

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-15074-02-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 04.07.2022

Date of issue: 04.07.2022

Holder of certificate:

**Mahr GmbH, Standort Esslingen
Reutlinger Straße 48, 73728 Esslingen**

Calibration in the fields:

Dimensional quantities

Length

- **Diameter**
- **Form Error**
- **Length measuring instruments**
- **Length measuring devices**
- **Thread**

Coordinate measuring technology

- **Application coordinate measuring machines**

Within the measurands / calibration items marked with * the calibration laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, to use calibration standards or equivalent calibration procedures listed here with different issue dates. The calibration laboratory maintains a current list of all calibration standards / equivalent calibration procedures within the flexible scope of accreditation.

The management system requirements of DIN EN ISO/IEC 17025 are written in the language relevant to the operations of calibration laboratories. Laboratories that conform to the requirements of this standard, operate generally in accordance with the principles of DIN EN ISO 9001.

The certificate together with the annex 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/en/accredited-bodies-search.html>.

Abbreviations used: see last page

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This document is a translation. The definitive version is the original German annex to the accreditation certificate.

Annex to the accreditation certificate D-K-15074-02-00

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Length Cylindrical setting gauges, Setting ring gauges* Diameter	10 mm to 250 mm	VDI/VDE/DGQ 2618 Part 4.1:2006	$0.3 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	d = measured diameter
Straightness deviation and Parallelism deviation of surface lines			0.5 μm	
Roundness deviation		Cut-off wave number = 150	0.1 μm	
Cylindrical setting gauges, Setting ring gauges* Diameter	2mm to 300 mm	VDI/VDE/DGQ 2618 Part 4.1:2006 Option 3 and 4	$1 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	With coordinate measuring machine
Cylindrical setting gauges, Setting plug gauges* Diameter	1 mm to 250 mm	VDI/VDE/DGQ 2618 Part 4.1:2006	$0.25 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	d = measured diameter In the area of 1 mm to 3 mm, only Option 3 or 4 with increased measuring uncertainty
Straightness deviation and Parallelism deviation of surface lines			0.5 μm	
Roundness deviation		Cut-off wave number = 150	0.1 μm	
Measuring pins* Diameter	0.14 mm to 0.25 mm > 0.25 mm to 0.4 mm > 0.4 mm to 3 mm > 3 mm to 100 mm	VDI/VDE/DGQ 2618 Part 4.2:2007	0.8 μm 0.6 μm 0.5 μm $0.25 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	d = measured diameter
Straightness deviation and Parallelism deviation of surface lines	3 mm to 100 mm		0.5 μm	
Roundness deviation		Cut-off wave number = 150	0.1 μm	
Double sided spherical probe for thread measurement Roundness deviation	0.3 mm to 4 mm to 40 μm	DKS038-EA001:2019-07	0.4 μm 0.7 μm	
Gap gauges*	0 mm to 150 mm	VDI/VDE/DGQ 2618 Part 4.7:2005	$2 \mu\text{m} + 8 \cdot 10^{-6} \cdot d$	
Straight edges*	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 5.1:2013	$1 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	l = measured length

