

Deutsche Akkreditierungsstelle

Annex to the Accreditation Certificate D-K-15074-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 02.01.2024

Date of issue: 02.01.2024

Holder of accreditation certificate:

Mahr GmbH
Carl-Mahr-Straße 1, 37073 Göttingen

with the location

Mahr GmbH
Carl-Mahr-Straße 1, 37073 Göttingen

The calibration laboratory meets the requirements of DIN EN ISO/IEC 17025:2018 to carry out the conformity assessment activities listed in this annex. The calibration laboratory meets additional legal and normative requirements, if applicable, including those in relevant sectoral schemes, provided that these are explicitly confirmed below.

The management system requirements of DIN EN ISO/IEC 17025 are written in the language relevant to the operations of calibration laboratories and they conform to the general with the principles of DIN EN ISO 9001.

Calibration in the fields:

Dimensional quantities

Length

- **Roughness**
- **Form error**
- **Contours**
- **Stylus instruments ^{a)}**
- **Length measuring devices ^{a)}**

^{a)} **also on-site calibration**

This certificate annex is only valid together with the written accreditation certificate and reflects the status as indicated by the date of issue. The current status of any given scope of accreditation can be found in the directory of accredited bodies maintained by Deutsche Akkreditierungsstelle GmbH at <https://www.dakks.de>.

Annex to the Accreditation Certificate D-K-15074-01-00

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range		Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Length Groove depth P_t and d on depth setting standards	0.2 μm to	12 μm	DIN EN ISO 3274:1998 DIN EN ISO 4287:2010 DIN EN ISO 5436-1:2000 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	0.03 μm	
Roughness on extra fine roughness standards R_a R_z R_{max} , $R_{zx}(l)$	0.025 μm to 0.15 μm to 0.15 μm to	0.1 μm 0.8 μm 0.8 μm	DIN 4768:1990 DIN EN ISO 3274:1998 DIN EN ISO 4287:2010 DIN EN ISO 4288:1998 DIN EN ISO 16610-21:2013 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	$0.06 \cdot R_a$ $0.07 \cdot R_z$ $0.09 \cdot R_{max}$ $0,09 \cdot R_{zx}(l)$	
Roughness on roughness standards and R_k -Standards R_a R_z R_{max} , $R_{zx}(l)$	0.1 μm to 0.8 μm to 0.8 μm to	4 μm 20 μm 20 μm	DIN 4768:1990 DIN EN ISO 3274:1998 DIN EN ISO 4287:2010 DIN EN ISO 4288:1998 DIN EN ISO 16610-21:2013 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	$0.025 \cdot R_a$ $0.030 \cdot R_z$ $0.035 \cdot R_{max}$ $0.035 \cdot R_{zx}(l)$	
Roughness on roughness standards R_{pk} R_k R_{vk}	On surfaces in the range:		DIN EN ISO 13565-1:1998 DIN EN ISO 13565-2:1998 DIN EN ISO 16610-31:2015 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	$0,10 \cdot R_{pk}$ $0,06 \cdot R_k$ $0,09 \cdot R_{vk}$ <i>Rk-Standards:</i> $0,05 \cdot R_{vk}$	
$Mr1$, $Rmr1$ $Mr2$, $Rmr2$	$0.1 \mu\text{m} \leq R_a \leq$ $0.8 \mu\text{m} \leq R_z \leq$	4 μm 20 μm		3 % 5 %	Relative measuring uncertainty relative to 100 % material ratio
Roughness on roughness standards R_a R_z R_{max} , $R_{zx}(l)$	0.1 μm to 0.8 μm to 0.8 μm to	4 μm 20 μm 20 μm	DIN 4768:1990 DIN EN ISO 3274:1998 DIN EN ISO 4287:2010 DIN EN ISO 4288:1998 DIN EN ISO 16610-21:2013 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	$0.015 \cdot R_a$ $0.015 \cdot R_z$ $0.020 \cdot R_{max}$ $0,020 \cdot R_{zx}(l)$	If necessary, the filter cutoff wavelength λ_c can be used one level lower or higher than specified in ISO 4288:1998

