

of **TRESCAL Hengelo B.V.**
Calibration Laboratory

This annex is valid from: **12-06-2024** to **01-12-2024**

Replaces annex dated: **08-09-2021**

Location(s) where activities are performed under accreditation

Head Office

Joseph Schumpeterstraat 10
 7559 SG
 Hengelo
 The Netherlands

| Location | Abbreviation/ location code |
|---|-----------------------------|
| Joseph Schumpeterstraat 10 7559 SG Hengelo The Netherlands | HLO |
| On site | OS |

| HCS code | Measured quantity, Instrument, Measure | Range | CMC ¹ | Remarks | Location |
|----------|--|---------------------------------------|----------------------------------|-----------------------------|----------|
| DM 0 0 | DIMENSIONAL QUANTITIES | | | | |
| DM 1 0 | Gauge blocks | | | | HLO |
| | Gauge blocks, steel | 0.5 mm – 100 mm 0.02 inch – 4 inch | 0.06 μm + 1.2·10 ⁻⁶ / | Central length, fixed sizes | |
| | Gauge blocks, tungsten carbide | 0.5 mm – 100 mm 0.02 inch – 4 inch | 0.06 μm + 0.7·10 ⁻⁶ / | Central length, fixed sizes | |
| | Gauge blocks, ceramic | 0.5 mm – 100 mm 0.02 inch – 4 inch | 0.06 μm + 1.0·10 ⁻⁶ / | Central length, fixed sizes | |

This annex has been approved by the Board of the Dutch Accreditation Council, on its behalf,

J.A.W.M. de Haas

¹ Calibration and Measurement Capability (CMC): Demonstrated measurement uncertainty, with coverage probability of 95%, in a given measurement point or measurement range. Measurement uncertainty, *U*, is calculated according to EA-4/02 "Expression of the Uncertainty of Measurement in Calibration".

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|----------|--|-----------------|--|---|----------|
| | Gauge blocks, steel / tungsten carbide / ceramic | | $0.05 \mu\text{m} + 0.1 \cdot 10^{-6} \cdot l$ | Length variation | |
| | Step gauge | up to 1000 mm | $1.2 \mu\text{m} + 6.0 \cdot 10^{-6} \cdot l$ | | |
| DM 1 0 | Length gauges | | | Comparative measure | HLO |
| | Steel | 125 mm – 500 mm | $0.2 \mu\text{m} + 3 \cdot 10^{-6} \cdot l$ | | |
| DM 2 0 | Line scales, distances | | | | HLO |
| | Rulers (all models) | up to 300 mm | $0.8 \mu\text{m} + 4 \cdot 10^{-6} \cdot l$ | | |
| | | up to 600 mm | $1.1 \mu\text{m} + 4 \cdot 10^{-6} \cdot l$ | | |
| | | up to 3000 mm | $6 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$ | | |
| | | up to 100 m | $6 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| DM 3 0 | Length measuring instruments | | | | HLO, OS |
| | 1D-measuring machines ⁽ⁱ⁾ | | | Laser interferometer; machine equipped with | |
| | | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.0 \cdot 10^{-6} \cdot l$ | Zerodur scales | |
| | | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.3 \cdot 10^{-6} \cdot l$ | Glass scales | |
| | | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.6 \cdot 10^{-6} \cdot l$ | Steel scales | |
| | | up to 400 mm | $0.3 \mu\text{m} + 0.7 \cdot r + 3 \cdot 10^{-6} \cdot l$ | Optical systems | |
| | | up to 700 mm | $0.05 \mu\text{m} + 0.5 \cdot 10^{-6} \cdot l + S$ | Using special gauge blocks | |

