# GENERAL INFORMATION

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HAEFELI TYPE DESIGNATION

All our grinding tools have a type designation based on the FEPA norm (Federation of European Producers of Abrasives). The first number stands for the core shape, the first letter(s) for the shape of the abrasive layer, the second number for the position of the abrasive layer while any letters at the end stand for special features. Here is an example:

Core shape: 6 = Cylindrical cup
Shape of abrasive layer: A = Rectangle
Position of abrasive layer: 2 = On one side
Special feature: H = Additional bore(s)

CORE SHAPE

SHAPE OF ABRASIVE LAYER
**POSITION OF ABRASIVE LAYER**

1 - Periphery  
2 - One side  
3 - Both sides  
4 - Sloped inwards  
5 - Sloped outwards  
6 - Part of periphery  
7 - Part of side  
8 - Throughout  
9 - Corner  
10 - Inside

**SPECIAL FEATURE**

D - Thin/pointed  
V/Y - Inverted profile  
Z - Profile 90° turned  
N - Gap between abrasive layers  
B - Diameter of abrasive layer smaller on reinforced side  
K - Diameter of abrasive layer larger on reinforced side  
E - Radius closer to the centre, not at the tip as usual  
H - Additional bore(s), any shape including coolant holes  
R - Relieved on both sides, thin  
RR - Relieved on both sides, thick  
P - Relieved on one side; grinding pins: relieved on the front side  
A - Cylindrical core at the bottom  
G - Thread  
W - Shank

**Examples**

3B1K  
1E1W  
1E1WZ  
14E1DH  
11V9
Our wheels are engraved with the following:

The ID number that can be found on each of our grinding tools is not an article number but a lot number from our production. Our tools can be exactly identified and traced back to the year 1956 with that number. The ID number is always recorded in our order confirmations, invoices and delivery notes.

Grinding wheels with diamond are marked green while those with CBN are marked red. This colour code can also be found in this catalogue.

Depending on the wheel, additional information can be engraved such as the angle, radius or maximum cutting speed.
BONDS

In addition to the quality of the abrasive grains, the grit size and the concentration of the grains in the abrasive layer, the bond has decisive influence on the grinding performance. All sorts of different grinding tasks can be optimally tackled with various adapted bonds. For this, we have more than 400 self-developed bonds at our disposal.

Metal bonds

Metal bonds are predominantly bronze alloys and distinguish themselves with their particular high hardness. The abrasive grains are tightly enclosed, which leads to the grinding wheel appearing “blunter”, but also to significantly longer tool life and higher shape retention. In contrast to resin ceramic bonds, metal bonds generate more grinding heat and shallower depths of cut have to be used if the protrusion of the abrasive grains from the bond is not maintained (see → 4-08). Metal bonds are ideal for profiles, small radii starting from 0.02 mm, thin wheel widths and smallest grinding pins starting from ø 0.18 mm as well as when grinding materials subject the bond to high levels of wear. Our metal bonds can be eroded very well and are very wear resistant. We possess a large selection of various metal bonds suited for different applications.

Materials

Diamond: especially carbide, technical ceramics (Al₂O₃, ZrO₂, Si₃N₄), sapphire, ruby, glass and cermet
CBN: high speed steel, alloyed tool steel, hardened steel, ...

Cooling: wet (oil, emulsion) and dry grinding
Dressing: with rotating SiC wheels (no stationary dressers or metal bonded dressing wheels!) or electrical discharge machining (EDM)

Regenerating: HACO-FLEX
Cutting speed: between 2 and 30 m/s, optimal mostly between 20 and 25 m/s (guide values)

Grinding wheels:
(in general) Type/shape: small 1A1W, distinct profile, e.g. 14E1D, 1E1W
Diameter: ø 0.18 - 300 mm
Grit sizes: D/BN 16 - D/BN 251
Concentration: C 30 - C 175
Metal hybrid bonds (SHARKLINE)

Specially for creep feed grinding with high feed rates and deep depths of cut on the newest CNC machines we have developed metal hybrid bonds with a lot of bite. They have a more porous bond structure and thus generate less grinding pressure and in consequence less heat.