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Stylus instruments (Surface) to DIN EN ISO 3274:1998 Groove depth P_r and d R_a R_z R_{max} , $R_{zx}(l)$	0.2 μm to 12 μm 0.1 μm to 4 μm 0.8 μm to 20 μm 0.8 μm to 20 μm	DKD-R 4-2 Blatt 2:2018 DIN EN ISO 12179:2000 DIN 4768:1990 DIN EN ISO 3274:1998 DIN EN ISO 4287:2010 DIN EN ISO 4288:1998 DIN EN ISO 16610-21:2013 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	$U_{\text{standard}} + 0.01 \mu\text{m}$ $U_{\text{standard}} + 0.01 \cdot R_a$ $U_{\text{standard}} + 0.01 \cdot R_z$ $U_{\text{standard}} + 0.01 \cdot R_{max}$ $U_{\text{standard}} + 0,01 \cdot R_{zx}(l)$	U_{standard} is the measuring uncertainty of the standards used. Smaller measuring ranges for which standards are available can also be calibrated.
Stylus instruments (Contour) to DIN EN ISO 3274 and VDI/VDE BI.1:2023 Distance X Distance Z Radii Angle Straightness	to 100 mm to 10 mm 2 mm to 12 mm 40° to 135° to 20 μm	MK03/07:2021	1.25 μm 1.1 μm 1.6 μm 0.025° 0.36 μm	The measuring uncertainty of mechanical scanning of contour standards and contour stylus instruments of the Mahr GmbH
Roundness standards Roundness deviation	to 0.1 μm	DIN ISO 1101:2014	0.025 μm	Diameter: 3 mm to 100 mm
Magnification standards Roundness deviation for cylinder with flat area (flick)	0.5 μm to 20 μm		$0.05 \mu\text{m} + 2.5 \cdot 10^{-2} \cdot RONt$	Diameter: 3 mm to 100 mm
Magnification standards Roundness deviation Multi-wave standard	to 20 μm		$0.1 \mu\text{m} + 2.5 \cdot 10^{-2} \cdot RONt$	Diameter: 50 mm to 150 mm
Cylinder square Roundness deviation	to 20 μm	DIN ISO 1101:2014	$0.1 \mu\text{m} + 2.5 \cdot 10^{-2} \cdot RONt$	Diameter: 3 mm to 100 mm
Straightness deviation of the generatrices	to 20 μm		$0.2 \mu\text{m} + 2.0 \cdot 10^{-2} \cdot STRt$	Length: 10 mm to 400 mm
Parallelism deviation of the generatrices	to 20 μm		$0.3 \mu\text{m} + 1.5 \cdot 10^{-2} \cdot PART$	$RONt$ = roundness deviation $STRt$ = Straightness deviation
Cylindricity deviation	to 20 μm		$0.4 \mu\text{m} + 3.0 \cdot 10^{-2} \cdot CYLt$	$PART$ = Parallelism deviation $CYLt$ = Cylindricity deviation

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Contour standards		Substitution measurement with reference contour standard		
X length Lateral distances	5 mm to 100 mm	Procedure according to DIN ISO/TS 15530-3:2008	0.6 µm	
Z length Vertical distances	to 10 mm		0.75 µm	
Radii	2 mm to 12 mm		0.75 µm	
Angles	40° to 135°		0.01°	
Dial gauge checkers	to 100 mm	MK03/05:2014 Calibration with traceable electronic linear reference gauge	0.22 µm	
Horizontal Length measuring machines	0 mm to 1000 mm	VDI/VDE/DGQ 2618 part 17.1:2014	$0.08 \mu\text{m} + 0.7 \cdot 10^{-6} \cdot l$	l = measured length The measurement uncertainty of the length measurement uncertainty in mechanical probing of gauge blocks and is valid for horizontal length measuring machines of the Mahr GmbH
	> 1000 mm to 2000 mm		$0.1 \mu\text{m} + 0.5 \cdot 10^{-6} \cdot l$	

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Length Stylus instruments (Surface) to DIN EN ISO 3274:1998 Groove depth Pt and d Ra Rz Rmax, RzX(l)	0.2 µm to 12 µm 0.1 µm to 4 µm 0.8 µm to 20 µm 0.8 µm to 20 µm	DKD-R 4-2 Blatt 2:2018 DIN EN ISO 12179:2000 DIN 4768:1990 DIN EN ISO 3274:1998 DIN EN ISO 4287:2010 DIN EN ISO 4288:1998 DIN EN ISO 16610-21:2013 DIN EN ISO 21920-2:2022 DIN EN ISO 21920-3:2022	$U_{\text{standard}} + 0.01 \mu\text{m}$ $U_{\text{standard}} + 0.01 \cdot Ra$ $U_{\text{standard}} + 0.01 \cdot Rz$ $U_{\text{standard}} + 0.01 \cdot R_{\text{max}}$ $U_{\text{Standard}} + 0,01 \cdot RzX(l)$	U_{standard} is the measuring uncertainty of the standards used. Smaller measuring ranges for which standards are available can also be calibrated.

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Stylus instruments (Contour) to DIN EN ISO 3274 and VDI/VDE Bl.1:2023		MK03/07:2021		The measuring uncertainty of mechanical scanning of contour standards and contour stylus instruments of the Mahr GmbH
Distance X	to 100 mm		1.25 µm	
Distance Z	to 10 mm		1.1 µm	
Radii	2 mm to 12 mm		1.6 µm	
Angle	40° to 135°		0.025°	
Straightness	to 20 µm		0.36 µm	
Dial gauge checkers	to 100 mm	MK03/05:2014 Calibration with traceable electronic linear reference gauge	0.22 µm	
Horizontal Length measuring machines	0 mm to 1000 mm	VDI/VDE/DGQ 2618 part 17.1:2014	0.08 µm + 0.7 · 10 ⁻⁶ · l	l = measured length The measurement uncertainty of the length measurement uncertainty in mechanical probing of gauge blocks and is valid for horizontal length measuring machines of the Mahr GmbH
	> 1000 mm to 2000 mm		0.1 µm + 0.5 · 10 ⁻⁶ · l	

Abbreviations used:

- CMC Calibration and measurement capabilities
- DIN Deutsches Institut für Normung e.V.
- DKD-R Guideline on Deutscher Kalibrierdienst (DKD), published by Physikalisch-Technische Bundesanstalt
- MK Calibration instruction of the Mahr GmbH
- VDE Verband der Elektrotechnik, Elektronik und Informationstechnik
- VDI Verein Deutscher Ingenieure