></div></div> |  |  |  |  | <div><div></div><div></div><div></div><div></div><div></div></div> |  |  |  |  |
| inappropriate                                                      |  |  |  |  | inappropriate                                                      |  |  |  |  |
| optimal                                                            |  |  |  |  | optimal                                                            |  |  |  |  |

| K203212  | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|----------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 0,3X1,75 | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 1.75                                                                                           | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X2    | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 2.0                                                                                            | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X2,25 | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 2.25                                                                                           | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X2,5  | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 2.5                                                                                            | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X2,75 | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 2.75                                                                                           | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X3    | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 3.0                                                                                            | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X3,5  | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 3.5                                                                                            | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X4    | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 4.0                                                                                            | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,3X4,5  | 0.3                                                                                                 | 0.27                                                                                                 | 0.24                                                                                           | 4.5                                                                                            | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.15                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,5X10   | 0.5                                                                                                 | 0.47                                                                                                 | 0.4                                                                                            | 10.0                                                                                           | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.25                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,6X10   | 0.6                                                                                                 | 0.57                                                                                                 | 0.48                                                                                           | 10.0                                                                                           | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.30                                                                                             | 30                                                                                        | 16                                                                                             |
| 0,6X12   | 0.6                                                                                                 | 0.57                                                                                                 | 0.48                                                                                           | 12.0                                                                                           | 50.0                                                                                           | 4.0                                                                                                  | 2                                                                                             | 0.30                                                                                             | 30                                                                                        | 16                                                                                             |

| K203212 | D1<br><br>mm<br>ø | D3<br><br>mm<br>ø | L2<br><br>mm | L3<br><br>mm | L1<br><br>mm | D2<br><br>mm<br>ø | z<br><br># | r<br><br>mm | <br>° | α<br><br>° |
|---------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 0,8X10  | 0.8                                                                                                  | 0.77                                                                                                 | 0.64                                                                                            | 10.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.40                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X14    | 1.0                                                                                                  | 0.96                                                                                                 | 0.8                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1X16    | 1.0                                                                                                  | 0.96                                                                                                 | 0.8                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.50                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,2X14  | 1.2                                                                                                  | 1.16                                                                                                 | 0.96                                                                                            | 14.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.60                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,2X16  | 1.2                                                                                                  | 1.16                                                                                                 | 0.96                                                                                            | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.60                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,4X16  | 1.4                                                                                                  | 1.34                                                                                                 | 1.12                                                                                            | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.70                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X14  | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,5X16  | 1.5                                                                                                  | 1.44                                                                                                 | 1.2                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.75                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,6X16  | 1.6                                                                                                  | 1.54                                                                                                 | 1.28                                                                                            | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.80                                                                                           | 30                                                                                       | 16                                                                                            |
| 1,8X16  | 1.8                                                                                                  | 1.74                                                                                                 | 1.44                                                                                            | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 0.90                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X14    | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 14.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2X16    | 2.0                                                                                                  | 1.94                                                                                                 | 1.6                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.00                                                                                           | 30                                                                                       | 16                                                                                            |
| 2,5X15  | 2.5                                                                                                  | 2.41                                                                                                 | 2.0                                                                                             | 15.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.25                                                                                           | 30                                                                                       | 16                                                                                            |
| 3X16    | 3.0                                                                                                  | 2.92                                                                                                 | 3.5                                                                                             | 16.0                                                                                            | 50.0                                                                                            | 4.0                                                                                                  | 2                                                                                             | 1.50                                                                                           | 30                                                                                       | 16                                                                                            |

|             | Material       | Hardness<br>in HRC | Dimension       | Ø0.3 x1.75                                                                        | Ø0.3 x4.5                                                                         | Ø0.5 x10                                                                          | Ø0.6 x10                                                                          | Ø0.6 x12                                                                          | Ø0.8 x10                                                                            | Ø1 x14                                                                              | Ø1 x16                                                                              | Ø1.2 x14                                                                            | Ø1.2 x16                                                                            |
|-------------|----------------|--------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|             |                |                    | Infeed<br>in mm | ae=0.09xD                                                                         | ae=0.03xD                                                                         | ae=0.01xD                                                                         | ae=0.01xD                                                                         | ae=0.01xD                                                                         | ae=0.035xD                                                                          | ae=0.02xD                                                                           | ae=0.01xD                                                                           | ae=0.035xD                                                                          | ae=0.03xD                                                                           |
|             |                |                    |                 | ap=0.09xD                                                                         | ap=0.03xD                                                                         | ap=0.01xD                                                                         | ap=0.01xD                                                                         | ap=0.01xD                                                                         | ap=0.035xD                                                                          | ap=0.02xD                                                                           | ap=0.01xD                                                                           | ap=0.035xD                                                                          | ap=0.03xD                                                                           |
|             |                |                    | Application     |  |  |  |  |  |  |  |  |  |  |
| Feed (mm/Z) | fz             | fz                 | fz              | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                | fz                                                                                  | fz                                                                                  | fz                                                                                  | fz                                                                                  |                                                                                     |
| H           | HARDENED STEEL | Vc (m/min)         |                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| 1.1         | 46-55          | 110                | 0.021           | 0.018                                                                             | 0.018                                                                             | 0.018                                                                             | 0.02                                                                              | 0.022                                                                             | 0.024                                                                               | 0.022                                                                               | 0.026                                                                               | 0.024                                                                               |                                                                                     |
| 1.2         | 56-60          | 70                 | 0.02            | 0.017                                                                             | 0.017                                                                             | 0.017                                                                             | 0.019                                                                             | 0.021                                                                             | 0.023                                                                               | 0.021                                                                               | 0.025                                                                               | 0.023                                                                               |                                                                                     |
| 1.3         | 60-65          | 50                 | 0.019           | 0.016                                                                             | 0.016                                                                             | 0.016                                                                             | 0.018                                                                             | 0.02                                                                              | 0.022                                                                               | 0.02                                                                                | 0.024                                                                               | 0.022                                                                               |                                                                                     |
| 1.4         | 66-70          | 40                 | 0.016           | 0.011                                                                             | 0.013                                                                             | 0.013                                                                             | 0.014                                                                             | 0.016                                                                             | 0.018                                                                               | 0.016                                                                               | 0.02                                                                                | 0.018                                                                               |                                                                                     |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | Strength |       |       |       |       |       |       |       |       |       |
|-----|------------------------------------|---------------------|-------------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |                                    |                     |             | fz       | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |          |       |       |       |       |       |       |       |       |       |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.021    | 0.018 | 0.018 | 0.018 | 0.02  | 0.022 | 0.024 | 0.022 | 0.026 | 0.024 |
| 2.1 | austenitic                         | <650                | 75          | 0.02     | 0.017 | 0.017 | 0.017 | 0.019 | 0.021 | 0.023 | 0.021 | 0.025 | 0.023 |
| 2.2 | austenitic                         | <750                | 70          | 0.019    | 0.016 | 0.016 | 0.016 | 0.018 | 0.02  | 0.022 | 0.02  | 0.024 | 0.022 |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.016    | 0.011 | 0.013 | 0.013 | 0.014 | 0.016 | 0.018 | 0.016 | 0.02  | 0.018 |