Materials
Diamond: carbide, (ceramics)
CBN: HSS
Cooling: wet (oil)
Dressing: rotating SiC wheels (no stationary dressers or metal bonded dressing wheels!)
or electrical discharge machining (EDM)
Regenerating: HACO-FLEX
Cutting speed: 14 m/s (guide value)
Grinding tools: Type/shape: esp. 1A1, 1V1, 11A2, 11B2, 12A2, 12B2
(diameter)
Diameter: ø 75 - 250 mm
Grit sizes: D 46 - 64, BN 64 - BN 126
Concentration: C 75 - C 100

Resin bonds

Resins containing the abrasive grains and fillers are used as the binding agent with which the grinding characteristics of the bond can be selectively regulated. Grinding wheels with resin bonds offer rapid and cool grinding, can be used for dry and wet grinding and generate only low grinding forces. The maximum thermic load of this bonding system lies between 200° and 350° C. Resin bonds can be used for polishing, creep feed grinding with high stock removal rates and anything in between. In short, it is the most universally applicable bond which also happens to be the cheapest.

Materials
Diamond: esp. carbide, but also cermet and ceramics
CBN: high speed steel, alloyed tool steel, hardened steel, ...
Cooling: wet (oil, emulsion) & dry grinding
Dressing: rotating SiC wheels (no stationary dressers or metal bonded dressing wheels!)
Regenerating: HACO-FLEX
Cutting speeds: between 15 and 35 m/s, optimal mostly between 25 and 28 m/s (guide values)
Resin ceramic bonds

Resin ceramic bonds work with the smallest grinding pressures, can be used in wet or dry grinding and with the finest as well as the most coarse grit sizes. Our resin ceramic bonds have a broad range of application. Nevertheless, we have a large number of application-specific resin ceramic bonds.

**Grinding tools:**
- **Type/shape:** basically all forms and shapes
- **Diameter:** ø 3 - 400 mm
- **Grit sizes:** D/BN 3 - D/BN 251
- **Concentration:** C 30 - C 125

Resin hybrid bonds

For deep grinding, particularly for tool grinding with high stock removal rates, we have developed resin hybrid bonds that distinguish themselves with their long tool life and high profile retention. Thanks to their excellent ability to divert heat away, high stock removal can be achieved. Grinding wheels with resin hybrid bonds are only used wet (oil) and on CNC machines. Materials to be machined are mainly carbide and cermet. These bonds can be spark eroded with the right body.

**Grinding tools:**
- **Type/shape** z.B. 1A1, 1V1, 11V9, 12A2, 14E1D
- **Diameter:** ø 3 - 200 mm
- **Grit sizes:** D 30 - D 151, BN 46 - BN 151
- **Concentration:** C 75 - C 125

Bakelite bonds

Bakelite (thermosetting plastic), to which fillers have been added along with the abrasive grains, is used as the binding agent. This bond can be used with fine abrasive grains due to their polishing effect. Grinding wheels with bakelite bond are only used in a few exceptional cases as the more versatile resin bond can handle the grinding tasks better most of the time.

**Grinding tools:**
- **Type/shape** e.g. 1A1W, 6A2, 9A3
- **Diameter:** ø 3 - 200 mm
- **Grit sizes:** D/BN 3 - D/BN 26
- **Concentration:** C 30 - C 125
Vitrified bonds

A mixture of meltable glass powder, fillers and abrasive grains constitutes the vitrified bond. In contrast to the metal and resin bonds, the vitrified bond offers amongst others the advantage that a certain pore volume can be produced. Due to its porosity, the bond is suitable for materials producing long chips. Vitrified bonds are mainly used in conjunction with CBN. As the bond is made from glass, the grinding wheels cannot withstand major impacts or temperature shocks. Uninterrupted cooling is therefore always required. The vitrified bond provides cool grinding with low grinding forces and can be easily dressed on the machine with rotating dressers. Hence, it is particularly suited for the production on a large scale and the production of thin workpieces.

