

3M Science.
Applied to Life.™

3M™ Precision Grinding & Finishing

3M™ Diamond Dressing Rollers

3M™ Diamond Dressing Rollers

Tailor-made for your specific requirements.

For many years, we have had dedicated dressing roller manufacturing plants and application engineers. We use their expert knowledge in the complete application process (grinding, dressing, machine operation) in combination with their knowledge of the dressing roller design and manufacturing process to enable us to produce a dressing roller tailored to meet your specific requirements in performance and efficiency.

We produce ideal tools for your perfect results.

Highly accurate
profile tolerances

Workpiece quality

Consistent dresser quality

High Productivity

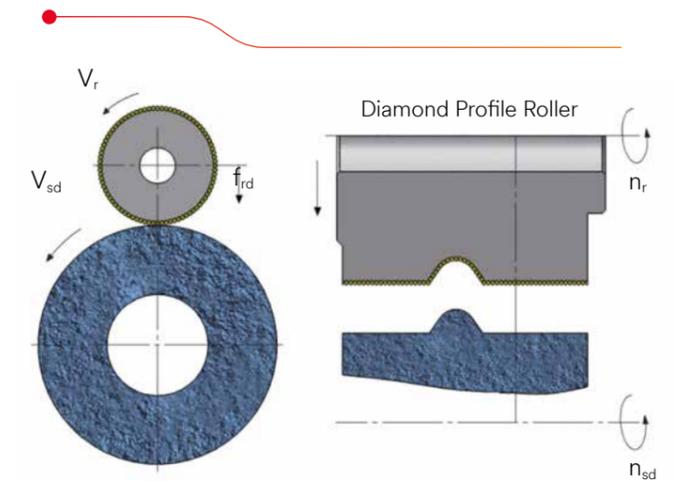
Reliable performance

Cost efficiency



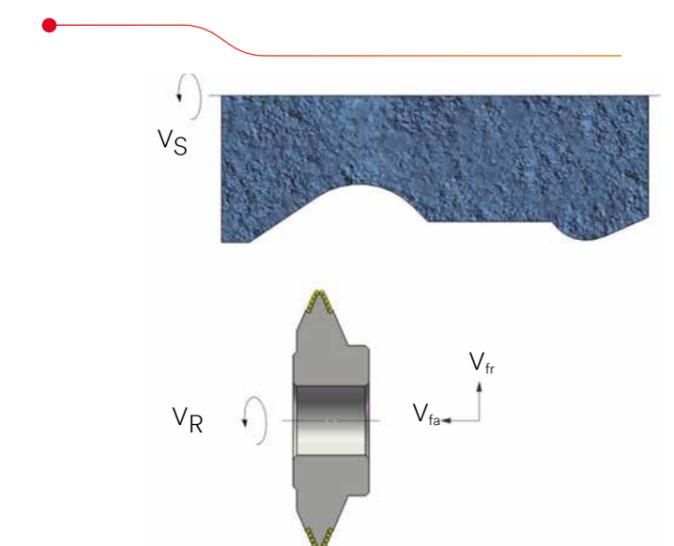
3M™ Diamond Profile Dressing Rollers

- ▶ Very short possible dressing cycles
- ▶ Plunge-cut dressing method
- ▶ Extreme profile accuracy
- ▶ Highly complex profile contours



3M™ Diamond Form Dressing Rollers

- ▶ Very high flexibility, rapid changes to profiles when required
- ▶ By CNC-guided dressing of the contours regardless if simple or highly complex profile contours



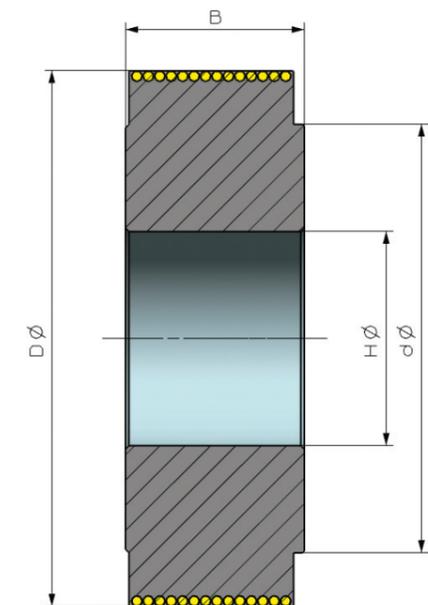
3M™ Diamond Profile Rollers

High precision solution for dressing of conventional and vitrified CBN grinding wheels, where high workpiece quality is required.



