

Deutsche Akkreditierungsstelle

Annex to the Accreditation Certificate D-K-15030-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 03.11.2023

Date of issue: 03.11.2023

Holder of accreditation certificate:

**JENOPTIK Industrial Metrology Germany GmbH
Drachenloch 5, 78052 Villingen-Schwenningen**

with the location

**JENOPTIK Industrial Metrology Germany GmbH
Drachenloch 5, 78052 Villingen-Schwenningen**

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 instruments ^{a)}**

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

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-15030-01-00

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 | 0.15 μm to 12 μm | DIN EN ISO 4287:2010 DIN EN ISO 5436-1:2000 | $0.012 \mu\text{m} + 0.8 \cdot 10^{-3} \cdot P_t$ $0.012 \mu\text{m} + 0.8 \cdot 10^{-3} \cdot d$ | Groove depth P_t and d in mm |
| | > 12 μm to 5500 μm | DIN EN ISO 3274:1998 DIN EN ISO 21920-2: 2022 DIN EN ISO 21920-3: 2022 | $0.022 \mu\text{m} + 0.036 \cdot 10^{-3} \cdot P_t$ $0.022 \mu\text{m} + 0.036 \cdot 10^{-3} \cdot d$ | |
| Roughness on geometric standards R_z R_{max} , $R_z I_{max}$ $R_{zx}(l)$ R_{Sm} | 0.1 μm to 3.5 μm 0.5 μm to 20 μm 0.5 μm to 20 μm 0.5 μm to 20 μm 40 μm to 400 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 | $1.5 \% \cdot R_a$ $1.5 \% \cdot R_z$ $2.0 \% \cdot R_{max}$ $2.0 \% \cdot R_z I_{max}$ $2.0 \% \cdot R_{zx}(l)$ 1.5 μm | If necessary, the cutoff length λ_c can be select-ed one step shorter or up to two steps longer than specified in the standard, but not more than $\lambda_c = 2,5$ mm |
| R_a R_z RP_c Rp_c | 0,1 μm to 3,5 μm 0,5 μm to 20 μm $25 \leq RP_c \leq 150$ $25 \leq Rp_c \leq 150$ | Steel test specification 1940 SEP 1940:2002 DIN EN 10049:2014 DIN EN ISO 21920-2: 2022 DIN EN ISO 21920-3: 2022 | $5.0 \% \cdot R_a$ $5.0 \% \cdot R_z$ 2.0 cm^{-1} 2.0 cm^{-1} | Depending on the profile height other intersection line distances can be chosen (as specified) |
| Roughness on aperiodic roughness standards R_a R_z R_{max} , $R_z I_{max}$ $R_{zx}(l)$ | 0.1 μm to 3,5 μm 0.5 μm to 20 μm 0.5 μm to 20 μm 0.5 μm to 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 | $2.5 \% \cdot R_a$ $3.0 \% \cdot R_z$ $3.5 \% \cdot R_{max}$ $3.5 \% \cdot R_z I_{max}$ $3.5 \% \cdot R_{zx}(l)$ | |
| Rpk Rk Rvk | On surfaces in the range | DIN 4776:1990 DIN EN ISO 13565-1:1998 DIN EN ISO 13565-2:1998 | $9.0 \% \cdot Rpk$ $5.0 \% \cdot Rk$ $8.0 \% \cdot Rvk$ | |
| $Mr1$, $Rmr1$ $Mr2$, $Rmr2$ | $0.1 \mu\text{m} \leq R_a \leq 3.5 \mu\text{m}$ $0.5 \mu\text{m} \leq R_z \leq 20 \mu\text{m}$ | DIN EN ISO 21920-2: 2022 DIN EN ISO 21920-3: 2022 DIN EN ISO 16610-31:2017 | 2.0 % 2.0 % | Relative measuring uncertainty relative to 100 % material ratio |
| R_a R_z RP_c Rp_c | 0.1 μm to 3.5 μm 0.5 μm to 20 μm $25 \leq RP_c \leq 100$ $25 \leq Rp_c \leq 100$ | Steel test specification 1940 SEP 1940:2002 DIN EN 10049:2014 DIN EN ISO 21920-2: 2022 DIN EN ISO 21920-3: 2022 | $8 \% \cdot R_a$ $8 \% \cdot R_z$ 2.0 cm^{-1} 2.0 cm^{-1} | Depending on the profile height other intersection line distances can be chosen (as specified) |