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|----------|---|-------------------|--|-----------------------------------|----------|
| | Handheld tools for external measurements | 0 mm – 200 mm | $0.45 \mu\text{m} + 0.5 \cdot r + 25 \cdot 10^{-6} \cdot l$ | e.g. vernier, micrometer | |
| | | 200 mm – 2000 mm | $4 \mu\text{m} + 0.5 \cdot r + 5 \cdot 10^{-6} \cdot l$ | | |
| | Handheld tools for internal measurements (2-point) | 0 mm – 200 mm | $0.7 \mu\text{m} + 0.5 \cdot r + 25 \cdot 10^{-6} \cdot l$ | e.g. vernier, internal micrometer | |
| | | 200 mm – 400 mm | $5 \mu\text{m} + 0.5 \cdot r + 4 \cdot 10^{-6} \cdot l$ | | |
| | Handheld tools for internal measurements (2- and 3-point) | 1 mm – 250 mm | $1.5 \mu\text{m} + 0.5 \cdot r + 25 \cdot 10^{-6} \cdot l$ | e.g. internal micrometers | |
| | Handheld tools for height- and depth measurements | 0 mm – 200 mm | $0.7 \mu\text{m} + 0.5 \cdot r + 25 \cdot 10^{-6} \cdot l$ | e.g. (depth) vernier | |
| | | 200 mm – 500 mm | $4 \mu\text{m} + 0.5 \cdot r + 5 \cdot 10^{-6} \cdot l$ | | |
| | Linear displacement sensor | up to 200 mm | $0.05 \mu\text{m} + 0.7 \cdot r + 2.5 \cdot 10^{-6} \cdot l + S$ | e.g. dial gauge | |
| | | 200 mm – 300 mm | $0.7 \mu\text{m} + 0.7 \cdot r + 3.5 \cdot 10^{-6} \cdot l$ | e.g. dial gauge | HLO |
| | Height gauge | up to 1500 mm | $0.8 \mu\text{m} + 0.7 \cdot r + 2.5 \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | Inside micrometer | up to 300 mm | $0.7 \mu\text{m} + 0.7 \cdot r + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | | 300 mm – 1000 mm | $0.4 \mu\text{m} + 0.7 \cdot r + 2 \cdot 10^{-6} \cdot l$ | | |
| | | 1000 mm – 3000 mm | $0.4 \mu\text{m} + 0.7 \cdot r + 2 \cdot 10^{-6} \cdot l$ | | HLO |
| | Film thickness gauge | up to 25 mm | $0.6 \mu\text{m} + 0.7 \cdot r + 22 \cdot 10^{-6} \cdot l$ | | |
| | Laser distance meter | up to 25 m | $0.5 \text{ mm} + 40 \cdot 10^{-6} \cdot l + 0.6 \cdot r$ | | |

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|----------|--|-------------------|--|-------------------------|----------|
| DM 4 0 | Diameter, length | | | | HLO |
| | Setting rings and ring gauges | Ø 1 mm – 4 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| | | Ø 4 mm – 200 mm | $1.0 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | |
| | | Ø 200 mm – 500 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| | Pin gauge | up to Ø 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | Plug gauge | up to Ø 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | Thread wires | up to Ø 20 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | Other external diameters | up to Ø 100 mm | $0.5 \mu\text{m} + (1+6 \cdot \Delta T) \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | | up to Ø 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | HLO |
| | Other internal diameters | Ø 1 mm – 4 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| | | Ø 4 mm – 200 mm | $1.0 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | |
| | | Ø 200 mm – 500 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| | Feeler gauges | up to 5 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | Setting gauges for micrometers | up to 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | | 300 mm – 1000 mm | $0.4 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | | 1000 mm – 3000 mm | $0.4 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | HLO |
| | Other distances for parallel faces | up to 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | | 300 mm – 1000 mm | $0.4 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | | 1000 mm – 3000 mm | $0.4 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | HLO |
| | Conical (taper) ring and pin | Ø 1 mm – 500 mm | $1.8 \mu\text{m} + 0.4 \cdot 10^{-6} \cdot l$ | $h \leq 390 \text{ mm}$ | HLO |

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| DM 5 0 | Form error | | | | |
| | Roundness in- and externally | Ø 1 mm – 500 mm | $0.05 \mu\text{m} + 0.01 \cdot A$ | A=roundness deviation | HLO |
| | Roundness testers and other instruments for measuring roundness | | $0.04 \mu\text{m} + 0.5 \cdot r$ | ⁽ⁱ⁾ | HLO, OS |
| | Knife edge straight edge | up to 100 mm | 0.25 μm | | |
| | | 100 mm – 300 mm | 0.6 μm | | |
| | | 300 mm – 500 mm | 0.7 μm | | |
| | Straight edge | up to 10 m | $0.4 \mu\text{m} + 0.25 \cdot 10^{-6} \cdot l$ | | |
| | Surface plate | Up to 6 x 10 m ² | $0.2 \mu\text{m} + 1.5 \cdot 10^{-6} \cdot l$ | l = longest side of the surface plate | |
| | Flick standard (roundness standard) | | 0.15 μm | | HLO |
| DM 6 0 | Roughness ⁽ⁱ⁾ | | | | |
| | Surface texture measuring instruments | Ra up to 5 μm | $0.01 \mu\text{m} + 0.02 \cdot A + 0.5 \cdot r + S$ | A = Ra-value of reference | HLO, OS |
| | | Rz up to 10 μm | $0.01 \mu\text{m} + 0.05 \cdot A + 0.5 \cdot r + S$ | A = Rz-value of reference | |
| | | Rt Rmax up to 10 μm | $0.01 \mu\text{m} + 0.05 \cdot A + 0.5 \cdot r + S$ | A = Rt Rmax-value of reference | |
| | Roughness standards | Ra up to 10 μm | $0.015 \mu\text{m} + 0.045 \cdot A$ | A = measured Ra-value | HLO |
| | | Rz up to 15 μm | $0.025 \mu\text{m} + 0.07 \cdot A$ | A = measured Rz-value | |
| | | Rt (Rmax) up to 15 μm | $0.025 \mu\text{m} + 0.07 \cdot A$ | A = measured Rt (Rmax)-value | |
| | Groove depth (-standaard) | up to 6 mm | $0.05 \mu\text{m} + 0.007 \cdot A$ | A = measured profile height | HLO |