| N | COPPER                |      | Vc (m/min) |       |       |       |       |      |       |       |       |       |       |
|---|-----------------------|------|------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|
|   | Tungsten Copper (WCu) | <700 | 120        | 0.021 | 0.018 | 0.018 | 0.018 | 0.02 | 0.022 | 0.024 | 0.022 | 0.026 | 0.024 |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1     | unalloyed    | <500  | 190        | 0.021 | 0.018 | 0.018 | 0.018 | 0.02  | 0.022 | 0.024 | 0.022 | 0.026 | 0.024 |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.021 | 0.018 | 0.018 | 0.018 | 0.02  | 0.022 | 0.024 | 0.022 | 0.026 | 0.024 |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.02  | 0.017 | 0.017 | 0.017 | 0.019 | 0.021 | 0.023 | 0.021 | 0.025 | 0.023 |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.02  | 0.017 | 0.017 | 0.017 | 0.019 | 0.021 | 0.023 | 0.021 | 0.025 | 0.023 |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.019 | 0.016 | 0.016 | 0.016 | 0.018 | 0.02  | 0.022 | 0.02  | 0.024 | 0.022 |
| 3.3     | high-alloyed | <1400 | 130        | 0.016 | 0.011 | 0.013 | 0.013 | 0.014 | 0.016 | 0.018 | 0.016 | 0.02  | 0.018 |

| K       | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |       |
|---------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.1-1.2 | Grey cast iron      | <1000 | 190        | 0.021 | 0.018 | 0.018 | 0.018 | 0.02  | 0.022 | 0.024 | 0.022 | 0.026 | 0.024 |
| 2.1-2.2 | Modular cast iron   | <850  | 180        | 0.02  | 0.017 | 0.017 | 0.017 | 0.019 | 0.021 | 0.023 | 0.021 | 0.025 | 0.023 |
| 3.1-3.2 | Malleable cast iron | <800  | 170        | 0.02  | 0.017 | 0.017 | 0.017 | 0.019 | 0.021 | 0.023 | 0.021 | 0.025 | 0.023 |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

|     | Material       | Hardness<br>in HRC | Dimension       |       |       |       |       |       |       |       |       |       |
|-----|----------------|--------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |                |                    | Infeed<br>in mm |       |       |       |       |       |       |       |       |       |
|     |                |                    | Application     |       |       |       |       |       |       |       |       |       |
|     |                |                    | Feed (mm/Z)     | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    |
| H   | HARDENED STEEL |                    | Vc (m/min)      |       |       |       |       |       |       |       |       |       |
| 1.1 |                | 46-55              | 110             | 0.026 | 0.03  | 0.028 | 0.03  | 0.032 | 0.034 | 0.032 | 0.037 | 0.038 |
| 1.2 |                | 56-60              | 70              | 0.025 | 0.028 | 0.026 | 0.028 | 0.03  | 0.032 | 0.03  | 0.035 | 0.036 |
| 1.3 |                | 60-65              | 50              | 0.024 | 0.026 | 0.024 | 0.026 | 0.028 | 0.03  | 0.028 | 0.033 | 0.034 |
| 1.4 |                | 66-70              | 40              | 0.02  | 0.022 | 0.021 | 0.023 | 0.025 | 0.027 | 0.025 | 0.03  | 0.031 |

|     | Material                           | Strength<br>(N/mm²) | Feed (mm/Z) | Strength |       |       |       |       |       |       |       |       |    |
|-----|------------------------------------|---------------------|-------------|----------|-------|-------|-------|-------|-------|-------|-------|-------|----|
|     |                                    |                     |             | fz       | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz    | fz |
| M   | STAINLESS STEEL                    |                     | Vc (m/min)  |          |       |       |       |       |       |       |       |       |    |
| 1.1 | ferritic/martensitic               | <850                | 90          | 0.026    | 0.03  | 0.028 | 0.03  | 0.032 | 0.034 | 0.032 | 0.037 | 0.038 |    |
| 2.1 | austenitic                         | <650                | 75          | 0.025    | 0.028 | 0.026 | 0.028 | 0.03  | 0.032 | 0.03  | 0.035 | 0.036 |    |
| 2.2 | austenitic                         | <750                | 70          | 0.024    | 0.026 | 0.024 | 0.026 | 0.028 | 0.03  | 0.028 | 0.033 | 0.034 |    |
| 3.1 | DUPLEX STEEL  <br>super austenitic | <1100               | 50          | 0.02     | 0.022 | 0.021 | 0.023 | 0.025 | 0.027 | 0.025 | 0.03  | 0.031 |    |

| N | COPPER                |      | Vc (m/min) |       |      |       |      |       |       |       |       |       |  |
|---|-----------------------|------|------------|-------|------|-------|------|-------|-------|-------|-------|-------|--|
|   | Tungsten Copper (WCu) | <700 | 120        | 0.026 | 0.03 | 0.028 | 0.03 | 0.032 | 0.034 | 0.032 | 0.037 | 0.038 |  |

| P       | STEEL        |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |  |
|---------|--------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| 1.1     | unalloyed    | <500  | 190        | 0.026 | 0.03  | 0.028 | 0.03  | 0.032 | 0.034 | 0.032 | 0.037 | 0.038 |  |
| 1.2-1.5 | unalloyed    | <1100 | 180        | 0.026 | 0.03  | 0.028 | 0.03  | 0.032 | 0.034 | 0.032 | 0.037 | 0.038 |  |
| 2.1-2.2 | low-alloyed  | <950  | 170        | 0.025 | 0.028 | 0.026 | 0.028 | 0.03  | 0.032 | 0.03  | 0.035 | 0.036 |  |
| 2.3-2.4 | low-alloyed  | <1300 | 150        | 0.025 | 0.028 | 0.026 | 0.028 | 0.03  | 0.032 | 0.03  | 0.035 | 0.036 |  |
| 3.1-3.2 | high-alloyed | <1100 | 150        | 0.024 | 0.026 | 0.024 | 0.026 | 0.028 | 0.03  | 0.028 | 0.033 | 0.034 |  |
| 3.3     | high-alloyed | <1400 | 130        | 0.02  | 0.022 | 0.021 | 0.023 | 0.025 | 0.027 | 0.025 | 0.03  | 0.031 |  |

| K       | CASTINGS            |       | Vc (m/min) |       |       |       |       |       |       |       |       |       |  |
|---------|---------------------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| 1.1-1.2 | Grey cast iron      | <1000 | 190        | 0.026 | 0.03  | 0.028 | 0.03  | 0.032 | 0.034 | 0.032 | 0.037 | 0.038 |  |
| 2.1-2.2 | Modular cast iron   | <850  | 180        | 0.025 | 0.028 | 0.026 | 0.028 | 0.03  | 0.032 | 0.03  | 0.035 | 0.036 |  |
| 3.1-3.2 | Malleable cast iron | <800  | 170        | 0.025 | 0.028 | 0.026 | 0.028 | 0.03  | 0.032 | 0.03  | 0.035 | 0.036 |  |

**ADVICE |** The values marked in turquoise are side applications!  
Values in the table are the shortest and the longest overhang length (L3) of each dimension;  
Please calculate fz, ap and ae depending on the given values.