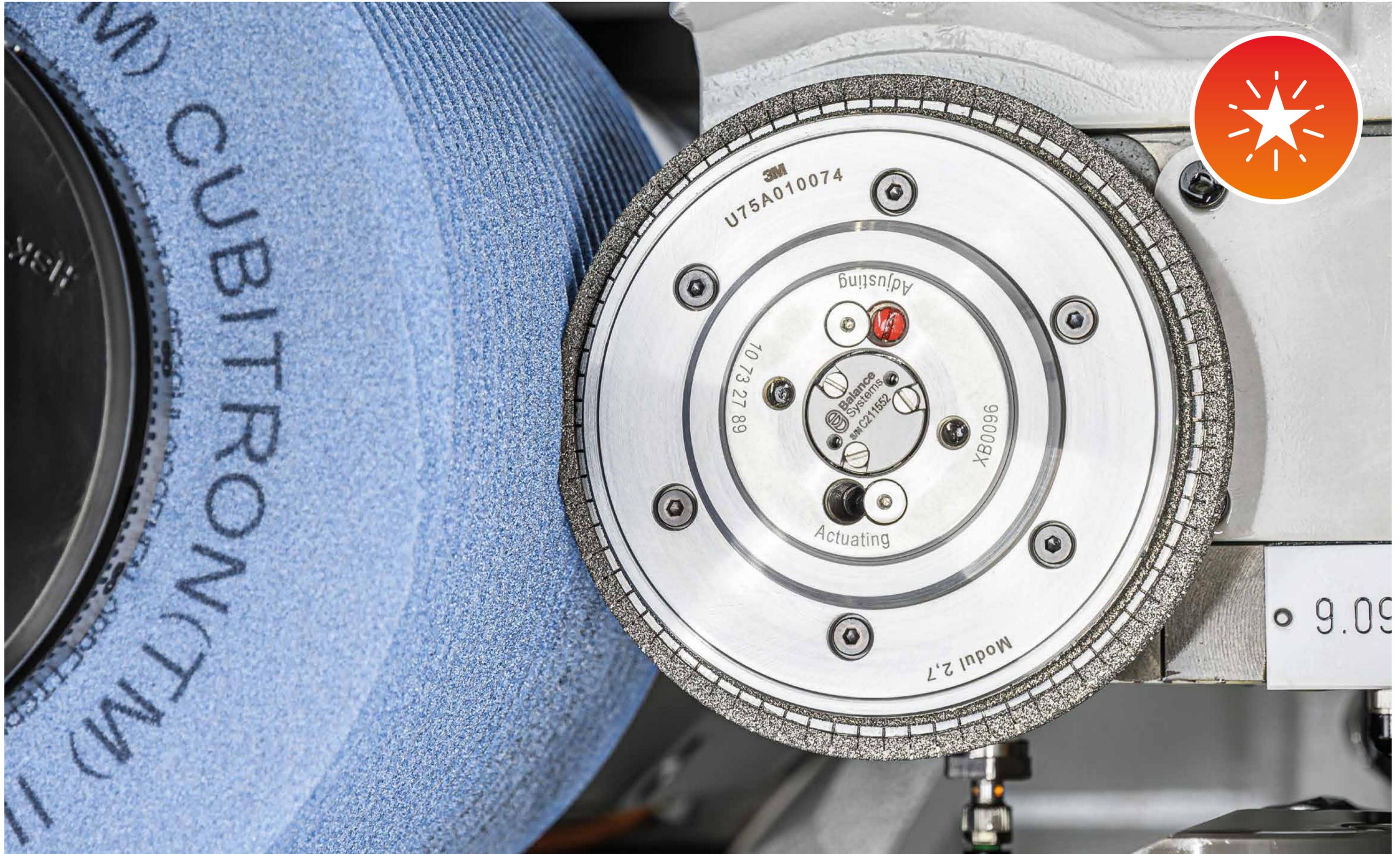
3M™ Product Name	3M™ Diamond Profile Roller 6JGN	3M™ Diamond Profile Roller 6JGP	3M™ Diamond Profile Roller 6JMI
Manufacturing Method Type	Negative Electroplated	Positive Electroplated	Negative Infiltrated
Diamond Layer	Random (NZ) or Handset (NS) Diamond Orientation	Random Diamond Orientation	Random (IZ) or Handset (IS) Diamond Orientation
MFG Process Complexity	High	Medium	High
Bond Type	Electroplated Bond	Electroplated Bond	Tungsten Bond
Rework possibility	Limited reprofiling possible	Layer replating possible	Limited reprofiling possible
Application	Designed for the highest precision	Standard applications	Designed for the highest precision
Dimension and tolerance (mm)			
D (mm)	50-250	70-250	60-210
R (tolerance)	+/- 0.002	+/- 0.025	+/- 0.004
B (max)	320	320	80
H (min.)	10	10	10
Shape tolerance	0.002	0.01	0.004