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| DM 7 0 | Thread quantities external | | | e.g. screw plug gauge | HLO |
| | Pitch | up to 10 mm | 2 µm | | |
| | Profile angle | up to 180° | (0.2 + 9/L) arcmin | | |
| | Simple pitch diameter | Ø 1 mm – 300 mm | α = 30°: (6.0 – 7.5) µm | According to Euramet/CG-10/V.02, method 1a or 1b | |
| | | Ø 1 mm – 300 mm | α = 55° 60°: (3.2 – 4.1) µm | | |
| | | Ø 1 mm – 300 mm | α = 90°: (2.6 – 3.4) µm | | |
| | Pitch diameter | Ø 1 mm – 300 mm | α = 30°: (6.0 – 7.5) µm | According to Euramet/CG-10/V.02, method 2a, 2b or 3 | |
| | | Ø 1 mm – 300 mm | α = 55° 60°: (3.2 – 4.1) µm | | |
| | | Ø 1 mm – 300 mm | α = 90°: (2.6 – 3.4) µm | | |
| DM 7 0 | Thread quantities | | | | HLO |
| | Thread quantities measured with master scanner (<i>Thread trapezium excluded</i>) | | | Method 4 according to TCGM – 04.05 d = nominal diameter α = flank angle P = pitch Cylindrical & Conical thread | |
| | Thread plug gauges (external thread) outside, core diameter pitch diameter | Ø 2 mm – 90 mm Ø 2 mm – 90 mm | 1.5 µm + 5·10 ⁻⁶ ·/ 2.5 µm + 10·10 ⁻⁶ ·/ 4.5 µm + 10·10 ⁻⁶ ·/ | α ≥ 27° α < 27° | |
| | Thread ring gauges (internal thread) outside, core diameter pitch diameter | Ø 3 mm – 100 mm Ø 3 mm – 100 mm | 1.5 µm + 10·10 ⁻⁶ ·/ 2.5 µm + 10·10 ⁻⁶ ·/ 4.5 µm + 10·10 ⁻⁶ ·/ | α ≥ 27° α < 27° | |

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| DM 7 0 | Thread quantities internal | | | e.g. screw ring gauge | HLO |
| | Pitch | up to 10 mm | 2 µm | | |
| | Profile angle | up to 180° | (0.2 + 9/L) arcmin | Measurement on cast | |
| | Simple pitch diameter | ∅ 4 mm – 200 mm | α = 30°: (9 – 14) µm | According to Euramet/CG-10/V.02, method 1a or 1b | |
| | | | α = 55° 60°: (3.6 – 7) µm | | |
| | | | α = 90°: (3.1 – 6.2) µm | | |
| | Pitch diameter | ∅ 4 mm – 200 mm | α = 30°: (9 – 14) µm | According to RvA-I-4.05, Euramet/CG-10/V.02, method 2a, 2b or 3 | |
| | | | α = 55° 60°: (3.6 – 7) µm | | |
| | | | α = 90°: (3.1 – 6.2) µm | | |
| DM 8 0 | Combined instruments ⁽ⁱ⁾ | | | | HLO, OS |
| | 1D-, 2D- en 3D-measuring machines | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.0 \cdot 10^{-6} \cdot l$ | Laser interferometer, Zerodur scales | |
| | | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.3 \cdot 10^{-6} \cdot l$ | Laser interferometer, glass scales | |
| | | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.6 \cdot 10^{-6} \cdot l$ | Laser interferometer, steel scales | |
| | | up to 400 mm | $0.3 \mu\text{m} + 0.7 \cdot r + 2.3 \cdot 10^{-6} \cdot l$ | Optical systems | |
| | | up to 700 mm | $0.05 \mu\text{m} + 0.5 \cdot 10^{-6} \cdot l + S$ | Using special gauge blocks | |
| | Deviation of nominal displacement | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.0 \cdot 10^{-6} \cdot l$ | Laser interferometer, Zerodur scales | |
| up to 20 m | | $0.15 \mu\text{m} + 0.7 \cdot r + 1.3 \cdot 10^{-6} \cdot l$ | Laser interferometer, glass scales | | |