# EXPLANATION

APPLICATIONS

|                                                                                                     |                                                                                                     |                                                                                                                  |                                                                                               |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|  Multipass milling |  Trimming          |  Deburring                      |  Engraving |
|  Corner rounding   |  Full slot milling |  Forward and backward deburring |                                                                                               |

COOLINGS

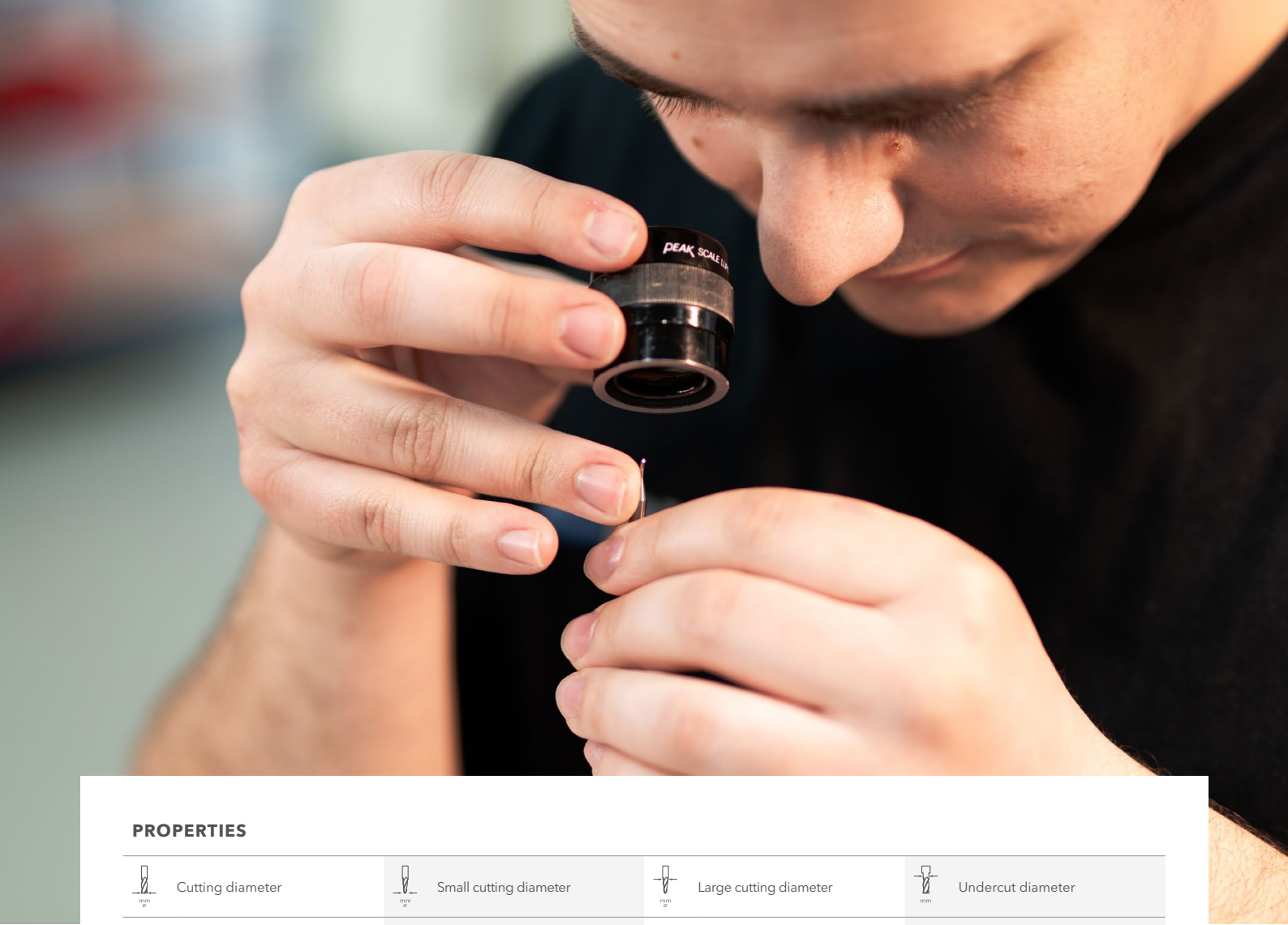
|                                                                                                                  |                                                                                                  |                                                                                                |                                                                                                        |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
|  Air-cooling                   |  Dry machining |  Oil cooling |  Cooling Lubricant |
|  Minimum quantity lubrication |                                                                                                  |                                                                                                |                                                                                                        |

FEATURES

|                                                                                                             |                     |                                                                                                               |     |                                                                                                           |       |                                                                                                           |                |
|-------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------|----------------|
|  0,5xD                   | 0,5xD               |  1xD                       | 1xD |  1,5xD                 | 1,5xD |  2xD                 | 2xD            |
|  2,5xD                   | 2,5xD               |  3xD                       | 3xD |  3,5xD                 | 3,5xD |  4xD                 | 4xD            |
|  5xD                     | 5xD                 |  Center cutting            |     |  Non-center cutting    |       |  HA                  | Without Weldon |
|  HB                      | With Weldon         |  Internal cooling          |     |  Dynamic helical pitch |       |  Chip breaker        |                |
|  ≠                       | Unequal tooth pitch |  Roughing teeth            |     |  Helical immersion     |       |  Feed directions x,y |                |
|  Feed directions x, y, z |                     |  Feed directions x, y, (z) |     |  Corner radius         |       |  45°                 | Corner bevel   |
|  90°                     | Sharp edged         |  60° Tip                   |     |  90° Tip               |       |  140°                | 140° Tip       |

STRATEGY

|                                                                                         |                             |                                                                                         |                          |                                                                                         |                    |                                                                                           |                   |
|-----------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------|-------------------|
|  ETC | Extended Trochoidal Cutting |  HPC | High Performance Cutting |  HSC | High Speed Cutting |  HFC | High Feed Cutting |
|  MTC | Multi Task Cutting          |  UNI | Universal Machining      |                                                                                         |                    |                                                                                           |                   |



PROPERTIES

|                                                                                                          |                                                                                                             |                                                                                                             |                                                                                                        |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
|  Cutting diameter    |  Small cutting diameter |  Large cutting diameter |  Undercut diameter |
|  Cutting length     |  Total bevel length    |  Undercut length       |  Total length     |
|  Shank diameter     |  Number of teeth       |  Corner radius         |  Corner bevel     |
|  Programming radius |  Maximum cutting depth |  Helical angle         |  Alpha angle      |

APPLICATION TABLE

The values given in the application table are only guidelines. These values are largely dependent on the machining situation and application.

FIGURES

All technical drawings and photographs are given as an example. The product may deviate from the original in terms of colour and dimensions.