Materials
CBN: high alloyed tool steel and hardened steel, but also high speed steel (HSS)
Cooling: only wet (oil, emulsion)
Dressing: rotating metal bonded wheels
Regenerating: not necessary
Cutting speeds: between 20 and 45 m/sec, optimal mostly between 30 and 35 m/sec (guide values)
Grinding tools:
Type/shape: 1A1W, 1A1, profiles
Diameter: ø 4 - 60 mm
Grit sizes: BN 46 - BN 251 (D 7 - D 30)
Concentration: C 100 - C 150

Ceramic bonds (conventional grinding wheels)

Ceramic bonds are used in conventional grinding wheels that contain neither diamond or CBN but silicon carbide (SiC) or corundum. We do not offer such wheels except as dressing wheels for dressing our diamond and CBN grinding wheels. The ceramic bond consists of meltable glass powder, filler and abrasive grains. It can be used to grind “soft” (<50 HRC) workpieces. As the bond uses higher grinding forces and is subjected to higher wear such wheels are not recommended for harder materials.
Advantages of sintered bonds

While the abrasive layer is massive in sintered bonds, it consists only of a thin layer in electroplated bonds. When the abrasive grains that were electroplated are blunting or breaking out, grinding is no longer possible. Not with sintered bonds where the whole thick abrasive layer is permeated with abrasive grains and where grinding is possible until the very last grain. Hence, sintered bonds have massively higher durability and are therefore very economical. In addition, sintered bonds have better edge retention than electroplated bonds and result in finer surfaces when using the same grit size. Furthermore, electroplated bonds are not suitable for small grit sizes.
ABRASIVES and MATERIALS

The abrasives contained in our grinding tools are diamond and CBN. Through choosing the suitable grain the grinding behaviour can be decisively influenced. We consider the different characteristics of the grain such as its size, outer and inner structure, cutting and splitting properties as well as any coating of grains.

Diamond

For our grinding tools we use natural as well as synthetic diamonds. Even though diamond is the hardest material known (≈ 70’000 - 80’000 N/mm² Knoop hardness), not everything can be ground with it as some materials can react with the carbon of the diamond.

Brittle, crystalline, not long swarf building materials are ground with diamond such as:

• carbide, all kinds of
• oxide and non-oxide ceramics, amongst others:
  - alumina (Al₂O₃)
  - zirconium oxide (ZrO₂)
  - silicon nitride (Si₃N₄)
  - silicon carbide (SiC, SiSiC)
• cermet
• ferrite
• silicon
• silicon carbide and emery grinding wheels (dressing)
• titanium carbide (ferro-TiC, Ferro-Titanit)
• graphite
• glass
• quartz
• technical gemstones (sapphire, ruby)
• other precious and semi-precious stones
• spraying alloys and hard facing alloys
• carbide-based powder coating
• glass fibre and carbon fibre plastics (FRP)
• PCD & CBN plates
• ...

CBN

CBN (Cubic Boron Nitride) is the second hardest material (≈ 45’000 - 48’000 N/mm² Knoop hardness).

CBN cannot be found in nature; it is exclusively manufactured artificially.

Hard (sometimes already from 45 HRC though), non-crystalline, long swarf building materials are ground with CBN such as:

• tool steel, incl.
  - high speed steel (HSS)
  - hot working steel
  - cold working steel
• case hardening steel
• heat treatable steel
• hardened steel alloy
• high alloy steel
• chrome steel
• stellite
• steel on cobalt and nickel basis
• powder metallurgical steel (PM steel)
• nickel-based super-alloy
• iron-based powder coating
• chilled casting
• ...

1-10
Grinding with **diamond**

When grinding said materials with diamond, small particles are knocked from the material (dust formation). As there is no need to shorten any chips with those materials, grinding can be done with lower cutting speeds but deeper depths of cut in comparison to grinding with CBN.

Grinding with **CBN**

When grinding said materials with CBN shorter or longer chips are formed. In order to keep the chips small and short so that the bond and the grain get damaged less, higher cutting speeds are used in comparison to grinding with diamond. To give the chips enough room, CBN grinding wheels with lower concentrations are normally used.

**Grinding of steel with CBN: range of application of the bonds**

<table>
<thead>
<tr>
<th>Tensile strength N/mm²</th>
<th>Hardness HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈ 500</td>
<td>-</td>
</tr>
<tr>
<td>[...]</td>
<td>[...]</td>
</tr>
<tr>
<td>≈ 1400</td>
<td>44</td>
</tr>
<tr>
<td>≈ 1480</td>
<td>46</td>
</tr>
<tr>
<td>≈ 1575</td>
<td>48</td>
</tr>
<tr>
<td>≈ 1675</td>
<td>50</td>
</tr>
<tr>
<td>≈ 1795</td>
<td>52</td>
</tr>
<tr>
<td>≈ 1910</td>
<td>54</td>
</tr>
<tr>
<td>≈ 2050</td>
<td>56</td>
</tr>
<tr>
<td>≈ 2200</td>
<td>58</td>
</tr>
<tr>
<td>60</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td></td>
</tr>
</tbody>
</table>