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| | | up to 20 m | $0.15 \mu\text{m} + 0.7 \cdot r + 1.6 \cdot 10^{-6} \cdot l$ | Laser interferometer, steel scales | |
| | | up to 400 mm | $0.3 \mu\text{m} + 0.7 \cdot r + 2.3 \cdot 10^{-6} \cdot l$ | Optical systems | |
| | | up to 700 mm | $0.05 \mu\text{m} + 0.5 \cdot 10^{-6} \cdot l + S$ | Using special gauge blocks | |
| | Deviations transverse to the translation directions | up to 0.5 mm | $0.1 \mu\text{m} + 3 \cdot 10^{-6} \cdot l + 0.005 \cdot A$ | A = measured deviation; measuring length up to 3000 mm | |
| | Rotational deviations around the translation direction | up to 400 arcsec | $0.5 \text{ arcsec} + 0.0035 \cdot H$ | H = measured angle; only horizontal translations | |
| | | up to 2000 $\mu\text{m}/\text{m}$ | $2.5 \mu\text{m}/\text{m} + 0.0035 \cdot H$ | | |
| | | up to 400 arcsec | $1.6 \text{ arcsec} + 0.007 \cdot H$ | Up to 2000 mm translation; ceramic straight edge and 2 displacement sensors | |
| | | up to 2000 $\mu\text{m}/\text{m}$ | $8 \mu\text{m}/\text{m} + 0.007 \cdot H$ | | |
| | Other rotational deviations | up to 7200 arcsec | $0.5 \text{ arcsec} + 0.0016 \cdot H$ | H = measured angle, translation up to 20 m | |
| | Translation deviation along a rotational axis | | 0.025 μm | | |
| | Parallelism of a rotation and a translation | translation up to 500 mm | 1 arcsec | | |
| | Squareness of 2 translations | up to 500 x 500 mm ² | 1 arcsec | Ceramic square and displacement sensor | |
| | | up to 500 x 500 mm ³ | 0.6 arcsec | | Ceramic square and measurement system on measuring machine; reversal method |
| | Squareness of a rotation and a translation | translation up to 150 mm | 0.07 μm | | |
| | | translation up to 300 mm | 0.7 μm | | |

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| DM 8 0 | Coordinate Measuring Machines X, Y and Z axis | | | using calibration fixture (steppauge) measuring (reference). | HLO, OS |
| | | max. 1000 mm | $0.95 \mu\text{m} + 0.5 \cdot 10^{-6} \cdot l$ | Measurement uncertainty steel reference and glass ruler. | |
| | | max. 2000 mm | $1.0 \mu\text{m} + 0.8 \cdot 10^{-6} \cdot l$ | Measurement uncertainty steel reference and glass ruler. | |
| | | max. 100 mm | $0.6 \mu\text{m}$ | Measurement uncertainty steel reference and zerodur ruler. | |
| | | max. 500 mm | $1.2 \mu\text{m} + 0.65 \cdot 10^{-6} \cdot l$ | Measurement uncertainty steel reference and zerodur ruler. | |
| DM 8 1 | Tools, products | | | | HLO |
| | Surface profiles | up to 6 x 120 mm ² | $0.05 \mu\text{m} + 0.007 \cdot A$ | A = measured profile height | |
| | Roughness | Ra: up to 10 μm | $0.015 \mu\text{m} + 0.045 \cdot A$ | A = measured Ra-value | |
| | | Rz: up to 15 μm | $0.025 \mu\text{m} + 0.07 \cdot A$ | A = measured Rz-value | |
| | | Rt, Rmax: up to 15 μm | $0.025 \mu\text{m} + 0.07 \cdot A$ | A = measured Rt, Rmax-value | |
| | Straightness | up to 6 x 120 mm ² | $0.05 \mu\text{m} + 0.007 \cdot A$ | A = measured profile height | |
| | | up to 100 mm | $0.25 \mu\text{m}$ | | |
| | | 100 mm – 300 mm | $0.6 \mu\text{m}$ | | |
| | | 300 mm – 500 mm | $0.7 \mu\text{m}$ | | |
| | | up to 1000 mm | $1.3 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | |

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| | | up to 10 m | $0.5 \mu\text{m} + 0.5 \cdot 10^{-6} \cdot l$ | - | HLO, OS |
| | Roundness external | up to \varnothing 500 mm | $0.05 \mu\text{m} + 0.01 \cdot A$ | A = measured roundness | HLO |
| | Roundness internal | \varnothing 0.7 mm – 500 mm | $0.05 \mu\text{m} + 0.01 \cdot A$ | A = measured roundness | |
| | Cylindricity | up to \varnothing 500 and up to height 100 mm | $0.5 \mu\text{m} + 1.1 \cdot 10^{-6} \cdot H + 0.01 \cdot A$ | A = measured cylindricity H = height cylinder | |
| | | up to \varnothing 500 and up to height 500 mm | $1.1 \mu\text{m} + 2 \cdot 10^{-6} \cdot H + 0.01 \cdot A$ | | |
| | Coaxiality and concentricity | up to \varnothing 500 and up to height 500 mm | $0.1 \mu\text{m} + 0.02 \cdot A$ | A = measured coaxiality / concentricity | |
| | Flatness | up to \varnothing 60 mm | $0.04 \mu\text{m}$ | | |
| | | up to \varnothing 145 mm | $0.06 \mu\text{m}$ | | |
| | | up to \varnothing 300 mm | $0.6 \mu\text{m}$ | | |
| | | up to $6 \times 10 \text{ m}^2$ | $0.2 \mu\text{m} + 1.5 \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | Angles between sides or planes | up to 180° | $(0.2 + 9/A) \text{ arcmin}$ | A = leg length; leg length up to 200 mm | HLO |
| | Diameter external | up to \varnothing 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | | up to \varnothing 100 mm | $0.5 \mu\text{m} + (1 + 6 \cdot \Delta T) \cdot 10^{-6} \cdot l$ | | HLO, OS |
| | | \varnothing 300 mm – 500 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | HLO |
| | Diameter internal | \varnothing 1 mm – 4 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| | | \varnothing 4 mm – 200 mm | $1.0 \mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | |
| | | \varnothing 200 mm – 500 mm | $1.2 \mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| DM 8 1 | Tools, products | Distance of 2 parallel planes | | | HLO |
| | External | up to 300 mm | $0.8 \mu\text{m} + 2.5 \cdot 10^{-6} \cdot l$ | | |
| | | up to 100 mm | $0.5 \mu\text{m} + (1 + 6 \cdot \Delta T) \cdot 10^{-6} \cdot l$ | | HLO, OS |