H 1.1-1.4 **HARDENED STEEL | 46-70 HRC**

| Materialnumber | Germany   DIN   | Europe   EN     | France   AFNOR       | Great Britain   BS | Italy   UNI         | Sweden   SIS | Spain   UNE    | Japan   JIS | USA   AISI |
|----------------|-----------------|-----------------|----------------------|--------------------|---------------------|--------------|----------------|-------------|------------|
| 1.2311         | 40CrMnMo7       |                 |                      | BP 20              | 35 CrMo 8 KU        |              |                |             | P 20       |
| 1.2312         | 40CrMnMoS86     |                 | 40 CMD 8             |                    |                     |              |                |             |            |
| 1.2316         | X36CrMo17       | X 36 CrMo 17    | X38CrMo 16 1         |                    | X 38 CrMo 16 1 KU   |              | X 38 CrMo 16   |             | D-4        |
| 1.2365         | X32CrMoV33      | X 32CrMOV 12 28 | 32 DCV 28            | BH 10              | 30 CrMoV 12 27 KU   |              | F.5313         | SKD 7       | H 10       |
| 1.2567         | X30WCrV53       | X 30 WCrV 5 3   | Z 32 WCV 5           |                    | X 30 WCrV 5 3 KU    |              |                | SKD 4       |            |
| 1.2581         | X30WCrV93       | X 30 WCrV 9 3   | Z 30 WCV 9           | BH 21              | X 30 WCrV 9 3 KU    |              | X 30 WCrV 9    | SKD 5       | H 21       |
| 1.2738         | 40CrMnNiMo864   |                 | 40 CMND 8            |                    |                     |              | F.5303         |             |            |
| 1.2885         | X32CrMoCoV333   |                 | 30 DCKV 28           |                    |                     |              |                |             |            |
| 1.4028         | X30Cr13         | X 30 Cr 13      | Z 30 Cr 13           | 420 S 45           | X 30 Cr 13          | 2304         | X 30 Cr 13     | SUS 420 J2  | 420        |
| 1.4031         | X40Cr13         | X 40 Cr 13      | Z 40 C 14            |                    | X 40 Cr 14          | 2304         | X 40 Cr 13     | SUS 420     | 420        |
| 1.4034         | X45Cr13         | X 45 Cr 13      | Z 40 C 14            | 420 S 45           | X 40 Cr 14          |              | X 46 Cr 13     |             | 420        |
| 1.4112         | X90CrMoV18      | X 90 CrMoV 18   | Z 3 CT 1 2           | 409 S 1 9          | X 6 Cr Ti 1 2       |              |                | SUS 440 B   | 440 B      |
| 1.5122         | 37 MnSi 4       |                 | 38 MS 5              |                    |                     |              |                |             |            |
| 1.6358         | X2NiCoMoTi 1895 |                 |                      |                    |                     |              |                |             |            |
| 1.6582         | 34CrNiMo6       |                 | 35 NCD 6             | 817 M 40           | 35 NiCrMo 6 (KW)    | 2541         | F.1270         | SNCM 447    | 4340       |
| 1.7003         | 38 Cr 2         |                 | 38 C 2               | 120 M 36           | 38 Cr 2             |              | F.1200         |             |            |
| 1.7006         | 46 Cr 2         |                 | 45 C 2               |                    | 4 5Cr 2             |              |                |             | 5045       |
| 1.7030         | 28 Cr 4         |                 |                      | 530 A 30           |                     |              |                |             | 5130       |
| 1.7176         | 55 Cr 3         |                 | 55 C 3               | 525 A 58           | 55 Cr 3             | 2253         | F.1431         | SUP 9       | 5155       |
| 1.0961         | 60SiCr7         | 60 SiCr 8       | 60 SC 7              | 250 A 61           | 60 SiCr 8           |              | 60 SiCr 8      | SUP 7       | 9262       |
| 1.1248         | Ck 75           |                 | XC 75                | 060 A 78           |                     | 1774         |                |             | 1078       |
| 1.1273         | 90Mn4           |                 |                      | 060 A 96           |                     |              |                | SUP 4       | 1090       |
| 1.2083         | X42Cr13         | X 42 Cr 13      | Z 40 C 14            |                    | X 41 Cr 13 KU       | 2314         |                | SUS 420 J2  | 420        |
| 1.2323         | 48CrMoV67       |                 | 45 CDV 6             |                    |                     |              |                |             |            |
| 1.2343         | X38CrMoVH1      | X 38 CrMoV 5 1  | Z 38 CDV 5           | BH 11              | X 37 CrMoV 5 1 KU   |              | X 37 CrMoV 5   | SKD 6       | H 11       |
| 1.2367         | X38CrMoV53      |                 | Z 38 CDV 5 3         |                    |                     |              |                |             |            |
| 1.2510         | 100 MnCrW 4     |                 | 90 MWCV 5            | B0 1               | 95 MnWCr 5 KU       | 2140         | F.5220         | SKS 3       | 0 1        |
| 1.2542         | 45WCrV7         | 45 WCrV 8       |                      | BS 1               | 45 WCrV 8 KU        | 2710         | 45 WCrSi 8     |             | S1         |
| 1.2550         | 60 WCrV 7       |                 | 55 WC 20             |                    | 55 WCrV 8 KU        |              |                |             |            |
| 1.2606         | X37CrMoW51      |                 | Z 35 CWDV 5          | BH 12              | X 35 CrMoW 05 KU    |              | F.537          | SKD 62      | H 12       |
| 1.2711         | 54 NiCrMoV      |                 | 55 NCDV 6            |                    |                     |              |                |             |            |
| 1.2713         | 55 NiCrMoV 6    |                 | 55 NCDV 7            |                    |                     |              | F.520.S        | SKT 4       | L 6        |
| 1.2764         | X19NiCrMo4      |                 |                      |                    |                     |              |                |             |            |
| 1.2767         | X45NiCrMo4      | 40 NiCrMo 4     | Y 35 NCD 16          |                    | 42 NiCrMo 15 7 KU   |              |                |             | A 9        |
| 1.4109         | X65CrMo14       | X 70 CrMo 15    | Z 70 CD 14           |                    |                     |              |                | SUS 440 A   | 440 A      |
| 1.1157         | 40Mn4           |                 | 35 M 5               | 150 M 36           |                     |              |                |             | 1039       |
| 1.1231         | Ck 67           |                 | XC 68                | 060 A 67           | C 70                | 1770         |                |             | 1070       |
| 1.1274         | Ck 101          |                 | XC 100               | 060 A 96           |                     | 1870         |                | SUP 4       | 1095       |
| 1.2080         | X210Cr12        |                 | Z 200 C 12           |                    | X 210 Cr 13 KU      |              |                | SKD 1       | D 3        |
| 1.2101         | 62SiMnCr4       |                 |                      |                    |                     |              |                |             |            |
| 1.2162         | 21MnCr5         | 21 MnCr 5       | 20 NC 5              |                    |                     |              |                | SCR 420 H   |            |
| 1.2201         | X165CrV12       |                 |                      |                    |                     |              |                |             |            |
| 1.2210         | 115CrV3         | 107 CrV 3 KU    | 100 C 3              |                    | 107 CrV 3 KU        |              | F.520.L        |             | L2         |
| 1.2341         | X6CrMo4         |                 |                      |                    |                     |              |                |             |            |
| 1.2379         | X155CrVMo121    | X 153 CrMoV 12  | Z 160 CDV 12         | BD 2               | X 155 CrVMo 12 1 KU | 2310         |                | SKD 11      | D 2        |
| 1.2419         | 105WCr6         | 105 WCr 5       | 105 WC 13            |                    | 107 WeR 5 KU        | 2140         | 105 WCr 5      | SKS 31      |            |
| 1.2601         | X165CrMoV12     | X 165 CrMoV 12  |                      |                    | X 165 CrMoW 12 KU   | 2310         | X 160 CrMoV 12 |             |            |
| 1.2721         | 50NiCr13        |                 |                      |                    |                     |              |                |             |            |
| 1.2735         | 15NiCr14        |                 | 10 NC 12             |                    |                     |              |                | SNC 22      |            |
| 1.2833         | 100V1           |                 | Y1 105 V             | BW 2               | 102 V 2 KU          |              |                | SKS 43      | W 210      |
| 1.2842         | 90MnCrV8        | 90 MnV 8        | 90 MV 8              | BO 2               | 90 MnVCr 8 KU       |              |                |             | 0 2        |
| 1.3505         | 100Cr6          |                 | 100 C 6              | 534 A 99           | 100 Cr 6            | 2258         | F.1310         | SUJ 2       | 52100      |
| 1.4125         | X105CrMo17      |                 | Z 100 CD 17          |                    | X 105 CrMo 17       |              |                | SUS 440 C   | 440 C      |
| 1.8161         | 58CrV4          |                 |                      |                    |                     |              |                |             |            |
| 1.1520         | C70W1           |                 |                      |                    |                     |              |                |             |            |
| 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  | SKD 12      | A 2        |
| 1.2436         | X210CrW12       | X 210 CrW 12    | Z 210 CW1 2          |                    | X 215 CrW 12 1 KU   | 2312         | X 210 CrW 12   | SKD 2       |            |
| 1.2880         | X165CrCoMo12    |                 |                      |                    |                     |              |                |             |            |
| 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      | SKH 57      | M 44       |
| 1.3243         | S6525           | HS6-5-2-5       | KCV 06-05-05-04-02   |                    | HS 6-5-2-5          | 2723         | 6-5-2-5        | SKH 55      | M 35       |
| 1.3246         | S7425           | HS1-8-1         | Z110 WKCDV 07-05-04  | T 11341            | 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        |             |            |

