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

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

This annex is valid from: **08-09-2021** to **01-12-2024** Replaces annex dated: **21-01-2021**

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 - 100) mm (0.02 - 4) inch	0.06 μm + 1.2•10^{-6}•*l*	Central length, fixed sizes	
	Gauge blocks, tungsten carbide	(0.5 - 100) mm (0.02 - 4) inch	0.06 μm + 0.7•10^{-6}•*l*	Central length, fixed sizes	
	Gauge blocks, ceramic	(0.5 - 100) mm (0.02 - 4) inch	0.06 μm + 1.0•10^{-6}•*l*	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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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
	Gauge blocks, steel / tungsten carbide / ceramic		0.05 μm + 0.1•10^{-6}•/	Length variation	
	Step gauge	up to 1000 mm	1.2 μm + 6.0•10^{-6}•/		
DM 1 0	Length gauges			Comparative measure	HLO
	Steel	(125 – 500) mm	0.2 μm + 3·10^{-6} ·/		
DM 2 0	Line scales, distances				HLO
	Rulers (all models)	up to 300 mm	0.8 μm + 4•10^{-6}•/		
		up to 600 mm	1.1 μm + 4•10^{-6}•/		
		up to 3000 mm	6 μm + 5•10^{-6}•/		
		up to 100 m	6 μm + 6•10^{-6}•/		
DM 3 0	Length measuring instruments				HLO, OS
	1D-measuring machines			Laser interferometer; machine equipped with	
		up to 20 m	0.15 μm + 0.7•R + 1.0•10^{-6}•/	Zerodur scales	
		up to 20 m	0.15 μm + 0.7•R + 1.3•10^{-6}•/	Glass scales	
		up to 20 m	0.15 μm + 0.7•R + 1.6•10^{-6}•/	Steel scales	
		up to 400 mm	0.3 μm + 0.7•R + 3•10^{-6}•/	Optical systems	
		up to 700 mm	0.05 μm + 0.5•10^{-6}•/ + S	Using special gauge blocks	
	Handheld tools for external	(0 - 200) mm	0.45 μm + 0.5•R + 25•10^{-6}•/	e.g. vernier, micrometer	

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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
	measurements	(200 - 2000) mm	4 μm + 0.5•R + 5•10^{-6}•*l*		
	Handheld tools for internal measurements (2-point)	(0 - 200) mm	0.7 μm + 0.5•R + 25•10^{-6}•*l*	e.g. vernier, internal micrometer	
		(200 - 400) mm	5 μm + 0.5•R + 4•10^{-6}•*l*		
	Handheld tools for internal measurements (2- and 3-point)	(1 - 250) mm	1.5 μm + 0.5•R + 25•10^{-6}•*l*	e.g. internal micrometers	
	Handheld tools for height- and depth measurements	(0 - 200) mm	0.7 μm + 0.5•R + 25•10^{-6}•*l*	e.g. (depth) vernier	
		(200 - 500) mm	4 μm + 0.5•R + 5•10^{-6}•*l*		
	Linear displacement sensor	up to 200 mm	0.05 μm + 0.7•R + 2.5•10^{-6}•*l* + *S*	e.g. dial gauge	
		(200 - 300) mm	0.7 μm + 0.7•R + 3.5•10^{-6}•*l*	e.g. dial gauge	HLO
	Height gauge	up to 1500 mm	0.8 μm + 0.7•R + 2.5•10^{-6}•*l*		HLO, OS
	Inside micrometer	up to 300 mm	0.7 μm + 0.7•R + 2.5•10^{-6}•*l*		
		(300 - 1000) mm	0.4 μm + 0.7•R + 2•10^{-6}•*l*		
		(1000 - 3000) mm	0.4 μm + 0.7•R + 2•10^{-6}•*l*		HLO
	Film thickness gauge	up to 25 mm	0.6 μm + 0.7•R + 22•10^{-6}•*l*		
	Laser distance meter	up to 25 m	0.5 mm + 40•10^{-6}•L + 0,6•R		