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| | | 300 mm – 3000 mm | 0.4 $\mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | HLO |
| | Internal | \varnothing 1 mm – 4 mm | 1.2 $\mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| | | \varnothing 4 mm – 200 mm | 1.0 $\mu\text{m} + 2 \cdot 10^{-6} \cdot l$ | | |
| | | \varnothing 200 mm – 500 mm | 1.2 $\mu\text{m} + 6 \cdot 10^{-6} \cdot l$ | | |
| DM 8 1 | Tools, products | Thread external | | | HLO |
| | Pitch | up to 10 mm | 2 μm | | |
| | Profile angle | up to 180° | (0.2 + 9/L) arcmin | | |
| | Simple pitch diameter | \varnothing 1 mm – 300 mm | $\alpha = 30^\circ$: (6.0 – 7.5) μm | According to Euramet/CG-10 V 2.0, method 1a or 1b | |
| | | \varnothing 1 mm – 300 mm | $\alpha = 55^\circ 60^\circ$: (3.2 – 4.1) μm | | |
| | | \varnothing 1 mm – 300 mm | $\alpha = 90^\circ$: (2.6 – 3.4) μm | | |
| | Pitch diameter | \varnothing 1 mm – 300 mm | $\alpha = 30^\circ$: (6.0 – 7.5) μm | According to Euramet/CG-10 V 2.0, method 2a, 2b or 3 | |
| | | \varnothing 1 mm – 300 mm | $\alpha = 55^\circ 60^\circ$: (3.2 – 4.1) μm | | |
| | | \varnothing 1 mm – 300 mm | $\alpha = 90^\circ$: (2.6 – 3.4) μm | | |
| | Simple pitch diameter | \varnothing 4 mm – 100 mm | $\alpha = 30^\circ$: (9 – 14) μm | According to Euramet/CG-10 V 2.0, method 1a or 1b | |
| | | \varnothing 4 mm – 100 mm | $\alpha = 55^\circ 60^\circ$: (3.6 – 7) μm | | |
| | | \varnothing 4 mm – 100 mm | $\alpha = 90^\circ$: (3.1 – 6) μm | | |
| | Pitch diameter | \varnothing 4 mm – 100 mm | $\alpha = 30^\circ$: (9 – 14) μm | According to Euramet/CG-10 V 2.0, method 2a, 2b or 3 | |
| | | \varnothing 4 mm – 100 mm | $\alpha = 55^\circ 60^\circ$: (3.6 – 7) μm | | |
| | | \varnothing 4 mm – 100 mm | $\alpha = 90^\circ$: (3.1 – 6) μm | | |

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| HCS code | Measured quantity, Instrument, Measure | Range | CMC ¹ | Remarks | Location |
|----------|--|-------------------------------------|--|------------------------------------|----------|
| DM 9 0 | Angle measurement | | | | HLO |
| | Angle gauge block | 0° – 180° | 2 arcsec | | |
| | Cylindrical square | up to Ø 300 mm, up to height 500 mm | $0.9 \mu\text{m} + 2.1 \cdot 10^{-6} \cdot l + 0.02 \cdot A$ | A = measured squareness | |
| | Square | up to 500 mm leg length | $0.7 \mu\text{m} + 2.2 \cdot 10^{-6} \cdot l + 0.02 \cdot A$ | A = measured squareness | |
| | Angle plate | 90° | 0.5 arcsec | | |
| | Autocollimator | up to 12.5 mm/m | $0.5 \mu\text{m}/\text{m} + 0.001 \cdot H + 0.7 \cdot r$ | | |
| | | up to 2600 arcsec | $0.1 \text{ arcsec} + 0.001 \cdot H + 0.7 \cdot r$ | | |
| | Spirit level | up to 12.5 mm/m | $0.5 \mu\text{m}/\text{m} + 0.001 \cdot H + 0.7 \cdot r$ | | |
| | | up to 2600 arcsec | $0.1 \text{ arcsec} + 0.001 \cdot H + 0.7 \cdot r$ | | |
| DM 9 1 | Angle measurement | | | | HLO |
| | Leveling instruments | | 0.01 mm/m | | |
| DM 9 2 | Angle measurement | | | | HLO |
| | Polygon | up to 360° | 0.5 arcsec | | |
| | Pentagon prism | 90° | 0.5 arcsec | | |
| DM 9 3 | Angle measurement | | | | HLO, OS |
| | Deviation of the nominal rotation | 360° | $0.9 \text{ arcsec} + 0.7 \cdot r$ | f.i. rotary heads and rotary table | |
| DM 9 4 | Angle measurement | | | | HLO, OS |
| | Clinometer | up to 360° | 5 arcsec | | |