Metal bond: 52 - 66 HRC, esp. 54 - 64 HRC
Resin ceramic bond: 48 - 68 HRC, esp. 52 - 66 HRC
Vitrified bond: 50 - 68 HRC, esp. 60 - 68 HRC
Electroplated bond: 45 - 66 HRC, esp. 52 - 64 HRC
# GRAIN SIZES (D & BN)

<table>
<thead>
<tr>
<th>FEPA grains</th>
<th>Diamond</th>
<th>CBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micrometre (μ)</td>
<td>FEPA</td>
<td>Application</td>
</tr>
<tr>
<td>min.</td>
<td>max.</td>
<td>D 261</td>
</tr>
<tr>
<td>212 - 250</td>
<td>180 - 212</td>
<td>150 - 180</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Micro grains</th>
<th>Diamond</th>
<th>CBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micrometre (μ)</td>
<td>HAEFELI</td>
<td>Application</td>
</tr>
<tr>
<td>30 - 40</td>
<td>22 - 32</td>
<td>20 - 30</td>
</tr>
</tbody>
</table>

Mesh sizes are used with emery or silicon carbide wheels.

<table>
<thead>
<tr>
<th>Mesh sizes</th>
<th>US mesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 - 70</td>
<td>70 - 80</td>
</tr>
<tr>
<td>80 - 100</td>
<td>100 - 120</td>
</tr>
<tr>
<td>120 - 140</td>
<td>140 - 170</td>
</tr>
<tr>
<td>170 - 200</td>
<td>200 - 230</td>
</tr>
<tr>
<td>230 - 270</td>
<td>270 - 325</td>
</tr>
<tr>
<td>325 - 400</td>
<td></td>
</tr>
</tbody>
</table>

No uniform designation for micro grain sizes

1 micrometre (μ) = 0.001 mm, i.e. 1/1000 mm.

With micro grains, many grinding wheel manufacturers base their grit size designation on the medium size of the grains used, even though the largest grains decisively determine the surface quality. We, however, carry the FEPA norm for the larger grains into the micro grains: largest grain in micrometre + 1 = HAEFELI designation. The higher the number, the larger the grain. It is the opposite with mesh sizes, as the designation corresponds to the number of mesh in a sieve of one inch length, through which the grains can still be sieved through.

**HAEFELI/FEPA:**

180 μ + 1 = D/BN 181 corresponds to 100 meshes per inch

45 μ + 1 = D/BN 46 corresponds to 400 meshes per inch

**US mesh:**

1 inch / 25,4 mm

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11.9.2017
SURFACE QUALITY

Guide values for cross-grinding with HAEFELI cup wheels in resin ceramic bond.

<table>
<thead>
<tr>
<th></th>
<th>0.025</th>
<th>0.05</th>
<th>0.10</th>
<th>0.20</th>
<th>0.40</th>
<th>0.80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ra</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rmax</td>
<td>0.50</td>
<td>0.80</td>
<td>1.25</td>
<td>2.50</td>
<td>5.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Rz</td>
<td>0.4</td>
<td>0.63</td>
<td>1.00</td>
<td>2.00</td>
<td>4.00</td>
<td>6.30</td>
</tr>
</tbody>
</table>

Given the same grain size, finer surface qualities can be achieved with diamond than with CBN.
CONCENTRATION (C)

The concentration C indicates how much diamond or CBN is contained in the abrasive layer. The higher the number, the higher the content of diamond or CBN grains in the abrasive layer. Usually the concentration is between C 50 and C 150, i.e. the abrasive layer consists between 12.5% and 37.5% of diamond or CBN.

The higher the concentration, the more abrasive grains are actively in use. This leads to longer tool life and better form retention, but also to larger grinding forces. Higher concentrations are used with small grinding contact surfaces (e.g. pointed profile wheels). Lower concentrations are used with large grinding contact surfaces (e.g. flat grinding wheels).
CUTTING SPEEDS (rpm)

The table below converts the cutting speed - also known as the peripheral speed \(v_p\) - of the grinding wheel or grinding pin from meter per second \(\text{m/s}\) to revolutions per minute \(\text{rpm}\). It also shows in which range our bonds are usually used and where the optimum normally lies. The cutting speeds are faster with CBN than with diamond, faster with coolant than without.