| Materialnumber | Germany   DIN | Europe   EN | France   AFNOR        | Great Britain   BS | Italy   UNI | Sweden   SIS | Spain   UNE | Japan   JIS | USA   AISI |
|----------------|---------------|-------------|-----------------------|--------------------|-------------|--------------|-------------|-------------|------------|
| 1.3257         | S181215       |             |                       |                    |             |              |             |             |            |
| 1.3333         | S332          | HS 3-3-2    |                       |                    | HS 3-3-2    |              |             |             |            |
| 1.3343         | S652          | HS6-5-3     | Z85 WDCV 06-05-04-02  | BM 2               | HS 6-5-2    | 2722         | 6-5-2       | SKH 51      | M2         |
| 1.3344         | S653          |             | Z120 WDCV 06-05-04-03 |                    |             |              | 6-5-3       | SKH 52      | M 3 Cl.2   |
| 1.3346         | S291          | HS1-8-1     | Z85 DCWV 08-04-02-01  | BM 1               | HS 1-8-1    |              |             |             | M1         |
| 1.3348         | S292          | HS2-9-2     | Z100 DCWV 09-04-02-02 |                    | HS 2-9-2    | 2782         | 2-9-2       |             | M 7        |
| 1.3355         | S1801         | HS18-0-1    | Z80 WCV 18-04-01      | BT 1               | HS 18-0-1   |              | 18-0-1      | SKH 2       | T 1        |
| 1.1654         | C 110 W       |             |                       |                    |             |              |             |             |            |

Technical formulas

Calculate cutting speed (m/min)

$$V_c = \frac{D \cdot \pi \cdot n}{1000}$$

Explanation of terms

Vc Cutting speed in m/min

Calculate rotational speed (rpm)

$$n = \frac{V_c \cdot 1000}{D \cdot \pi}$$

n Rotational speed in rpm

Calculate feed rate (mm/min)

$$V_f = n \cdot z \cdot f_z$$

Vf Feed rate in mm/min

Calculate feed per tooth (mm/number of teeth)

$$f_z = \frac{V_f}{n \cdot z}$$

Fz Feed per tooth in mm/number of teeth

z Number of teeth (cutting)

Calculate chip removal rate (cm³/min)

$$Q = \frac{a_p \cdot a_e \cdot V_f}{1000}$$

ap Depth of cut in mm

ae Width of cut in mm

hm Average chip thickness in mm

Calculate average chip thickness (mm)

$$h_m = f_z \cdot \frac{\sqrt{a_e}}{D}$$

Q Chip removal rate in cm³/min

D Diameter of tool in mm



CONVERSION TABLE STRENGTH HARDNESS

| Material              |                                        | Strength<br>(N/mm²) | Hardness<br>(HRC) | Hardness<br>(HB) |
|-----------------------|----------------------------------------|---------------------|-------------------|------------------|
| P (Steel)             |                                        |                     |                   |                  |
| 1.1                   | STEEL   unalloyed                      | <500                | <15,2             | <147             |
| 1.2-1.5               | STEEL   unalloyed                      | <1100               | <33,5             | <325             |
| 2.1-2.2               | STEEL   low-alloyed                    | <950                | <28,8             | <280             |
| 2.3-2.4               | STEEL   low-alloyed                    | <1300               | <40               | <385             |
| 3.1-3.2               | STEEL   high-alloyed                   | <1100               | <33,5             | <325             |
| 3.3                   | STEEL   high-alloyed                   | <1400               | <44               | <410             |
| K (Castings)          |                                        |                     |                   |                  |
| 1.1-1.2               | CASTINGS   Grey cast iron              | <1000               | <30               | <295             |
| 2.1-2.2               | CASTINGS   Modular cast iron           | <850                | <25               | <250             |
| 3.1-3.2               | CASTINGS   Malleable cast iron         | <800                | <24               | <235             |
| M (Stainless Steel)   |                                        |                     |                   |                  |
| 1.1                   | STAINLESS STEEL   ferritic/martensitic | <850                | <25               | <250             |
| 2.1                   | STAINLESS STEEL   austenitic           | <650                | <20               | <190             |
| 2.2                   | STAINLESS STEEL   austenitic           | <750                | <22               | <220             |
| 3.1                   | DUPLEX STEEL   super austenitic        | <1100               | <33,5             | <325             |
| N (Non-Ferrous Metal) |                                        |                     |                   |                  |
| 1.1                   | ALUMINIUM   alloyed                    | <500                | <15,2             | <147             |
| 1.2                   | ALUMINIUM   alloyed                    | <600                | <18,2             | <177             |
| 2.1-2.3               | ALUMINIUM   casted                     | <600                | <18,2             | <177             |
| 3.1-3.3               | COPPER   alloyed                       | <650                | <20               | <190             |
| 4.1                   | MAGNESIUM   alloyed                    | <250                | <7,5              | <76              |
| 5.1                   | PLASTICS   thermoplastic               | <100                | 0                 | 0                |
| 5.2                   | PLASTICS   duroplastic                 | <150                | 0                 | 0                |
| S (Superalloys)       |                                        |                     |                   |                  |
| 1.1                   | IRON-BASED ALLOY   HRSA                | <1200               | <36               | <355             |
| 1.2                   | NICKEL-BASED ALLOY   HRSA              | <1450               | <45               | <425             |
| 1.3                   | COBALT-BASED ALLOY   HRSA              | <1450               | <45               | <425             |
| T (Titanium)          |                                        |                     |                   |                  |
| 2.1-2.2               | TITANIUM   pure; alloyed               | <1000               | <30               | <295             |
| 2.3                   | TITANIUM   alloyed                     | <1400               | <44               | <410             |

GENERAL TERMS OF SALE

§ 1 SCOPE

1. These General Terms of Sale apply to all business relationships between Hofmann & Vratny OHG (hereinafter referred to as “Hofmann & Vratny”) and its customers (hereinafter referred to individually as the “Ordering Party” and collectively as the “Ordering Parties”).

2. These General Terms of Sale only apply to Ordering Parties that are entrepreneurs pursuant to §§ 14 and 310 para. 1 of the BGB (Civil Code of Germany), legal entities under public law, and/or special funds under public law.