Annex to declaration of accreditation (scope of accreditation)
 Normative document: EN ISO/IEC 17025:2017
 Registration number: **K 018**

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| HCS code | Measured quantity, Instrument, Measure | Range | CMC ¹ | Remarks | Location |
|----------|--|----------------|---|-------------------|----------|
| MW 1 0 | MASS AND WEIGHT | | | | HLO, OS |
| MW 1 2 | Weighing instruments | 1 mg – 33 kg | $2.5 \cdot 10^{-5} \cdot m + \text{last digit} + h/2$ | h = Repeatability | |
| | | 1 mg – 2500 kg | $6 \cdot 10^{-5} \cdot m + \text{last digit} + h/2$ | h = Repeatability | |

| HCS code | Measured quantity, Instrument, Measure | Frequency | CMC ¹ | Remarks | Location |
|----------|--|-----------|---|-----------|----------|
| LF 0 0 | DC/LF ELECTRICITY | | | | |
| LF 1 0 | Direct voltage | | | | HLO, OS |
| | 0 mV – 200 mV | | $1.0 \cdot 10^{-5} \cdot U$, minimum 0.15 μ V | Measuring | |
| | 0.2 V – 2 V | | $7 \cdot 10^{-6} \cdot U$ | Measuring | |
| | 2 V – 20 V | | $5 \cdot 10^{-6} \cdot U$ | Measuring | |
| | 20 V – 200 V | | $7 \cdot 10^{-6} \cdot U$ | Measuring | |
| | 200 V – 1000 V | | $8 \cdot 10^{-6} \cdot U$ | Measuring | |
| | 0 mV – 220 mV | | $2.0 \cdot 10^{-5} \cdot U$, minimum 1.5 μ V | Generate | |
| | 0.22 V – 2.2 V | | $7 \cdot 10^{-6} \cdot U$ | Generate | |
| | 2.2 V – 22 V | | $1.0 \cdot 10^{-5} \cdot U$ | Generate | |
| | 22 V – 220 V | | $1.5 \cdot 10^{-5} \cdot U$ | Generate | |
| | 220 V – 1100 V | | $1.0 \cdot 10^{-5} \cdot U$ | Generate | |
| LF 2 0 | Direct current | | | | HLO, OS |
| | 1 μ A – 200 μ A | | $1 \cdot 10^{-4} \cdot I$, minimum 0.5 nA | Measuring | |
| | 200 μ A – 20 mA | | $3 \cdot 10^{-5} \cdot I$ | Measuring | |

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| HCS code | Measured quantity, Instrument, Measure | Frequency | CMC ¹ | Remarks | Location |
|----------|--|------------------|---|--------------------------------|----------|
| | 20 mA – 200 mA | | $7 \cdot 10^{-5} \cdot I$ | Measuring | |
| | 0.2 A – 2 A | | $2.5 \cdot 10^{-4} \cdot I$ | Measuring | |
| | 2 A – 20 A | | $6 \cdot 10^{-4} \cdot I$ | Measuring | |
| | 0 μ A – 220 mA | | $1.0 \cdot 10^{-4} \cdot I$, minimum 0.5 nA | Generate compliance < 0,5 V | |
| | 0.22 A – 2.2 A | | $1 \cdot 10^{-4} \cdot I$ | Generate compliance < 0,5 V | |
| | 2.2 A – 20 A | | $2.0 \cdot 10^{-4} \cdot I$ | Generate compliance < 0,5 V | |
| | 20 A – 1000 A | | $5 \cdot 10^{-3} \cdot I$ | Generate, with coils | |
| LF 3 0 | Alternating voltage | | | | HLO, OS |
| | 10 mV – 200 mV | 20 Hz – 20 kHz | $1.4 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 10 mV – 200 mV | 20 kHz – 100 kHz | $4 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 0.2 V – 2 V | 20 Hz – 10 kHz | $2.0 \cdot 10^{-4} \cdot U$ | Measuring | |
| | 0.2 V – 2 V | 10 kHz – 100 kHz | $1.0 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 2 V – 20 V | 20 Hz – 10 kHz | $1.6 \cdot 10^{-4} \cdot U$ | Measuring | |
| | 2 V – 20 V | 10 kHz – 100 kHz | $1 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 20 V – 200 V | 20 Hz – 10 kHz | $1.6 \cdot 10^{-4} \cdot U$ | Measuring | |
| | 20 V – 200 V | 10 kHz – 100 kHz | $1 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 200 V – 1000 V | 55 Hz – 10 kHz | $2.0 \cdot 10^{-4} \cdot U$ | Measuring | |
| | 200 V – 1000 V | 10 kHz – 30 kHz | $1.0 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 1 kV – 100 kV | 50 Hz | $1.0 \cdot 10^{-3} \cdot U$ | Measuring | |
| | 2.2 mV – 22 mV | 40 Hz – 20 kHz | $5 \cdot 10^{-4} \cdot U$ | Generate | |
| | 22 mV – 220 V | 40 Hz – 20 kHz | $1.0 \cdot 10^{-4} \cdot U$ | Generate | |
| | 220 V – 1100 V | 40 Hz – 1 kHz | $1.0 \cdot 10^{-4} \cdot U$ | Generate | |