We require a workpiece drawing in order to ensure that correct dimensions and tolerances are used during the design process.



One Standard Shape

3M™ Diamond Dressing Rollers for Gear Grinding



3M™ Diamond Dressing Rollers for Gear Grinding

High precision solution for dressing of conventional and vitrified CBN grinding wheels, for the highest requirements in gear grinding.



3M™ Product Name	3M™ Diamond Set Profile Roller 6JGS	3M™ Diamond Profile Roller 6JGM
Manufacturing Method Type	Positive Electroplated	Negative Electroplated
Diamond Layer	Random Diamond Orientation (PM)	Random Diamond Orientation (NZ)
MFG Process Complexity	High	High
Bond Type	Electroplated Bond	Electroplated Bond
Rework possibility	Layer replating possible	Single use
Application	Designed for the highest precision	Designed for the highest precision (multi-ribbed dressing)
Dimension and tolerance (mm)		
D (mm)	50-250	50-250
B (max)	60	60
H (min.)	10	10
Shape tolerance	0.002	0.002

The indicated dimensions may serve as an orientation. Generally, we equip all gear grinding machines. We require a workpiece drawing in order to ensure that correct dimensions and tolerances are used during the design process.



3M™ Diamond Form Rollers

High precision dressing solution for dressing of conventional and vitrified CBN grinding wheels, where profile flexibility is required.



3M™ Product Name	3M™ Diamond Form Roller 6HGP	3M™ Diamond Form Roller 6HMS	3M™ Diamond Form Roller 6HVK	3M™ Diamond Form Roller 6HMI
Manufacturing Method Type	Positive Electroplated (PM)	Positive Metal Bonded (SM)	Positive Vitrified Bonded (VIT)	Negative Infiltrated
Diamond Layer	Random Diamond Orientation	Interspersed Diamond Orientation	Interspersed Diamond Orientation	Random (IZ) or Handset (IS) Diamond Orientation and CVD fitted
MFG Process Complexity	Medium	Medium	Medium	High
Bond Type	Electroplated Bond	Sintered Metal Bond	Vitrified Bond	Tungsten Bond
Rework possibility	Single use	Layer regrinding possible	Layer replating possible	Multiple regrinding possible
Application	Specifically for dressing Vit-CBN grinding wheels	Specifically for dressing Vit-CBN grinding wheels	Specifically for dressing Vit-CBN grinding pins	Designed for the highest precision

We require a workpiece drawing in order to ensure that correct dimensions and tolerances are used during the design process.