3. The scope of application of these General Terms of Sale includes, but is not limited to, contracts regarding the sale and/or delivery of chattels (hereinafter referred to as “Goods”) regardless of whether they are produced by Hofmann & Vratny or procured from suppliers (§§ 433 and 651 of the BGB). Unless agreed upon otherwise, the version of these General Terms of Sale applicable at the time the Ordering Party places an order and in any case the most recent version of these General Terms of Sale provided to the Ordering Party in writing in the form of a master agreement also shall apply to similar contracts made at a later date without Hofmann & Vratny being required to make reference to them in every individual case.

4. These General Terms of Sale shall apply exclusively. These General Terms of Sale also shall apply if and when Hofmann & Vratny executes a delivery without reservation despite having knowledge of the Ordering Party's terms of sale which contradict or deviate from these General Terms of Sale. Any of the Ordering Party's terms of sale which contradict or deviate from these General Terms of Sale shall become part of a contract only with Hofmann & Vratny's express prior consent. Such requirement to consent shall apply in any case even, for example, if the Ordering Party refers to its terms of sale as part of an order placement and Hofmann & Vratny does not object explicitly to such terms.

5. If Hofmann & Vratny and the Ordering Party have entered into any individual agreements, such individual agreements shall prevail over these General Terms of Sale. The content of such individual agreements only can be substantiated by a written contract or by written confirmation from Hofmann & Vratny. Individual agreements (e.g., outline delivery contracts, quality assurance agreements) and information provided in Hofmann & Vratny's order confirmation shall prevail over these General Terms of Sale. In case of doubt, commercial clauses shall be interpreted based on the Incoterms® issued by the International Chamber of Commerce in Paris (ICC) and applicable at the time the contract is entered into.

6. All of the Ordering Party's legal declarations and notifications made with regard to the contract (e.g., in connection with deadlines or notices of defects, rescission, or reduction) shall be made in writing to be effective. In the context of these General Terms of Sale, in writing shall include written and text forms (e.g., letters, e-mails, faxes). Legal requirements regarding form and other verifications including, but not limited to, cases of doubt regarding the legitimation of the notifying party shall remain unaffected.

7. All references to applicable laws shall be for the purpose of clarification only. Unless amended in or excluded expressly from these General Terms of Sale, laws shall apply even without express reference.

§ 2 OFFERS AND ACCEPTANCE

1. All offers made by Hofmann & Vratny shall be subject to change and shall be non-binding including if and when images, drawings, technical documentation, calculations, analyses, other documents or product descriptions of whatever nature (hereinafter referred to as “Documents”) are provided to the Ordering Party if the proprietary rights and copyrights to those Documents are retained by Hofmann & Vratny.

2. All orders for Goods placed by the Ordering Party shall constitute binding offers. Unless stated otherwise in the respective order, Hofmann & Vratny shall be entitled to accept an offer within two weeks after receipt of said offer.

3. Hofmann & Vratny shall accept offers in writing (e.g., in the form of an order confirmation) or by delivering the respective Goods to the Ordering Party.

4. All proprietary rights and copyrights to Documents shall remain with Hofmann & Vratny. Documents marked as confidential shall be forwarded to third parties only with the express written consent of Hofmann & Vratny.

§ 3 DELIVERY DEADLINES AND DEFAULT OF DELIVERY

1. Delivery deadlines shall be agreed upon by Hofmann & Vratny and the individual Ordering Party or shall be specified by Hofmann & Vratny upon acceptance of the order or in the order confirmation.

2. Hofmann & Vratny's compliance with delivery obligations shall be conditional upon the Ordering Party's on-time and proper compliance with the Ordering Party's obligations including, but not limited to, the provision of the papers, permits and approvals required to be provided by the Ordering Party and the receipt by Hofmann & Vratny of the agreed-upon down payment, if any. In the event of delays, the delivery time shall be extended reasonably.

3. If Hofmann & Vratny is unable to meet any binding delivery deadlines for reasons beyond the control of Hofmann & Vratny (non-availability of services), the Ordering Party shall be notified without undue delay and shall be provided with an estimated new delivery deadline. If the agreed upon Goods do not become available before the new deadline expires, Hofmann & Vratny shall be entitled to rescind the contract in whole or in part and shall reimburse the Ordering Party without undue delay for any and all consideration paid up to that time. For the fulfillment of this clause, non-availability of services shall include, but shall not be limited to, delayed delivery from any of Hofmann & Vratny's suppliers for reasons beyond the control of Hofmann & Vratny or its suppliers, or if Hofmann & Vratny is not responsible for procuring the Goods.

4. If failure to comply with a delivery deadline is due to an act of God, industrial dispute or other event beyond the control of Hofmann & Vratny, the delivery time shall be extended reasonably. The same shall apply if and when any such act of God, industrial dispute or other event has arisen at any of Hofmann & Vratny's sub-suppliers which event can be demonstrated to have had an impact on compliance with the delivery deadline. Hofmann & Vratny shall notify the Ordering Party of such circumstances without undue delay. Events also shall be deemed to be beyond Hofmann & Vratny's control if and when they occur during a delay. In this case, the delay shall be deemed to be suspended for the duration of the respective event.

5. The beginning of a period of delivery default shall be in accordance with the law, but shall in any case require a reminder issued by the Ordering Party.

6.If a contract regarding stand-by delivery has been signed, Hofmann & Vratny shall deliver and invoice the Goods no later than 12 months after the date of such contract (hereinafter referred to as the “Recall Period”), even if the Ordering Party has failed to recall the Goods by that time. After the Recall Period has expired, Hofmann & Vratny can notify the Ordering Party of Hofmann & Vratny's readiness to deliver and can request that the Ordering Party recall the Goods within a reasonable period of time. If the Ordering Party fails to recall the Goods within such period, Hofmann & Vratny shall be entitled to demand an additional lumpsum compensation for warehousing costs (hereinafter referred to as the “Warehousing Allowance”). The Warehousing Allowance shall be 0.5% of the net value of the purchased Goods for every full week, but shall not exceed 5% of the net value of the purchased Goods in total. The Ordering Party shall be free to prove that Hofmann & Vratny did not incur any damages or that any damages incurred were lower than the Warehousing Allowance. If the Ordering Party fails to recall the Goods within the Recall Period determined by Hofmann & Vratny, Hofmann & Vratny shall be entitled to dispose of the Goods as Hofmann & Vratny sees fit. The statutory provisions regarding rescission shall remain unaffected.

#### § 4 DELIVERY AND DEFAULT OF ACCEPTANCE

1. Unless agreed upon otherwise, all deliveries shall be ex works, that is, the place of performance for deliveries and for all subsequent actions. Unless agreed upon otherwise, upon request and at the expense of the Ordering Party the Goods shall be delivered to another destination (hereinafter referred to as "Sales Involving the Carriage of Goods"). Unless agreed upon otherwise, Hofmann & Vratny shall be entitled to determine the shipment method (including, but not limited to, the forwarder, the type of shipment and the packaging).

2. Partial deliveries shall be admissible, provided the Ordering Party reasonably can be expected to accept them.

3. Delivered Goods shall be accepted by the Ordering Party even if the delivered Goods have minor defects provided the Ordering Party reasonably can be expected to accept such Goods.

4. The risk of accidental destruction and/or deterioration of the Goods shall transfer to the Ordering Party no later than upon surrender of the Goods. In the case of Sales Involving the Carriage of Goods, the risk of accidental destruction and/or deterioration of the Goods and the risk of delay shall transfer to the Ordering Party no later than at the time of delivery of the Goods to the forwarder, carrier, or any other person designated to execute shipment of the Goods. Delivery shall be deemed to have been effected even if the Ordering Party is in default of acceptance.