<table>
<thead>
<tr>
<th>Diameter of grinding tool</th>
<th>2 m/s</th>
<th>5 m/s</th>
<th>10 m/s</th>
<th>15 m/s</th>
<th>20 m/s</th>
<th>25 m/s</th>
<th>30 m/s</th>
<th>35 m/s</th>
<th>40 m/s</th>
<th>45 m/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø 600.0 mm</td>
<td>64</td>
<td>159</td>
<td>318</td>
<td>477</td>
<td>637</td>
<td>796</td>
<td>955</td>
<td>1'114</td>
<td>1'273</td>
<td>1'432</td>
</tr>
<tr>
<td>ø 500.0 mm</td>
<td>76</td>
<td>191</td>
<td>382</td>
<td>573</td>
<td>764</td>
<td>955</td>
<td>1'116</td>
<td>1'337</td>
<td>1'528</td>
<td>1'719</td>
</tr>
<tr>
<td>ø 400.0 mm</td>
<td>95</td>
<td>239</td>
<td>477</td>
<td>716</td>
<td>955</td>
<td>1'194</td>
<td>1'413</td>
<td>1'671</td>
<td>1'910</td>
<td>2'148</td>
</tr>
<tr>
<td>ø 350.0 mm</td>
<td>109</td>
<td>273</td>
<td>546</td>
<td>818</td>
<td>1'091</td>
<td>1'364</td>
<td>1'637</td>
<td>1'910</td>
<td>2'182</td>
<td>2'455</td>
</tr>
<tr>
<td>ø 300.0 mm</td>
<td>127</td>
<td>318</td>
<td>637</td>
<td>955</td>
<td>1'273</td>
<td>1'591</td>
<td>1'910</td>
<td>2'228</td>
<td>2'546</td>
<td>2'864</td>
</tr>
<tr>
<td>ø 250.0 mm</td>
<td>153</td>
<td>382</td>
<td>764</td>
<td>1'146</td>
<td>1'528</td>
<td>1'910</td>
<td>2'292</td>
<td>2'673</td>
<td>3'055</td>
<td>3'437</td>
</tr>
<tr>
<td>ø 225.0 mm</td>
<td>170</td>
<td>424</td>
<td>849</td>
<td>1'273</td>
<td>1'697</td>
<td>2'122</td>
<td>2'546</td>
<td>2'971</td>
<td>3'395</td>
<td>3'819</td>
</tr>
<tr>
<td>ø 200.0 mm</td>
<td>191</td>
<td>477</td>
<td>955</td>
<td>1'432</td>
<td>1'910</td>
<td>2'387</td>
<td>2'864</td>
<td>3'342</td>
<td>3'819</td>
<td>4'297</td>
</tr>
<tr>
<td>ø 175.0 mm</td>
<td>218</td>
<td>546</td>
<td>1'091</td>
<td>1'637</td>
<td>2'182</td>
<td>2'728</td>
<td>3'274</td>
<td>3'819</td>
<td>4'365</td>
<td>4'910</td>
</tr>
<tr>
<td>ø 150.0 mm</td>
<td>255</td>
<td>637</td>
<td>1'273</td>
<td>1'910</td>
<td>2'546</td>
<td>3'183</td>
<td>3'819</td>
<td>4'456</td>
<td>5'092</td>
<td>5'729</td>
</tr>
<tr>
<td>ø 125.0 mm</td>
<td>306</td>
<td>764</td>
<td>1'528</td>
<td>2'292</td>
<td>3'055</td>
<td>3'819</td>
<td>4'583</td>
<td>5'347</td>
<td>6'111</td>
<td>6'875</td>
</tr>
<tr>
<td>ø 100.0 mm</td>
<td>382</td>
<td>955</td>
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GRINDING PARAMETERS

Depth of cut $a_e$

Giving general values for the depth of cut is difficult since it depends on so many factors (grinding type, abrasive grain, bond, material to be ground, grinding contact surface, cooling, stability of the machine, infeed, cutting speed, clamping and so forth). Nonetheless, we cautiously try to give some reference points for the depth of cut.

In general, cutting depths in the range of about $10 - 12\%$ of the grain size used per stroke or workpiece revolution is not a bad start (for the grit sizes and the designation used by us, please refer to page 1-10). With the exception of creep feed grinding, the depth of cut should generally not exceed $1/3$ of the grit size.

