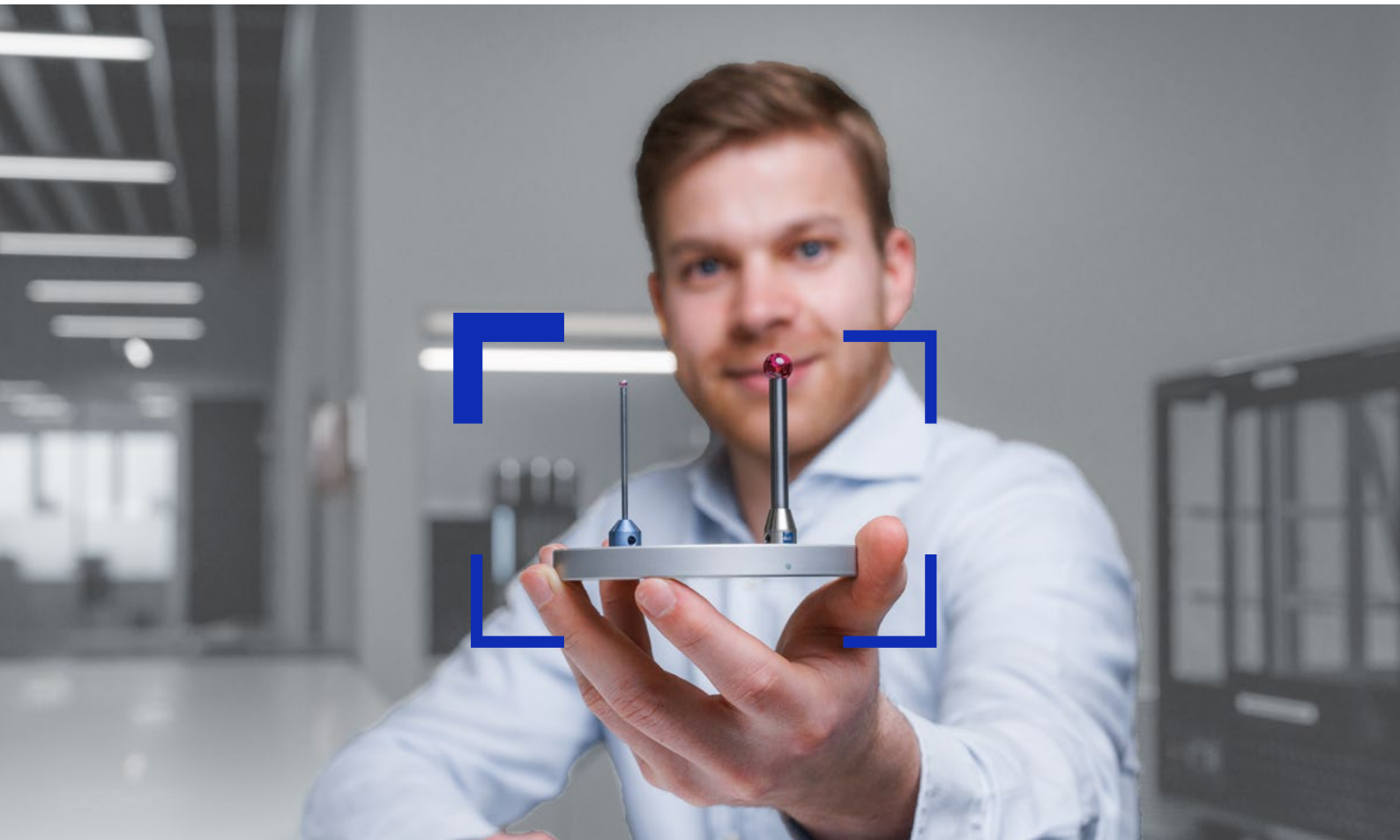




Seeing beyond

# ZEISS Metrology Expert Tip



**Not every sphere is a round sphere.  
Accuracy Guarantee with Certificate only.**

# Roundness of stylus spheres

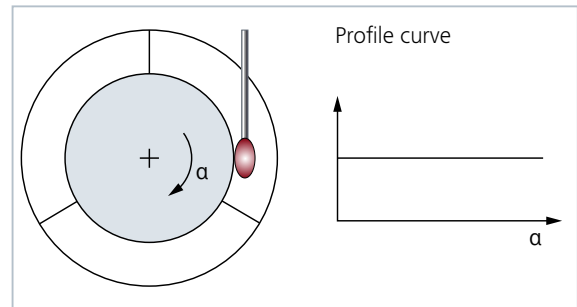
The stylus sphere represents the „tip“ of the probe system and is the first point of contact with the workpiece. For this reason, the accuracy of the ball plays a decisive role in the measurement for certain applications.



The more precise the measuring machine, the more important the shape accuracy of the ball.

## Roundness measurement with a rotary table:

For measurements where the sphere only touches the workpiece at one point, the roundness accuracy of the stylus sphere is not so crucial for a measurement, as you can see in the example.

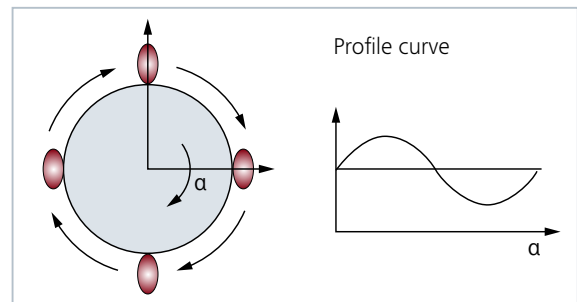


The stylus sphere only touches the workpiece at one point. → straight profile due to one probing point

## Roundness measurement without rotary table:

E.g. measuring a roundness, the inaccuracy of the stylus sphere will be noticeable in the measurement result.