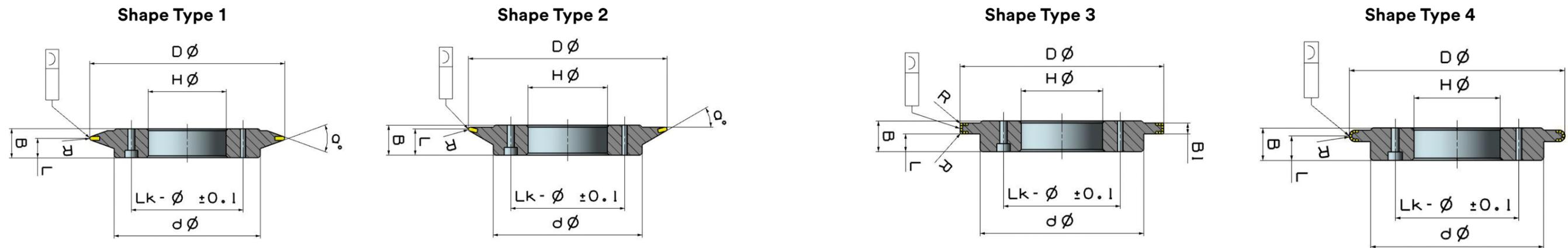
3M™ Diamond Form Rollers

High precision dressing solution for dressing of conventional and vitrified CBN grinding wheels, where profile flexibility is required.



3M™ Product Name	3M™ Diamond Form Roller 6HGP		3M™ Diamond Form Roller 6HMS	3M™ Diamond Form Roller 6HVK	3M™ Diamond Form Roller 6HMI			3M™ Diamond Form Roller 6HMI		
Manufacturing Method Type	PM		SM	VIT	IZ			IS		
Standard Shape	Type 3	Type 4	Type 3	Type 3	Type 1 or 2	Type 3	Type 4	Type 1 or 2	Type 3	Type 4
Dimension (mm)	50-250		50-250	50-180	50-250			50-250		
R (min)	0.3	1	0.1	0.1	0.3	0.2	1	0.05	0.2	0.5
R (tolerance)	+/- 0.025		+/- 0.025	+/- 0.025	+/- 0.004			+/- 0.002	+/- 0.002	+/- 0.004
B (min)	7		7	8	8			8		
a/° min.	-	-	-	-	30	-	-	18	-	-
H (min.)	6		6	6	10			10		
Shape tolerance	0.01		0.02	0.02	0.004			0.002		

We require a workpiece drawing in order to ensure that correct dimensions and tolerances are used during the design process.



In case of any requirement for non-standard shapes, please contact us with your workpiece drawing.



Application Requirements and Methods

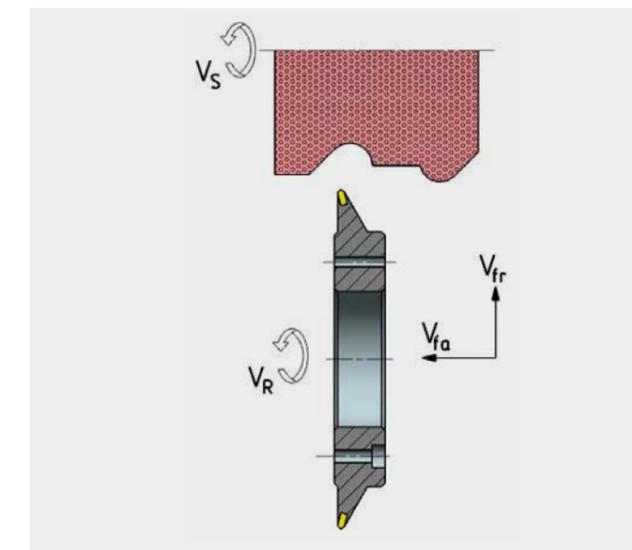
Machine Requirements (for the use of form dressing rollers)