When grinding internally, the depth of cut should normally be less than the aforementioned $8 - 12\%$ of the grit size. Said range can be exceeded with electroplated bonds in general. The depth of cut can of course be higher when deep grinding with good cooling (creep feed grinding).

Speed ratio $q_s$

The speed ratio $q_s$ indicates the ratio between the peripheral speed of the grinding wheel and the peripheral speed of the workpiece.

With cylindrical grinding, it is generally advised that the peripheral speed of the grinding wheel exceeds the peripheral speed of the workpiece by a factor of 60 to 120 (roughing: 60-80, finishing: 80-120). With creep feed grinding the speed ratio is massively higher (> 1’200).

$$q_s = \frac{\text{peripheral speed of grinding wheel } v_c (\text{m/s}) \times 1000 \times 60}{\text{peripheral speed of workpiece } v_w (\text{mm/min})}$$
KEY FIGURES IN THE GRINDING PROCESS

G-ratio

The G-ratio indicates the ratio of the volume of material removed from the workpiece(s) and the volume that has been consumed on the grinding wheel through abrasion and dressing. Our grinding tools distinguish themselves with high G-ratios. Thus, they have long tool lives.

Specific material removal rate $Q'_w$

The specific material removal rate indicates how many cubic millimetres (mm$^3$) a grinding tool can remove from the workpiece in one second per one millimetre wheel width.

Formulas that are valid for most grinding types:

Internal and external cylindrical grinding (without significant cross feed):

$$Q'_w = \frac{a_e \cdot n_w \cdot d_w \cdot \pi}{60}$$

Flat/surface grinding:

$$Q'_w = \frac{a_e \cdot n_w}{60}$$

where:

- $a_e$ = depth of cut in mm per revolution of the workpiece
- $n_w$ = revolution of the workpiece per minute
- $d_w$ = internal or external diameter of the workpiece in mm
- $a_e$ = depth of cut in mm per stroke
- $n_w$ = workpiece (table) speed in mm per minute
DRESSING

Dressing is for restoring the desired geometry of the abrasive layer and to correct any radial and axial runouts.

Generally, our grinding tools keep their shape and profile for very long if used correctly so that dressing is only rarely required. After each dressing, but also in between dressing intervals, we recommend to open the abrasive layer (metal or resin ceramic bond) with regenerators in order to obtain an ideal protrusion of the abrasive grains from the bond (HACO-FLEX \(\rightarrow\) 4-02).

Our grinding tools should only be dressed with silicon carbide wheels, never with single point dressers or multiple diamond dressers. Vitrified bonds (V5000) ideally should be dressed with metal bonded diamond grinding wheels (\(\rightarrow\) 4-05). SiC dressing wheels that are suited for our grinding tools can be obtained from us (\(\rightarrow\) 4-04). We also offer our services for regrinding wheels.

The values below are approximate values.

Dressing with powered grinding wheel

Dressing can be done on a dressing machine (wheel profiling machines) or within the cylindrical grinding machine itself, where the dressing wheel is mounted like a workpiece.

Peripheral wheel speeds:

- SiC or corundum dressing wheel
  
  18 - 30 m/s

- Diamond/CBN wheel (concurrent rotation)
  
  6 - 15 m/s

The peripheral wheel speed of the dressing wheel should be about \(2x - 3x\) faster than that of the diamond or CBN wheel.

Depth of cut per stroke:

> 0.01 mm, but at least 1/3 of the grain size (e.g. with D 64 at least 0.02 mm, with D 151 at least 0.05 mm). Depth of cut can be larger with wheels in metal and vitrified bonds than with wheels in resin ceramic bonds.

After every stroke, the grinding wheels have to overtravel each other fully, i.e. they should not touch each other.

Traverse feed:

200 - 400 mm/min

In general, dressing can be done with or without coolant. Vitrified bonds, however, should preferably only be dressed wet since they do not sustain high temperatures.
Dressing with brake controlled truing device

A method less used is the dressing with small devices with a centrifugal brake. For detailed instructions please refer to the information given by the manufacturer of such devices.

Dressing with soft steel

If the aforementioned methods are not available, wheels with resin ceramic or vitrified bonds can also be dressed by grinding soft steel. However, this takes longer. Normal construction steel can be used (St 37-2 / S235 JR).