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Knife straight edges*	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 5.2:2013	$1 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	
Steel squares*	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 7.1:2010	$1 \mu\text{m} + 5 \cdot 10^{-6} \cdot l_z$	l_z = leg length
Protractors*	0° to 360°	VDI/VDE/DGQ 2618 Part 7.2:2008	1'	scale interval $\geq 1'$
straightness	to 300 mm		$0.5 \mu\text{m} + 5 \cdot 10^{-6} l_z$	
parallelism			$1 \mu\text{m} + 6 \cdot 10^{-6} l_z$	
Calipers for external, internal and depth dimensions*	0 mm to 500 mm	VDI/VDE/DGQ 2618 Part 9.1: 2006	$15 \mu\text{m} + 15 \cdot 10^{-6} \cdot l$	l = measured length
	> 500 mm to 1000 mm		$15 \mu\text{m} + 20 \cdot 10^{-6} \cdot l$	
Depth calipers*	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 9.2: 2006	$20 \mu\text{m} + 20 \cdot 10^{-6} \cdot l$	
Height calipers*	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 9.3:2006	$30 \mu\text{m} + 20 \cdot 10^{-6} \cdot l$	
Special calipers	0 mm to 1000 mm	DKS032-EA001:2019-06	$20 \mu\text{m} + 15 \cdot 10^{-6} \cdot l$	
Micrometers*	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 10.1: 2001	$2 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	scale interval 1 μm , for higher scale intervals the measurement uncertainty will rise 200 mm = final value of the measuring range
Reference gauges for micrometers*	25 mm to 500 mm	VDI/VDE/DGQ 2618 Part 4.4:2009	$1 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	l = measured length
Micrometers with replaceable anvils*	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 10.2: 2010	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	
Micrometers with dial indicator*	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 10.3:2002	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	
Micrometer heads*	0 mm to 50 mm	VDI/VDE/DGQ 2618 Part 10.4:2008	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	l = measured length
Depth micrometers*	0 mm to 300 mm	VDI/VDE/DGQ 2618 Part 10.5:2010	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	

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Internal micrometers with two-point contact*	25 mm to 500 mm	VDI/VDE/DGQ 2618 Part 10.7:2010	$3 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	d = measured diameter
Internal micrometers with three-line contact*	2 mm to 100 mm	VDI/VDE/DGQ 2618 Part 10.8:2002	$3 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	100 mm = final value of the measuring range
Dial gauges*	to 100 mm	VDI/VDE/DGQ 2618 Part 11.1:2020 E VDI/VDE/DGQ 2618 Part 11.4:2020	$0.8 \mu\text{m} + 12 \cdot 10^{-6} \cdot l$	scale interval $\leq 1 \mu\text{m}$, for higher scale intervals the measurement uncertainty will rise
Dial indicators*	to 3 mm	VDI/VDE/DGQ 2618 Part 11.2:2002	0.5 μm	
Lever gauges*	to 1.6 mm	VDI/VDE/DGQ 2618 Part 11.3:2002	0.7 μm	
Indicating snap gauges	0 mm to 500 mm	DKS029-EA001:2019-05	$0.9 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	l = measured length Measuring span of dial indicators max. 5 mm
Lever gauges (quicktests) for external measurement	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 12.1:2005	$7 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	l = measured length
Lever gauges (quicktests) for internal measurement*	2 mm to 200 mm	VDI/VDE/DGQ 2618 Part 13.1:2005	$7 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	
Bore gauges with two-point contact*	1 mm to 800 mm	VDI/VDE/DGQ 2618 Part 13.2:2005 image 1, image 2, image 3	0.8 μm	Measuring span off 0,1 mm to 3 mm
Inductive probe with measuring device*	to 10 mm	VDI/VDE/DGQ 2818 Part 14.1:2010	0.5 μm	
Inductive probe without measuring device*	to 10 mm		1.2 μm	

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Incremental probe	0 mm to 100 mm	DKS016-EA001:2017-10	$0.35 \mu\text{m} + 12 \cdot 10^{-6} \cdot l$	l = measured length
Snap gauge Thickness gauge	0 mm to 50 mm	DKS042-EA001:2019-06	$7 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	
Flat gauge	2 mm to 100 mm	DKS043-EA001:2019-06	$0.5 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	
Height gauges / Vertical length measuring machines	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 16.1:2009	$1.7 \mu\text{m} + 1,2 \cdot 10^{-6} \cdot l$	
Dial gauges- and dial indicator testing devices	0 mm to 100 mm	DKS044-EA001:2019-06	0.26 μm	Calibration by laser interferometry
	0 mm to 25 mm	DKS045-EA001:2019-06	$0.5 \mu\text{m} + 20 \cdot 10^{-6} \cdot l$	Calibration with incremental probe
Thread gauges (single-start cylindrical external and internal threads with straight flanks and symmetrical profile)				
External thread Simple pitch diameter with nominal lead 0,25 mm bis 6 mm	Nominal diameter 3 mm to 100 mm	VDI/VDE/DGQ 2618 Part 4.8:2006, Option 1	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot d$	d = pitch diameter
Internal thread Simple pitch diameter with nominal lead 0,25 mm bis 6 mm	Nominal diameter 5 mm to 100 mm	VDI/VDE/DGQ 2618 Part 4.9:2006, Option 1	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot d$	