- ▶ CNC-controlled axes
- ▶ Rotating dressing spindle

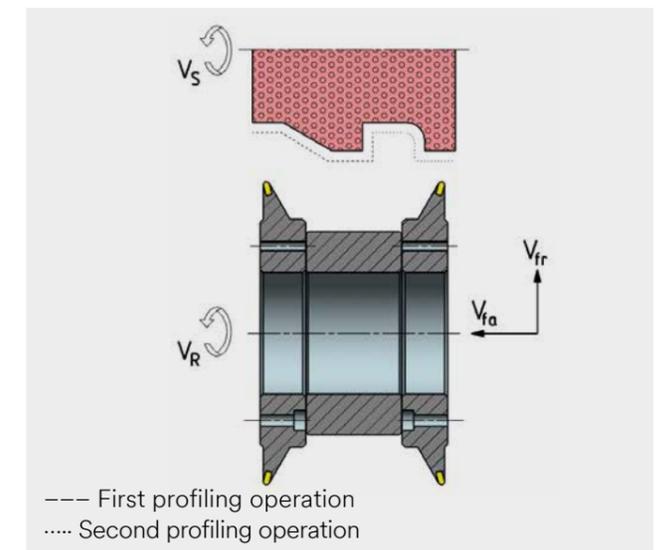


Methods of Application

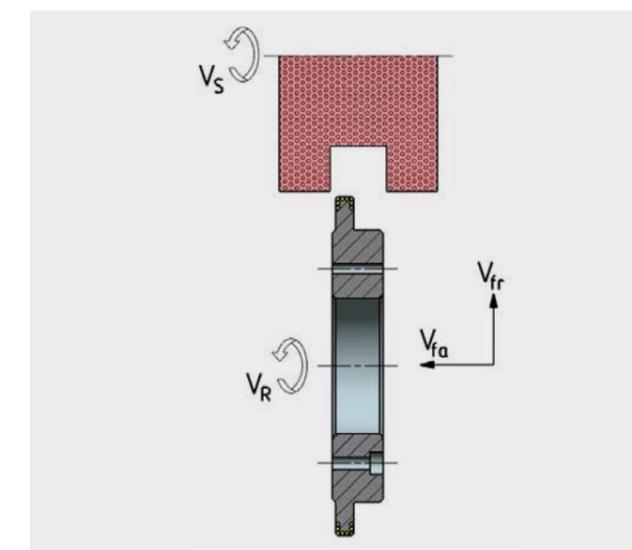
Different types of form dressing rollers are needed depending on desired grinding wheel profile.



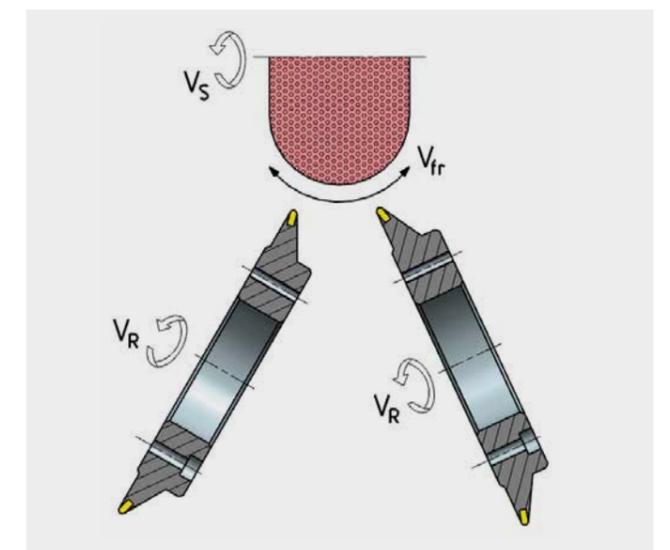
Method 1



Method 2



Method 3



Method 4

Why do operating conditions matter?

We know how to do it.

When using diamond profile dressing rollers, you have the ability to influence key process parameters, such as operating conditions, configuration of axes, speed ratio, direction of rotation, infeed and the number of rollout revolutions. This offers numerous opportunities for process optimisation.

It is also possible to directly influence the surface topography of the grinding wheel and optimise the results by matching the individual factors.

Speed ratio (q_d)

The greatest influence on the effective roughness is obtained by changing the speed ratio q_d , which is the quotient of the circumferential speed of the dressing roller V_r to the circumferential speed of the grinding wheel V_s (Figure 1: Down-cut (synchronous) and Up-cut dressing (asynchronous)) dressing at different feed increments. Speed ratios of 1 or almost 1 are not recommended as the diamond dressing roller is either dwelling on the grinding wheel and this could cause premature wear or damage.