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Calibration and Measurement Capabilities (CMC)

| Measurement quantity / Calibration item | Range | Measurement conditions / procedure | Expanded uncertainty of measurement | Remarks |
|---|--|--|--|---|
| Roughness on extra fine aperiodic roughness standards <i>Ra</i> <i>Rz</i> <i>Rmax, Rz1max</i> <i>Rzx(l)</i> | 0.015 µm to 0.1 µm 0.1 µm to 0.8 µm 0.1 µm to 0.8 µm 0.1 µm to 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 | 6 % · <i>Ra</i> 7 % · <i>Rz</i> 9 % · <i>Rmax</i> 9 % · <i>Rzx(l)</i> | |
| <i>Rpk</i> <i>Rk</i> <i>Rvk</i> | On surfaces in the range | DIN 4776:1990 DIN EN ISO 13565-1:1998 DIN EN ISO 13565-2:1998 | 10 % · <i>Rpk</i> 6 % · <i>Rk</i> 9 % · <i>Rvk</i> | |
| <i>Mr1, Rmrk1</i> <i>Mr2, Rmrk2</i> | 0.015 µm ≤ <i>Ra</i> ≤ 0.1 µm 0.1 µm ≤ <i>Rz</i> ≤ 0.8 µm | DIN EN ISO 21920-2: 2022 DIN EN ISO 21920-3: 2022 DIN EN ISO 16610-31:2017 | 2.0 % 2.0 % | Relative measuring uncertainty relative to 100 % material ratio |
| Roundness standards Roundness deviation | to 10 µm > 10 µm to 20 µm | DIN EN ISO 1101:2017 DIN EN ISO 12181-1:2011 DIN EN ISO 12181-1:2011 DKD-R 4-4:2018 | 0.025 µm 0.1 µm | Diameter: 5 mm to 300 mm |
| Magnification standards (flick standards) Roundness deviation | 2 µm to 20 µm > 20 µm to 60 µm > 60 µm to 500 µm | | 0.2 µm 0.3 µm 0.5 % of measured value | |
| Cylindrical form standards Roundness deviation | to 20 µm | DIN EN ISO 1101:2017 DIN EN ISO 12181-1:2011 DIN EN ISO 12181-1:2011 DKD-R 4-4:2018 | 0.1 µm | Diameter: 3 mm to 300 mm Length: 5 mm to 300 mm |
| Straightness deviation of the generatrices Length: 2 mm to 300 mm | to 10 µm | | 0.2 µm | |
| Length: 2 mm to 100 mm | | | 0.2 µm | |
| Length: > 100 mm to 300 mm | > 10 µm to 20 µm | | 0.3 µm | |
| Parallelism deviation of the generatrices Length: 2 mm to 300 mm | to 10 µm | | 0.3 µm | |
| Length: 2 mm to 100 mm Length: > 100 mm to 300 mm | > 10 µm to 20 µm | | 0.3 µm 0.4 µm | |

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Calibration and Measurement Capabilities (CMC)