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Coordinate measuring technology Prismatic, tapered and ball-shaped workpieces	Coordinate measuring machine with calibrated measuring volume of: X = 1200 mm Y = 1000 mm Z = 700 mm	DKS040-EA001:2019-08 Tactile measurements with single point probing with a coordinate measuring machine and determination of regular geometries through geometrical parameters (single-points, straight lines, planes, circles, balls, cylinders, toroids) using the evaluation software of the coordinate measuring machine. Single point measurements in the form of „Self-centering measurements“are not used within the accreditation. For ensuring metrological traceability, the calibration of a similar standard will be realized. Beyond that, following limitations should be considered: -Measuring points have to evenly distributed throughout the form element - at least 50 % of the geometry element's surface has to be covered by measuring points - evaluation of mean geometry elements	The uncertainty of measurement is determined with a uncertainty measurement balance Part on the basis of the guideline VDI/VDE 2617 part 11:2011. The uncertainty of measurement depends on the measuring task and is specified with a coverage probability of approximately 95 % (coverage factor k=2) Exemplary measurement uncertainty for a described measuring task: Gauge block with a nominal value of 500 mm, using a probe of 150 mm length, determinde is the expanded uncertainty of the inspection feature „distance“: U=4.3 mm	For general measuring tasks the measuring uncertainty could be significant differently form the exemplary specified.

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On-site Calibration
Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Length Calipers for external, internal and depth dimensions*	0 mm to 500 mm	VDI/VDE/DGQ 2618 Part 9.1:2006	$15 \mu\text{m} + 15 \cdot 10^{-6} \cdot l$	l = measured length
	> 500 mm to 1000 mm		$15 \mu\text{m} + 20 \cdot 10^{-6} \cdot l$	
Depth calipers*	0 mm to 1000 mm	VDI/VDE/DGQ 2618 Part 9.2:2006	$20 \mu\text{m} + 20 \cdot 10^{-6} \cdot l$	
Special calipers	0 mm to 1000 mm	DKS032-EA001:2019-06	$20 \mu\text{m} + 15 \cdot 10^{-6} \cdot l$	
Micrometers*	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 10.1:2001	$2 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	scale interval 1 μm , for higher scale intervals the measurement uncertainty will rise
				200 mm = final value of the measuring range
Micrometers with replacable anvils*	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 10.2: 2010	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	l = measured length
Micrometers with dial indicator*	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 10.3:2002	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	
Depth micrometers*	0 mm to 300 mm	VDI/VDE/DGQ 2618 Part 10.5:2010	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	
Dial gauges*	to 25 mm	VDI/VDE/DGQ 2618 Part 11.1:2020 E VDI/VDE/DGQ 2618 Part 11.4:2020	$3 \mu\text{m} + 12 \cdot 10^{-6} \cdot l$	
Dial indicators*	to 3 mm	VDI/VDE/DGQ 2618 Part 11.2:2002	0.5 μm	
Lever gauges*	to 1.6 mm	VDI/VDE/DGQ 2618 Part 11.3:2002	0.7 μm	
Indicating snap gauges	0 mm to 500 mm	DKS029-EA001:2019-05	$0.9 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	
Lever gauges (quicktests) for external measurement	0 mm to 200 mm	VDI/VDE/DGQ 2618 Part 12.1:2005	$7 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	l = measured length
Snap gauge Thickness gauge	0 mm to 50 mm	DKS042-EA001:2019-06	$7 \mu\text{m} + 10 \cdot 10^{-6} \cdot l$	

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Abbreviations used:

CMC	Calibration and measurement capabilities (Kalibrier- und Messmöglichkeiten)
DIN	Deutsches Institut für Normung e.V.
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik e.V.
VDI	Verein Deutscher Ingenieure e.V.
DGQ	Deutsche Gesellschaft für Qualität
DKS	Calibration instruction of the Mahr GmbH, location Esslingen