5. If the Ordering Party is in default of acceptance or fails to cooperate or if delivery is delayed for other reasons for which the Ordering Party is responsible, Hofmann & Vratny shall be entitled to demand reimbursement for the damages incurred in connection therewith including additional expenses (e.g., warehousing costs).

#### § 5 TERMS OF PAYMENT

1. Unless agreed upon otherwise in individual cases, Hofmann & Vratny's prices plus statutory sales tax valid at the time the contract is signed shall apply. The prices indicated in Hofmann & Vratny's catalogs are non-binding and subject to change and/ or correction.

2. Unless agreed upon otherwise, in the case of Sales Involving the Carriage of Goods the Ordering Party shall bear the costs of packaging and transportation ex works and the costs, if any, for transportation insurance if such insurance is requested by the Ordering Party. All customs and other fees, taxes and other public charges also shall be borne by the Ordering Party unless agreed upon otherwise. Ownership of the packaging for transportation and otherwise pursuant to the Verpackungsordnung (Packaging Ordinance of Germany) shall transfer to the Ordering Party and such packaging shall not be returned to Hofmann & Vratny. Pallets shall be exempt from this rule.

3. Unless agreed upon otherwise in the order confirmation, the purchase price plus statutory sales tax shall be due and payable without any deductions within 14 days after the date of invoicing and delivery or acceptance of the Goods. However, Hofmann & Vratny reserves the right to make full or partial deliveries against cash in advance at any time including during an ongoing business relationship. The assertion of such right shall be communicated no later than at the time the order confirmation is issued. The Ordering Party shall be deemed to be in default of payment upon the expiration of the aforementioned payment deadline. The applicable rate of interest on the purchase price of the Goods shall become payable during the default period. The right to assert claims for more substantial compensation shall be reserved. Hofmann & Vratny's right to claim commercial-rate default interest (§ 353 of the HGB) shall remain unaffected.

4. The Ordering Party's rights of set-off and retention shall be limited to the extent the Ordering Party's claim is determined in a court of law or is undisputed. The Ordering Party's rights based on defects in the purchased Goods (see § 7 hereof) shall remain unaffected.

5. After the contract has been signed, if there is evidence that Hofmann & Vratny's claim to the purchase price will be compromised due to lack of performance on the part of the Ordering Party, Hofmann & Vratny shall be entitled to refuse performance pursuant to the applicable laws and, after setting a deadline, if applicable, shall be entitled to rescind the contract. In the case of contracts regarding the production of customized items, Hofmann & Vratny

shall be entitled to rescind the contract immediately and the laws regarding the expendability of setting deadlines shall remain unaffected.

#### § 6 RETENTION OF TITLE

1. Until all pending and future receivables in connection with the business relationship between Hofmann & Vratny and the Ordering Party are paid in full, Hofmann & Vratny shall retain ownership of the Goods. If the Ordering Party violates the contract including, but not limited to, default of payment, Hofmann & Vratny shall be entitled to rescind the contract pursuant to the applicable laws and to demand the surrender of the Goods.

2. Goods subject to retention of title shall not be pledged or assigned as collateral before the Ordering Party has paid in full. The Ordering Party shall notify Hofmann & Vratny in writing without undue delay in the event of a fling for commencement of insolvency proceedings or if third parties gain access (e.g., seizures) to Goods belonging to Hofmann & Vratny.

3. If the Ordering Party violates the contract including, but not limited to, by failing to pay the purchase price when due, Hofmann & Vratny shall be entitled to rescind the contract pursuant to the applicable laws and to demand the surrender of the Goods due to the retention of title and the rescission.

4. Until further notice, the Ordering Party shall be entitled to resell/and or process in the ordinary course of business any Goods subject to retention of title. In this case, the provisions below also shall apply.

a) The retention of title shall include title to the full value of work products resulting from processing, mixing or combining the Goods, in which case Hofmann & Vratny shall be deemed to be the manufacturer. If and when third-party goods are processed, mixed or combined and such third parties retain ownership, Hofmann & Vratny shall acquire coownership pro rata of the invoiced value of work products so processed, mixed or combined. In all other cases, the creation of work products shall be subject to the same provisions as the delivered Goods subject to retention of title.

b) The Ordering Party hereby agrees to assign to Hofmann & Vratny as collateral any and all receivables against third parties resulting from the resale of the Goods or work results in full or in the amount of Hofmann & Vratny's estimated share of co-ownership pursuant to a) above, and Hofmann & Vratny hereby accepts such assignment. The Ordering Party's obligations under § 6 2) hereof also shall apply with respect to the receivables assigned.

c) In addition to Hofmann & Vratny, the Ordering Party shall remain authorized to collect receivables. Hofmann & Vratny undertakes to refrain from collecting receivables as long as the Ordering Party meets its payment obligations vis-à-vis Hofmann & Vratny and does not fail to perform and Hofmann & Vratny does not assert its retention of title by asserting a right under § 6 3) hereof. Otherwise, Hofmann & Vratny shall be entitled to demand that the Ordering Party inform Hofmann & Vratny of such receivables assigned and of the names of the debtors, provide Hofmann & Vratny with all the information required for collecting such receivables and the pertinent documents, and inform the debtors (third parties) of the assignment. In addition, in this case Hofmann & Vratny shall be entitled to revoke the Ordering Party's authorization to resell and/or process Goods which are subject to retention of title.

5. Upon request of the Ordering Party, Hofmann & Vratny shall release the collateral to which Hofmann & Vratny is entitled insofar as the realizable value of such collateral exceeds the receivables to be collateralized by more than 10 percent. Hofmann & Vratny shall be free in its decision regarding which collateral to release.

#### § 7 LIABILITY FOR DEFECTS AND CLAIMS FOR DEFECTS

1. Unless otherwise agreed upon herein, the Ordering Party's rights based on defects in quality and/or in title (including delivery of the wrong Goods or insufficient amounts, improper assembly/installation, or incomplete instructions) shall be subject to the applicable laws. The special legal stipulations regarding reimbursement of expenses at the time of delivery of newly produced Goods (supplier's recourse as specified in §§ 478, 445a, 445b and §§ 445c, 327 para. 5, 327u of the BGB) shall remain unaffected in any case, unless equal-value compensation has been agreed upon, for example, as part of a quality assurance agreement.

2. Hofmann & Vratny's liability for defects shall be based first and foremost on the respective agreement entered into regarding the quality and the postulated use of the Goods (including fittings and instructions). In this context, an agreement regarding the quality of Goods shall be any and all product descriptions and manufacturer-provided information outlined in the individual agreement or made publicly known by Hofmann & Vratny (including, but not limited to, in catalogs or on Hofmann & Vratny's internet homepage) at the time the contract was signed. However, if and when no agreement regarding quality has been entered into, the presence or absence of a defect shall be determined based on the legal regulations (§ 434 para. 3 of the BGB). Statements made publicly by the manufacturer or on the manufacturer's behalf including, but not limited to, in advertising materials or on labels on the Goods shall prevail over other third parties' statements. In the case of Goods comprising digital elements or other digital content, Hofmann & Vratny shall be responsible for providing and, if required, updating the digital content only if defined expressly in an agreement regarding the quality of Goods, as stipulated above. Hofmann & Vratny shall not assume any liability for public statements made by the manufacturer or other third parties.