Peripheral wheel speeds:
- \(\approx 18 \text{ m/s}\) Diamond/CBN wheels
- \(\approx 0.3 \text{ m/s}\) Cylindrical grinding with steel cylinder

Traverse feed/table speed:
- 16 - 24 m/min Flat grinding with steel plate

Depth of cut per stroke:
- \(\approx 0.008 - 0.01 \text{ mm}\) with medium grit size

Dry or wet grinding. With vitrified bonds only wet.

Regenerate for more bite

We recommend regenerating the abrasive layer in metal or resin bond after each dressing, but also between dressing intervals, so that the abrasive grains protrude by about 1/3 from the bond. The wheel then grinds with less heat and pressure → 4-02
Dressing of 14E1D pointed profile wheels

The pointed profile wheels of HAEFELI belong to the very best. To tap their full potential over their tool life, we recommend the following values. They apply to our standard grit sizes for this type of wheels:

**Resin hybrid bond R159 D126 & metal bond M4010 D64**

**Dressing wheel:** Soft ceramic wheel of medium structure and porosity (aluminium oxide with grit 120)

**Bond regenerator:** HACO-FLEX, „RGIH“ disc or „RSCE“ stick

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1. **Dressing the flanks**

   - **Pointed profile wheel:** 4 m/s
   - **Dressing wheel:** 26 m/s (concurrent rotation)
   - **Oscillating swing.**
   - **Roughing:**
     - Infeed at the rear: 0.05 - 0.10 mm (R159 D126)
     - 0.03 - 0.07 mm (M4010 D64)
   - **Finishing:**
     - Infeed: 0.02 - 0.05 mm (R159 D126)
     - 0.01 - 0.03 mm (M4010 D64)

2. **Regenerating the flanks**

   - **Pointed profile wheel:** 26 m/s
   - Press the HACO-FLEX regenerator (RGIH/RSCE) continuously by hand very lightly into the flanks from the side.

3. **Dressing the radius**

   - **Pointed profile wheel:** 4 m/s
   - **Dressing wheel:** 26 m/s (concurrent rotation)
   - **Oscillating swing.**
   - **Infeed left and right:**
     - 0.01 - 0.02 mm (R159 D126 & M4010 D64)

4. **Regenerating the radius**

   - **Pointed profile wheel:** 26 m/s
   - Press the HACO-FLEX regenerator (RGIH/RSCE) lightly by hand and only shortly, but continuously head-on.

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With grit sizes smaller than D/BN 64 the infeed has to be reduced accordingly and finer dressing wheels have to be used. With very small grit sizes (≤ D/BN 26) the dressing wheel should only turn half as fast, i.e. with about 13 m/s.

- 4 m/s = ø 75 mm: 1'000 rpm  | ø 100 mm: 760 rpm  | ø 150 mm: 500 rpm  | ø 175 mm: 440 rpm  | ø 200 mm: 380 rpm  | ø 250 mm: 300 rpm
- 26 m/s = ø 75 mm: 6'600 rpm | ø 100 mm: 5'000 rpm | ø 150 mm: 3'300 rpm | ø 175 mm: 2'850 rpm | ø 200 mm: 2'500 rpm | ø 250 mm: 2'000 rpm
MOUNTING OF GRINDING WHEEL

- The flange must be ground and appropriate for the bore tolerance. Our bores are manufactured according to your diameter specifications with ISO H7 tolerance (ISO H6 available upon request).
- Control the flange without the wheel on the machine. The concentricity and axial run-out has to be less than 0.01 mm.
- The wheel now has to be positioned with loosely tightened flange screws. The concentricity and axial run-out should be less than 0.02 mm. The finer the grit size the more important it is to keep the run-outs as small as possible.
- Tighten the screws.
- In general, all HAefeli wheels are balanced. Depending on the application the wheels still have to be balanced finely on the flange.
- If necessary, the grinding wheel has to grind for a while to correct the last radial run-outs.

Option A: Grind a soft material for a couple of minutes (→ 1-19).
Option B: Dress the wheel with SiC dressing wheels (→ 1-18). It is recommended to regenerate the abrasive layer afterwards (→ 4-02).

- The abrasive layer does not have to be opened unless it was dressed with a SiC wheel. Our wheels are delivered “sharp”, i.e. they were already regenerated with HACO-FLEX (→ 4-02).
- The wheel should not be taken from the flange until the end of its tool life if possible.

We wish successful grinding!