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| HCS code | Measured quantity, Instrument, Measure | Frequency | CMC ¹ | Remarks | Location |
|----------|--|----------------|-----------------------------|---|----------|
| LF 4 0 | Alternating current | | | | HLO, OS |
| | 10 µA – 100 µA | 55 Hz – 1 kHz | $4 \cdot 10^{-3} \cdot I$ | Measuring | |
| | 100 µA – 200 mA | 55 Hz – 1 kHz | $6 \cdot 10^{-4} \cdot I$ | Measuring | |
| | 0.2 A – 2 A | 55 Hz – 1 kHz | $1.0 \cdot 10^{-3} \cdot I$ | Measuring | |
| | 2 A – 20 A | 55 Hz – 1 kHz | $1.3 \cdot 10^{-3} \cdot I$ | Measuring | |
| | 20 A – 600 A | 50 Hz | $6 \cdot 10^{-4} \cdot I$ | Measuring | |
| | 100 µA – 220 mA | 40 Hz – 1 kHz | $2.0 \cdot 10^{-4} \cdot I$ | Generate | |
| | 0.22 A – 2.2 A | 40 Hz – 1 kHz | $3 \cdot 10^{-4} \cdot I$ | Generate | |
| | 2.2 A – 20 A | 40 Hz – 440 Hz | $1.0 \cdot 10^{-3} \cdot I$ | Generate | |
| | 20 A – 1000 A | 45 – 60 Hz | $5 \cdot 10^{-3} \cdot I$ | Generate, with coils Calibration of clamps | HLO |
| | 20 A – 200 A | 60 – 440 Hz | $7.5 \cdot 10^{-3} \cdot I$ | Generate, with coils Calibration of clamps | HLO |
| | | | | | |
| LF 6 1 | Resistance | | | | HLO, OS |
| | 100 µΩ – 1 mΩ | | $3 \cdot 10^{-4} \cdot R$ | Measuring | |
| | 1 mΩ – 100 mΩ | | $1.5 \cdot 10^{-4} \cdot R$ | Measuring | |
| | 100 mΩ – 1 Ω | | $5 \cdot 10^{-5} \cdot R$ | Measuring | |
| | 1 Ω – 2 Ω | | $3.0 \cdot 10^{-5} \cdot R$ | Measuring | |
| | 2 Ω – 2 kΩ | | $1.3 \cdot 10^{-5} \cdot R$ | Measuring | |
| | 2 kΩ – 20 kΩ | | $1.1 \cdot 10^{-5} \cdot R$ | Measuring | |
| | 20 kΩ – 2 MΩ | | $1.2 \cdot 10^{-5} \cdot R$ | Measuring | |
| | 2 MΩ – 20 MΩ | | $3.6 \cdot 10^{-5} \cdot R$ | Measuring | |
| | 20 MΩ – 200 MΩ | | $2.8 \cdot 10^{-4} \cdot R$ | Measuring | |
| | 200 MΩ – 2 GΩ | | $3.0 \cdot 10^{-3} \cdot R$ | Measuring | |
| | | | | | |

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|----------|--|-----------|-------------------------|-----------------------------------|----------|
| LF 6 1 | Resistance | | | | HLO, OS |
| | 0 Ω | | 70 μΩ | Generate | |
| | 100 μΩ, 1 mΩ, 10 mΩ | | 1·10 ⁻⁴ ·R | Generate | |
| | 100 mΩ | | 4·10 ⁻⁵ ·R | Generate | |
| | 1 Ω, 1.9 Ω | | 8·10 ⁻⁵ ·R | Generate | |
| | 10 Ω | | 2.5·10 ⁻⁵ ·R | Generate | |
| | 19 Ω, 100 Ω, 190 Ω, 1 kΩ, 1.9 kΩ, 10 kΩ, 19 kΩ, 100 kΩ, 190 kΩ | | 2.0·10 ⁻⁵ ·R | Generate | |
| | 1 MΩ, 1.9 MΩ | | 3·10 ⁻⁵ ·R | Generate | |
| | 10 MΩ | | 4·10 ⁻⁵ ·R | Generate | |
| | 19 MΩ, 100 MΩ | | 6·10 ⁻⁵ ·R | Generate | |
| LF 6 5 | LF Capacity | | | | HLO, OS |
| | 2 nF, 10 nF, 20 nF, 200 nF | 1 kHz | 1.0·10 ⁻³ ·C | Generate only sine-shaped signals | |