Direction of rotation

Down-cut (synchronous) and Up-cut (asynchronous) dressing refers to the relative direction of rotation of the diamond dressing roller with respect to the grinding wheel. They each have a different effect on roughness (Figure 1).

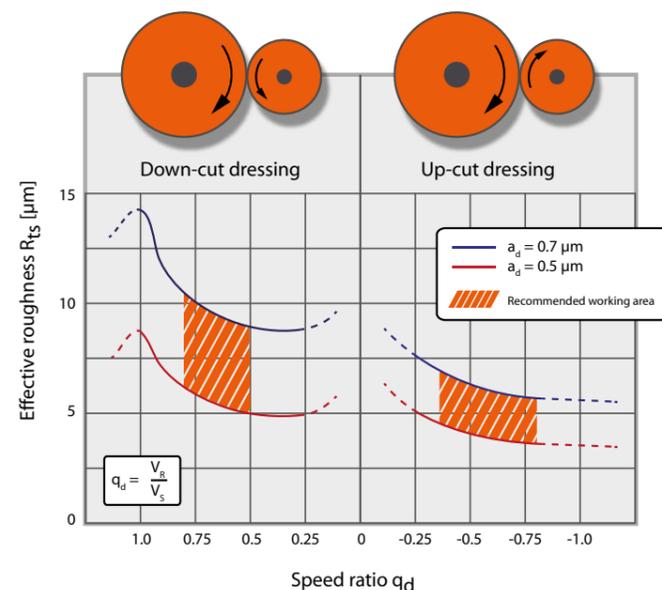
Down-cut dressing is associated with increased effective roughness, it is used for high performance applications, the dressing of rough grinding wheels and fine grinding of critical profiles that have a tendency to burn when grinding.

Changing the speed ratio has a greater influence on the effective roughness than with up-cut dressing.

Up-cut dressing is associated with a lower effective roughness and is used for fine grinding wheels when used to grind non-critical profiles that do not tend to burn during grinding.

3M™ Diamond Profile and Form Rollers

Figure 1



Overlap ratio (U_d)

The overlap ratio indicates how many revolutions the grinding wheel makes in the time it takes the dressing tool to advance 1x its effective width (a_{pd})

- ▶ U_d roughing = 3-4
- ▶ U_d finishing = 6-8
- ▶ U_d Standard = 5

Axial feed rate (v_{fad})

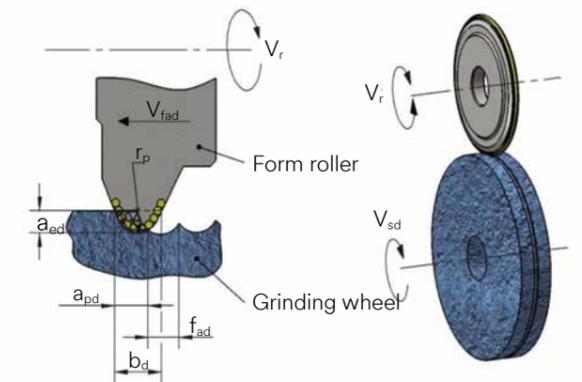
Refers to the velocity at which the dressing rollers move across the face of the grinding wheel. As the feed rate increases (in down-cut – synchronous dressing more than in up-cut asynchronous dressing), the effective roughness increases. Since the feed rate depends on the combination of the application and working conditions, we can only specify 100-300 mm/min as a standard value for rough grinding and 30-100 mm/min for finishing grinding.

Dressing infeed (a_{ed})

Our parameter for the infeed is the radial feed increment a_{ed} (μ) of the diamond dressing roller per revolution of the grinding wheel. As the infeed increases (for down-cut dressing more than for up-cut dressing), the effective roughness increases. The recommended feed increments are between 0.25-0.5 μ per revolution of the grinding wheel. The total infeed selected should always be as small as necessary to restore the grinding wheel profile (generally $<0.03\text{mm}$).