3. Hofmann & Vratny shall not assume liability for any defects of which the Ordering Party is aware, or for any defects of which the Ordering Party is grossly negligent if it is not aware (§ 442 of the BGB) at time the contract is signed. The assertion of claims by the Ordering Party regarding defects shall be conditional upon the Ordering Party's meeting of its statutory duty to inspect and to give notice of defects (§§ 377 and 381 of the HGB (Commercial Code of Germany)). If a defect in the Goods becomes apparent during or after inspection, the Ordering Party shall give written notice to Hofmann & Vratny without undue delay. Regardless of the Ordering Party's duty to inspect and to give notice of defects, the Ordering Party shall give written notice of obvious defects within two weeks after delivery, which notice shall be deemed to have been given in a timely manner if it is transmitted before the end of such period. If the Ordering Party fails to inspect the Goods properly and/or to give proper notice of any defects, Hofmann & Vratny shall not assume liability for any defects for which no notice was given.

4. If any of the Goods are defective, Hofmann & Vratny shall be free to offer supplementary action to remedy the defect or defects (supplementary remedy) or to deliver defect-free Goods (replacement) to the Ordering Party. In individual cases, the Ordering Party may refuse a supplementary action selected by Hofmann & Vratny that the Ordering Party considers to be unreasonable. It is Hofmann & Vratny's right to refuse to offer supplementary action under the applicable laws shall remain unaffected. The requirement for Hofmann & Vratny to provide any supplementary action owed shall be conditional upon the Ordering Party's paying of the purchase price when due. However, the Ordering Party shall be entitled to retain a reasonable portion of the purchase price pro rata in consideration of the defect. The Ordering Party shall give Hofmann & Vratny the time and the opportunity to provide the supplementary action owed including, but not limited to, providing Hofmann & Vratny the opportunity to inspect the Goods which are subject to complaint. If Hofmann & Vratny opts to replace the Goods, at Hofmann & Vratny's request the Ordering Party shall return the defective Goods to Hofmann & Vratny in accordance with the applicable laws; however, the Ordering Party shall not have the right to request to return the defective Goods. Supplementary action shall not include the disassembly, removal, or de-installation of defective Goods nor the assembly, mounting, or installation of defect-free Goods, provided Hofmann & Vratny was not originally obligated to provide such services; any rights the Ordering Party may have to be reimbursed for such costs (hereinafter referred to as "Disassembly and Assembly Costs") shall remain unaffected.

5. If in fact a defect is present, any and all expenses incurred in connection with inspections and supplementary action including, but not limited to, transportation, road, labor and material costs, and Disassembly and Assembly Costs shall be borne by Hofmann & Vratny in accordance with the laws and these General Terms of Sale. However, if the Ordering Party's demand for remedy of a defect is proven to be invalid because the Ordering Party was aware or was grossly negligent if it was not aware that no defect actually was present, Hofmann & Vratny can demand reimbursement from the Ordering Party for any costs incurred therewith. If the costs of supplementary remedy would be disproportionately high, the Ordering Party shall not be entitled to claim remedy of defects.

6. If and when a reasonable deadline for supplementary action set by the buyer has expired unsuccessfully or can be disregarded under the law, the Ordering Party can rescind the purchasing contract in accordance with the law or reduce the purchase price. However, no right to rescind shall apply in the case of insignificant defects.

7. The Ordering Party's claims for damages or reimbursement for wasted expenses shall be limited by the provisions of § 8 below and shall be excluded in all other cases.

8. The statute of limitations for claims for defects in quality and in title shall be one year after delivery of the Goods. The statute of limitations shall commence upon delivery of the Goods provided acceptance has been agreed upon. Other special legal stipulations regarding statutes of limitations (including, but not limited to, § 438 para. 1 no. 1, no. 2, para. 3, §§ 444, 445b of the BGB) shall remain unaffected. The aforementioned statutes of limitations specified in the purchasing laws also shall apply to any contractual and extra-contractual claims for reimbursement made by the Ordering Party based on a defect in the Goods, unless applying the regular statute of limitations stipulated by law (§§ 195, 199 of the BGB) would result in a reduced statute of limitations in individual cases. Any claims for reimbursement the Ordering Party may have pursuant to § 8 para. 2 p. 1 and p. 2 (a) and pursuant to the Produkthaftungsgesetz (Product Liability Act of Germany) shall be subject exclusively to the statutes of limitations stipulated by law.

#### § 8 OTHER LIABILITIES

1. Unless agreed upon otherwise in these General Terms of Sale and in the provisions below, Hofmann & Vratny's liability for breach of contractual and non-contractual obligations shall be in accordance with the applicable laws.

2. Hofmann & Vratny's liability for damages, regardless of the legal reasons and of whether or not they are known, as part of Verschuldenshaftung (liability arising from damage caused by negligent act) shall include intent and gross negligence. Subject to the limitations of liability stipulated by law (e.g., diligence with its own affairs, insignificant breach of duty), in the event of minor negligence Hofmann & Vratny's liability shall be limited to (a) damages resulting from harm to life, body or health and/or (b) damages resulting from the not-insignificant breach of a material contractual obligation, that is, an obligation which must be met to make the proper fulfillment of the contract possible and the meeting of which the Ordering Party relies upon and can rely upon on a regular basis. In this case, however, Hofmann & Vratny's liability shall be limited to reimbursement of the foreseeable damages typical in such cases.

3. The limitation of liability specified above also shall apply vis-à-vis third parties and in the event of a breach of duty by any person (including to his/ her own benefit) for which Hofmann & Vratny is responsible by law; however, it shall not apply if and when Hofmann & Vratny is found to have failed to disclose a defect maliciously or has assumed a guarantee for the quality of the Goods and for the Ordering Party's claims under the Produkthaftungsgesetz.

4. The Ordering Party can rescind or cancel a contract due to a breach of obligation other than a breach based on a defect only if and when Hofmann & Vratny is responsible for such breach of obligation. The Ordering Party shall not have an unrestricted right to terminate a contract. All other cases shall be subject to the applicable laws and legal consequences.

#### § 9 APPLICABLE LAW AND JURISDICTION

1. These General Terms of Sale and all legal relationships between Hofmann & Vratny and the Ordering Party shall be subject to the laws of the Federal Republic of Germany under exclusion of the provisions of uniform international law. The CISG shall not apply.

2. Any and all disputes arising directly or indirectly from the contractual relationship shall be subject exclusively, including at an international level, to the jurisdiction of Aßling if the Ordering Party is a businessperson as defined in the Handelsgesetzbuch (Commercial Code of Germany), a legal entity under public law, or a special fund under public law. The same shall apply if the Ordering Party is an entrepreneur pursuant to §§ 14 of the BGB. However, in any case Hofmann & Vratny shall be entitled to sue the Ordering Party at the place of performance of the obligation to deliver under these General Terms of Sale and/or under a prevailing individual agreement or at the Ordering Party's general jurisdiction. Prevailing legal regulations including, but not limited to, regarding exclusive jurisdictions, shall remain unaffected.

Hofmann & Vratny OHG  
June 2022

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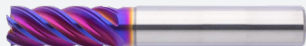
**EXPERT** | Steel & cast iron



**EXPERT** | Stainless steel



**EXPERT** | Titanium



**BASIC** | Universal





EN

## HOFMANN & VRATNY HARDENED STEEL-BROCHURE

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