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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
DM 4 0	Diameter, length				HLO
	Setting rings and ring gauges	Ø (1 - 4) mm	1.2 μm + 6•10^{-6}•*l*		
		Ø (4 - 200) mm	1.0 μm + 2•10^{-6}•*l*		
		Ø (200 - 500) mm	1.2 μm + 6•10^{-6}•*l*		
	Pin gauge	up to Ø 300 mm	0.8 μm + 2.5•10^{-6}•*l*		
	Plug gauge	up to Ø 300 mm	0.8 μm + 2.5•10^{-6}•*l*		
	Thread wires	up to Ø 20 mm	0.8 μm + 2.5•10^{-6}•*l*		
	Other external diameters	up to Ø 100 mm	0.5 μm + (1+6•ΔT)•10^{-6}•*l*		HLO, OS
		up to Ø 300 mm	0.8 μm + 2.5•10^{-6}•*l*		HLO
	Other internal diameters	Ø (1 - 4) mm	1.2 μm + 6•10^{-6}•*l*		
		Ø (4 - 200) mm	1.0 μm + 2•10^{-6}•*l*		
		Ø (200 - 500) mm	1.2 μm + 6•10^{-6}•*l*		
	Feeler gauges	up to 5 mm	0.8 μm + 2.5•10^{-6}•*l*		
	Setting gauges for micrometers	up to 300 mm	0.8 μm + 2.5•10^{-6}•*l*		HLO, OS
		(300 - 1000) mm	0.4 μm + 2•10^{-6}•*l*		HLO, OS
		(1000 - 3000) mm	0.4 μm + 2•10^{-6}•*l*		HLO
	Other distances for parallel faces	up to 300 mm	0.8 μm + 2.5•10^{-6}•*l*		HLO, OS
		(300 - 1000) mm	0.4 μm + 2•10^{-6}•*l*		HLO, OS
		(1000 - 3000) mm	0.4 μm + 2•10^{-6}•*l*		HLO
	Conical (taper) ring and pin	Ø (1 – 500) mm	1.8 μm + 0.4·10^{-6} ·*l*	$h \leq$ 390 mm	HLO
DM 5 0	Form error				~~HLO~~
	Roundness in- and externally	Ø (1 - 500 mm)	0.05 μm + 0.01•A	A=roundness deviation	HLO

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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
	Roundness testers and other instruments for measuring roundness		0.04 μm + 0.5•R		HLO, OS
	Knife edge straight edge	up to 100 mm	0.25 μm		
		(100 - 300) mm	0.6 μm		
		(300 - 500) mm	0.7 μm		
	Straight edge	up to 10 m	0.4 μm + 0.25•10^{-6}•l		
	Surface plate	Up to 6 x 10 m^2	0.2 μm + 1.5•10^{-6}•l	l = longest side of the surface plate	
	Flick standard (roundness standard)		0.15 μm		HLO
DM 6 0	Roughness				
	Surface texture measuring instruments	Ra up to 5 μm	0.01 μm + 0.02•A + 0.5•R+S	A = Ra-value of reference	HLO, OS
		Rz up to 10 μm	0.01 μm + 0.05•A + 0.5•R+S	A = Rz-value of reference	
		Rt Rmax up to 10 μm	0.01 μm + 0.05•A + 0.5•R+S	A = Rt Rmax-value of reference	
	Roughness standards	Ra up to 10 μm	0.015 μm + 0.045•A	A = measured Ra-value	HLO
		Rz up to 15 μm	0.025 μm + 0.07•A	A = measured Rz-value	
		Rt (Rmax) up to 15 μm	0.025 μm + 0.07•A	A = measured Rt (Rmax)-value	
	Groove depth (-standaard)	up to 6 mm	0.05 μm + 0.007•A	A = measured profile height	HLO