| Measurement quantity / Calibration item | Range | Measurement conditions / procedure | Expanded uncertainty of measurement | Remarks |
|---|--|--|---|--|
| Contour standards | | Substitution measurement with reference contour standard according to VDI 2629 part 1:2008 Procedure according to DIN EN ISO 15530-3:2012 | | |
| X Length Lateral distances | 5 mm to 100 mm | | 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° | |
| Stylus instruments according to DIN 4772:1979 DIN EN ISO 3274:1998 Groove depth Pt and d Ra Rz R_{max} , RzI_{max} $Rz(l)$ RSm | 0.15 μm to 5500 μm 0.015 μm to 3.5 μm 0.1 μm to 20 μm 0.1 μm to 20 μm 0.1 μm to 20 μm 40 μm to 400 μm | DKD-R 4-2 Blatt 2:2018 DIN EN ISO 12179:2020 E | $U_{\text{normal}} + 0.01 \mu\text{m}$ $U_{\text{normal}} + 1 \% \cdot Ra$ $U_{\text{normal}} + 1 \% \cdot Rz$ $U_{\text{normal}} + 1 \% \cdot R_{max}$ $U_{\text{normal}} + 1 \% \cdot Rz(l)$ $U_{\text{normal}} + 1 \mu\text{m}$ | U_{normal} is the measurement uncertainty of the standards used. Smaller measuring ranges for which standards are available can also be calibrated. |
| Rpk Rk Rvk | On surfaces in the range | DIN 4776: 1990 DIN EN ISO 13565-1: 1998 DIN EN ISO 13565-2: 1998 | $U_{\text{normal}} + 1 \% \cdot Rpk$ $U_{\text{normal}} + 1 \% \cdot Rk$ $U_{\text{normal}} + 1 \% \cdot Rvk$ | Relative measuring uncertainty relative to 100 % material ratio |
| $Mr1$, $Rmr1$ $Mr2$, $Rmr2$ | | 0.015 $\mu\text{m} \leq Ra \leq 3.5 \mu\text{m}$ 0.1 $\mu\text{m} \leq Rz \leq 20 \mu\text{m}$ | DIN EN ISO 21920-2: 2022 DIN EN ISO 21920-3: 2022 DIN EN ISO 16610-31:2017 | |
| Optoelectronic length and diameter measuring devices (Shaft measuring systems) | | Shadow image method QMA: Kalibrierung von Wellenmessgeräten: 2021-10 (english: Calibration of shaft measuring systems 2021-10) | | Smaller measuring ranges for which standards are available can also be calibrated |
| Diameter | to 320 mm | | 0.4 $\mu\text{m} + 0.6 \cdot 10^{-6} \cdot d$ | d = measured diameter |
| Length | to 1200 mm | | 0.5 $\mu\text{m} + 0.6 \cdot 10^{-6} \cdot l$ | l = measured length |

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On-site Calibration

| Calibration and Measurement Capabilities (CMC) | | | | | |
|--|---|--------------------|---|---|---|
| Measurement quantity / Calibration item | Range | | Measurement conditions / procedure | Expanded uncertainty of measurement | Remarks |
| Length Stylus instruments according to DIN 4772:1979 DIN EN ISO 3274:1998 Groove depth P_t and d R_a R_z R_{max} , $R_z I_{max}$ $R_{zx}(l)$ R_{Sm} | 0.15 μm to | 5500 μm | DKD-R 4-2 part 2:2010 DIN EN ISO 12179:2020 E 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 | $U_{\text{normal}} + 0.01 \mu\text{m}$ $U_{\text{normal}} + 1\% \cdot R_a$ $U_{\text{normal}} + 1\% \cdot R_z$ $U_{\text{normal}} + 1\% \cdot R_{max}$ $U_{\text{normal}} + 1\% \cdot R_{zx}(l)$ $U_{\text{normal}} + 1 \mu\text{m}$ | U_{normal} is the measurement uncertainty of the standards used. Smaller measuring ranges for which standards are available can also be calibrated. |
| R_{pk} R_k R_{vk} | On surfaces in the range $0.015 \mu\text{m} \leq R_a \leq 3,5 \mu\text{m}$ $0.1 \mu\text{m} \leq R_z \leq 20 \mu\text{m}$ | | | $U_{\text{normal}} + 1\% \cdot R_{pk}$ $U_{\text{normal}} + 1\% \cdot R_k$ $U_{\text{normal}} + 1\% \cdot R_{vk}$ | Relative measuring uncertainty relative to 100 % material ratio |
| M_{r1} , R_{mr1} M_{r2} , R_{mr2} | | | | $U_{\text{normal}} + 1\%$ $U_{\text{normal}} + 1\%$ | |
| Optoelectronic length and diameter measuring devices (Shaft measuring systems) | | | Shadow image method QMA: Kalibrierung von Wellenmessgeräten: 2021-10 (english: Calibration of shaft measuring systems 2021-10) | | Smaller measuring ranges for which standards are available can also be calibrated. |
| Diameter | to | 320 mm | | $0.4 \mu\text{m} + 0.6 \cdot 10^{-6} \cdot d$ | $d = \text{measured diameter}$ |
| Length | to | 1200 mm | | $0.5 \mu\text{m} + 0.6 \cdot 10^{-6} \cdot l$ | $l = \text{measured length}$ |

Abbreviations used:

| | |
|-------|--|
| CMC | Calibration and measurement capabilities |
| DIN | German Institute for Standardization e.V. |
| DKD-R | Guidelines of the German Calibration Service (DKD), published by the Physikalisch-Technische Bundesanstalt |
| QMA | Internal documentation of JENOPTIC Industrial Metrology Germany GmbH |
| VDI | Association of German Engineers e.V. |

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