If the stylus sphere scans around the workpiece, then the stylus sphere touches the workpiece with a different location with each angle of rotation  $\alpha$ . In this measurement process, the shape accuracy of the stylus sphere is of decisive importance for the accuracy of the measurement result. This applies to point probing and scanning.



The stylus sphere touches the workpiece at several points. → Curved profile due to different probing points

# Grades of stylus sphere

The stylus spheres are divided into so-called grades based on the way they are produced. Production takes place in batches, sometimes with several thousand stylus spheres. The quality is checked by random sampling and applied to the entire batch.

The grade describes the deviation from the ideal sphere shape. The smaller the grade, the more accurate the sphere shape and leads to a higher measuring accuracy.

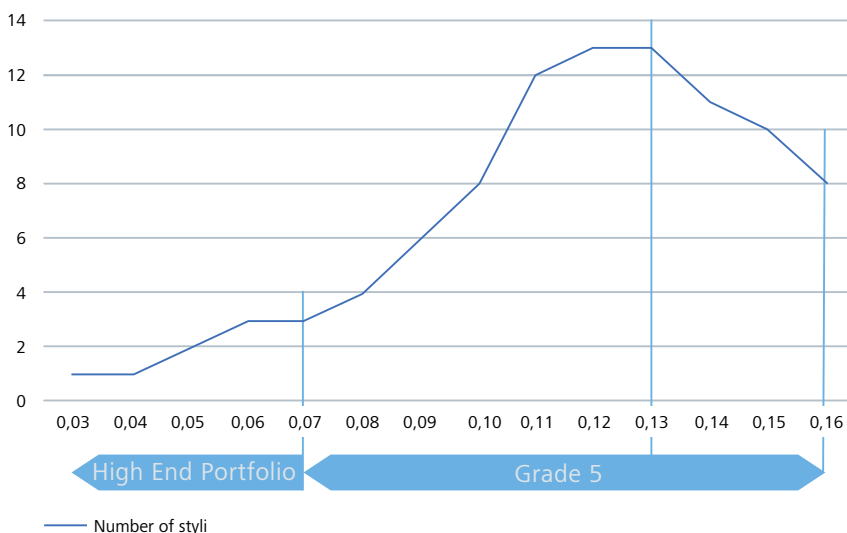
ZEISS uses grade 5 as standard for styli that nominally have a roundness deviation of  $\pm 0.13 \mu\text{m}$ .

Grade	Max. deviation of roundness
20	0,50 $\mu\text{m}$
16	0,40 $\mu\text{m}$
10	0,25 $\mu\text{m}$
5	0,13 $\mu\text{m}$
3	0,08 $\mu\text{m}$

Due to the sampling test, there are logically also deviations between the spheres within the grades. In principle, this results in a Gauss distribution of the spheres. This means that most of the spheres are close to the nominal value. However, there are also spheres that are better and worse. The uncertainty is that one does not know the exact value of the sphere.

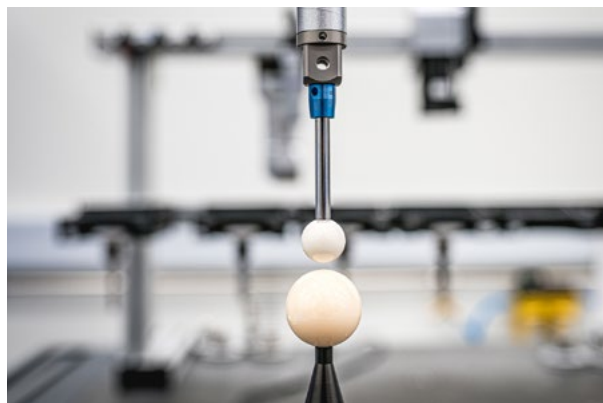
The graph below shows the Gauss distribution of the roundness deviations from a check of 50 randomly selected spheres of grade 5.

## Roundness frequency distribution of Grade 5



# High-End Stylus

The ZEISS portfolio of high-end styli offers you spheres with a certified absolute value. This is made possible by a special ZEISS process in which all spheres are measured and classified on a ZEISS RONDCOM roundness measuring device. All high-end styli are supplied with a certificate. To make it easier to identify the high-end styli from the standard styli, the adapter is coated in blue.



The ZEISS portfolio offers two types of accuracies, only one of them being certified in each case:

- Accuracy 1: Roundness < 60 nm
- Accuracy 2: Diameter tolerance  $\pm 0,001$  mm

## Certificate for styli:

Zertifikat für Taster - Precision Line - Certificate for Stylus - Precision Line -			
Seriennummer / Serial no.:		L00789B	
Kalibrierungsdatum / Calibration date:		27.04.2021	
Seriennummer Serial no.	Materialnummer Material no.	Durchmesser / Mittlerer Radius Diameter/mean radius	Rundheit Roundness
<b>L00789B</b>	<b>626115-1741-083</b>	<b>17.4624 / 8.7312 mm</b>	<b>0.12 <math>\mu</math>m</b>
	Ausdehnungskoeffizient Expansion coefficient	Messunsicherheit Maß Measurement uncertainty, size	Messunsicherheit Form Measurement uncertainty, shape
	<b><math>5,5 \times 10^{-6} \text{ K}^{-1}</math></b>	<b>0.2 <math>\mu</math>m</b>	<b>0.05 <math>\mu</math>m</b>

**ZEISS Original Accessories  
are available in the  
ZEISS Metrology Shop.**

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Industrielle Messtechnik GmbH  
Carl Zeiss Straße 22  
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