When dressing with diamond form dressing rollers, the feed increment depends mainly on the type of form dressing roller, the desired grinding wheel profile, the cutting conditions, and whether you are rough grinding or finishing grinding. Due to the numerous combinations of the application and working conditions, we can only specify 0.1-0.5 mm as a standard value for rough grinding and 0.005-0.05 mm for finishing grinding.

Terms and Formulas



Dressing overlap ratio

$$U_d = \frac{a_{pd}}{f_{ad}}$$

$$\text{with } b_d = \sqrt{8 \cdot r_p \cdot a_{ed}}$$

$$a_{pd} = \frac{1}{2} (b_d + f_{ad})$$

Dressing speed ratio

$$q_d = \pm \frac{V_r}{V_{sd}}$$

+ Down-cut
- Up-cut

a_{pd}	Width of cut	in mm
a_{ed}	Dressing infeed	in μm
b_d	Effective width of the dressing tool	in mm
f_{ad}	Dressing infeed per revolution	in mm/U
v_{fad}	Axial feed rate	in mm/min
v_r	Dressing roller circumferential speed	in m/s
v_{sd}	Grinding wheel circumferential speed	in m/s
r_p	Profile radius of the form roller	in mm

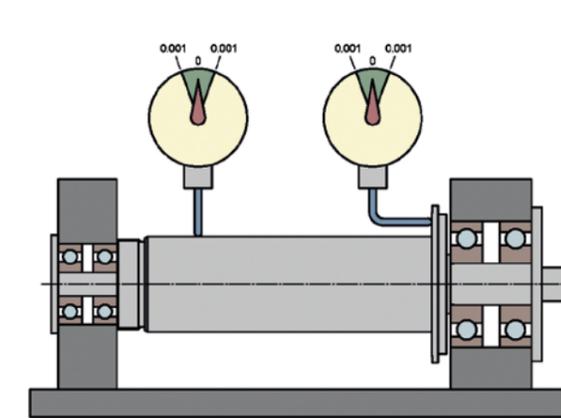


3M™ Precision Grinding & Finishing – Assembly Instruction

Only a perfect fit assures a perfect result.

Spindle check before installation

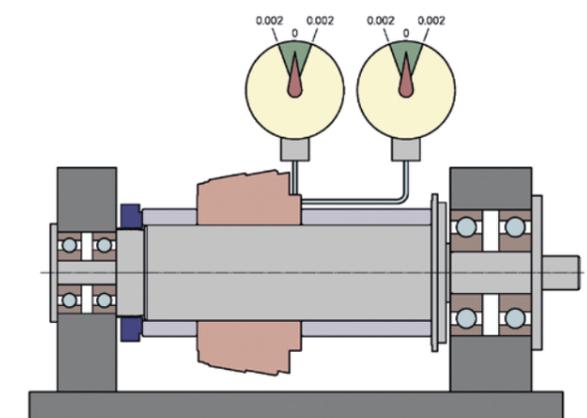
Test the spindle for radial and face runout without a dressing roller.
Reference: $\sim 2 \mu\text{m}$



Spindle without dressing roller

Spindle check after installation

Test the spindle for radial and face runout after completed assembly.
Reference: $\sim 4 \mu\text{m}$



Spindle with dressing roller

The optimum mounting leads to the following advantages and benefits:

- ▶ Maximum lifetime
- ▶ Highest precision at the workpiece
- ▶ Highest level of dimensional stability and dimensional accuracy
- ▶ Best preconditions for a proper disassembly



3M™ Precision Grinding & Finishing - your reliable global business partner.

With global plants, we serve your area and global business

Our dresser manufacturing plants are located in both the US and Germany. Since the 1970s, we have focused on the production of diamond dressing rollers. With our expertise, application knowledge and experience, we provide our customers tailored solutions utilizing the advantage of the latest 3M technology.

With both global technical experts and local support teams we respond to your specific requirements.

We have the answers not only for dressing solutions, but for the complete grinding and machining process. As a system supplier we offer the perfect match of 3M™ Diamond Dressing Rollers and 3M™ conventional and vitrified CBN grinding wheels.

For additional product information or to request a visit from an application technician, please check www.3M.com/precisiongrinding or contact us.



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