| HCS code | Measured quantity, Instrument, Measure | Range | CMC ¹ | Remarks | Location |
|----------|--|--------------------|---|--|----------|
| PV 0 0 | PRESSURE AND VACUUM | | | | |
| PV 1 0 | Gas pressure | | | | |
| PV 1 1 | Absolute pressure | (750 – 1150) hPa a | 0.3 hPa | By comparison to a reference barometer | HLO |
| | | (0.01 – 1.1) MPa a | 0.3 hPa + 25·10 ⁻⁵ ·(p - 100 kPa) | | |
| | | (1.1 – 60.1) MPa a | 1·10 ⁻³ ·(p - 0.1 MPa) | By comparison with digital pressure indicators | HLO, OS |

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| HCS code | Measured quantity, Instrument, Measure | Range | CMC ¹ | Remarks | Location |
|----------|---|---------------------|--|---|----------|
| PV 1 2 | Relative pressure | (-1.5 – -90) kPa g | $25 \cdot 10^{-5} \cdot p_e$ | | HLO |
| | | (1.5 – 1000) kPa g | $25 \cdot 10^{-5} \cdot p_e$ | | |
| | | (1 – 60) MPa g | $1 \cdot 10^{-3} \cdot p_e$ | By comparison with digital pressure indicators | HLO, OS |
| PV 2 0 | Liquid pressure | | | | |
| PV 2 1 | Absolute pressure | (120 – 300) kPa a | $0.3 \text{ hPa} + 1 \cdot 10^{-3} \cdot (p - 100 \text{ kPa})$ | By comparison with digital pressure indicators | HLO, OS |
| | | (0.3 – 70.1) MPa a | $0.3 \text{ hPa} + 25 \cdot 10^{-5} \cdot (p - 0.1 \text{ MPa})$ | | |
| PV 2 2 | Relative pressure | (20 – 200) kPa g | $1 \cdot 10^{-3} \cdot p_e$ | By comparison with digital pressure indicators | HLO, OS |
| | | (0.2 – 70) MPa g | $25 \cdot 10^{-5} \cdot p_e$ | | |
| TE 0 0 | TEMPERATURE | | | | |
| TE 1 0 | Resistance thermometer with and without readout | -20 °C up to 250 °C | 0.10 °C | By comparison in liquid block baths with external reference probe | HLO, OS |
| | | 250 °C up to 650 °C | 0.20 °C | | |
| TE 3 0 | Thermocouple with and without readout | -20 °C up to 250 °C | 0.10 °C | By comparison in liquid block baths with external reference probe | HLO, OS |
| | | 250 °C up to 650 °C | 0.20 °C | | |

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| HCS code | Measured quantity, Instrument, Measure | Range | CMC ¹ | Remarks | Location |
|----------|---|---------------|---|--|----------|
| TF 0 0 | TIME AND FREQUENCY | | | | |
| TF 2 0 | Relative time | | | | HLO |
| | Electronic chronometers | 24 h | 0.1 s / 24 h | Direct measurement | |
| | Mechanical chronometers | 24 h | 5 s / 24 h | Direct measurement | |
| TF 2 1 | Time and Frequency | | | | HLO |
| | 10 Hz – 225 MHz | | $3 \cdot 10^{-6} \cdot f$ | Measure | |
| TF 2 2 | Time interval | | | | HLO |
| | 1 μ s – 1000 s | | $3 \cdot 10^{-6} \cdot t$ | Measuring; period applicable to repetitive signals | |
| | 6 min ⁻¹ – 100.000 min ⁻¹ | | $4 \cdot 10^{-6} \cdot n$ | By comparison with frequency references with n = number of revolutions min ⁻¹ | |
| TQ 0 0 | TORQUE | | | | HLO, OS |
| TQ 1 2 | Torque wrenches | 0.1 – 1350 Nm | $1.5 \cdot 10^{-2} \cdot M + 0.5 \cdot r$ | | |

Remarks:

R = reading accuracy of the instrument

Temperature conditions for electrical calibrations is nominal 23 °C; temperature conditions for geometrical and torque calibrations is nominal 20 °C, temperature conditions for pressure and temperature calibrations is nominal 21 °C

$p_e = p - p_{amb}$: p_e is overpressure, p_{amb} is ambient pressure

This list of calibrations is, unless otherwise stated, applicable for calibrations performed inside the laboratory.

¹ $P_e = P - P_{amb}$: P_e is overpressure, P_{amb} is ambient pressure