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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
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 - 300) mm	α = 30°: (6.0 – 7.5) µm	According to Euramet/CG-10/V.02, method 1a or 1b	
		Ø(1 - 300) mm	α = 55° 60°: (3.2 – 4.1) µm		
		Ø(1 - 300) mm	α = 90°: (2.6 – 3.4) µm		
	Pitch diameter	Ø(1 - 300) mm	α = 30°: (6.0 – 7.5) µm	According to Euramet/CG-10/V.02, method 2a, 2b or 3	
		Ø(1 - 300) mm	α = 55° 60°: (3.2 – 4.1) µm		
		Ø(1 - 300) mm	α = 90°: (2.6 – 3.4) µm		
DM 7 0	Thread quantities			Cylindrical thread	HLO
	Thread quantities measured with master scanner (*Thread trapezium excluded*)			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 – 90) mm Ø (2 – 90) mm	1.5 µm + 5 × 10^{-6} × *l* 2.5 µm + 10 × 10^{-6} × *l* 4.5 µm + 10 × 10^{-6} × *l*	α ≥ 27° α < 27°	
	Thread ring gauges (internal thread) outside, core diameter pitch diameter	Ø (3 – 100) mm Ø (3 – 100) mm	1.5 µm + 10 × 10^{-6} × *l* 2.5 µm + 10 × 10^{-6} × *l* 4.5 µm + 10 × 10^{-6} × *l*	α ≥ 27° α < 27°	

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

HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
		up to 20 m	0.15 µm + 0.7•R + $1.6•10^{-6}$•/	Laser interferometer, steel scales	
		up to 400 mm	0.3 µm + 0.7•R + $2.3•10^{-6}$•/	Optical systems	
		up to 700 mm	0.05 µm + $0.5•10^{-6}$•/ + S	Using special gauge blocks	
	Deviations transverse to the translation directions	up to 0,5 mm	0.1 µm + $3•10^{-6}$•/ + 0.005•A	A = measured deviation; measuring length up to 3000 mm	
	Rotational deviations around the translation direction	up to 400 arcsec	0.5 arcsec + 0.0035•H	H = measured angle; only horizontal translations	
		up to 2000 µm/m	2.5 µm/m + 0.0035•H		
		up to 400 arcsec	1.6 arcsec + 0.007•H	Up to 2000 mm translation; ceramic straight edge and 2 displacement sensors	
		up to 2000 µm/m	8 µm/m + 0.007•H		
	Other rotational deviations	up to 7200 arcsec	0.5 arcsec + 0.0016•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	1arcsec		
	Squareness of 2 translations	up to 500 x 500 mm^2	1arcsec	Ceramic square and displacement sensor	
		up to 500 x 500 mm^3	0.6 arcsec	Ceramic square and measurement system op 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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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
DM 8 0	Coordinate Measuring Machines X, Y and Z axis			using calibration fixture (stepgauge) measuring (reference).	HLO, OS
		max. 1000 mm	0.95 µm + $0.5 \cdot 10^{-6} \cdot l$	Measurement uncertainty steel reference and glass ruler.	
		max. 2000 mm	1.0 µm + $0.8 \cdot 10^{-6} \cdot l$	Measurement uncertainty steel reference and glass ruler.	
		max. 100 mm	0.6 µm	Measurement uncertainty steel reference and zerodur ruler.	
		max. 500 mm	1.2 µm + $0.65 \cdot 10^{-6} \cdot l$	Measurement uncertainty steel reference and zerodur ruler.	
DM 8 1	Tools, products				HLO
	Surface profiles	up to 6 x 120 mm^2	0.05 µm + 0.007•A	A = measured profile height	
	Roughness	Ra: up to 10 µm	0.015 µm + 0.045•A	A = measured Ra-value	
		Rz: up to 15 µm	0.025 µm + 0.07•A	A = measured Rz-value	
		Rt. Rmax: up to 15 µm	0.025 µm + 0.07•A	A = measured Rt. Rmax-value	
	Straightness	up to 6 x 120 mm^2	0.05 µm + 0.007•A	A = measured profile height	
		up to 100 mm	0.25 µm		
		(100 - 300) mm	0.6 µm		
		(300 - 500) mm	0.7 µm		
		up to 1000 mm	1.3 µm + $2 \cdot 10^{-6} \cdot l$		

HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
		up to 10 m	0.5 µm + 0.5•10^{-6}•/	-	HLO, OS
	Roundness external	up to Ø500 mm	0.05 µm + 0.01•A	A = measured roundness	HLO
	Roundness internal	Ø(0,7 - 500) mm	0.05 µm + 0.01•A	A = measured roundness	
	Cylindricity	up to Ø500 and up to height 100 mm	0.5 µm + 1.1•10^{-6}•H + 0.01•A	A = measured cylindricity H = height cylinder	
		up to Ø500 and up to height 500 mm	1.1 µm + 2•10^{-6}•H + 0.01•A		
	Coaxiallity and concentricity	up to Ø500 and up to height 500 mm	0.1 µm + 0.02•A	A = measured coaxiallity / concentricity	
	Flatness	up to Ø60 mm	0.04 µm		
		up to Ø145 mm	0.06 µm		
		up to Ø300 mm	0.6 µm		
		up to 6 x 10 m^2	0.2 µm + 1.5•10^{-6}•/	-	HLO, OS
	Angles between sides or planes	up to 180°	(0.2 + 9/A) arcmin	A = leg length; leg length up to 200 mm	HLO
	Diameter external	up to Ø 300 mm	0.8 µm + 2.5•10^{-6}•/		
		up to Ø 100 mm	0.5 µm + (1+6•ΔT)•10^{-6}•/		HLO, OS
		Ø(300 - 500) mm	1.2 µm + 6•10^{-6}•/		HLO
	Diameter internal	Ø(1 - 4) mm	1.2 µm + 6•10^{-6}•/		
		Ø(4 - 200) mm	1.0 µm + 2•10^{-6}•/		
		Ø(200 - 500) mm	1.2 µm + 6•10^{-6}•/		
DM 8 1	Tools, products	Distance of 2 parallel planes			HLO
	External	up to 300 mm	0.8 µm + 2.5•10^{-6}•/		
		up to 100 mm	0.5 µm + (1+6xΔT)x10^{-6}x/		HLO, OS

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		(300 - 3000)mm	0.4 µm + 2•10^{-6}•/		HLO
	Internal	Ø(1 - 4) mm	1.2 µm + 6•10^{-6}•/		
		Ø(4 - 200) mm	1.0 µm + 2•10^{-6}•/		
		Ø(200 - 500) mm	1.2 µm + 6•10^{-6}•/		
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	Ø(1 - 300) mm	α = 30°: (6.0 – 7.5) µm	According to Euramet/CG-10 V 2.0, method 1a or 1b	
		Ø(1 - 300) mm	α = 55° 60°: (3.2 – 4.1) µm		
		Ø(1 - 300) mm	α = 90°: (2.6 – 3.4) µm		
	Pitch diameter	Ø(1 - 300) mm	α = 30°: (6.0 – 7.5) µm	According to Euramet/CG-10 V 2.0, method 2a, 2b or 3	
		Ø(1 - 300) mm	α = 55° 60°: (3.2 – 4.1) µm		
		Ø(1 - 300) mm	α = 90°: (2.6 – 3.4) µm		
	Simple pitch diameter	Ø(4 - 100) mm	α = 30°: (9 – 14) µm	According to Euramet/CG-10 V 2.0, method 1a or 1b	
		Ø(4 - 100) mm	α = 55° 60°: (3.6 – 7) µm		
		Ø(4 - 100) mm	α = 90°: (3.1 – 6) µm		
	Pitch diameter	Ø(4 - 100) mm	α = 30°: (9 – 14) µm	According to Euramet/CG-10 V 2.0, method 2a, 2b or 3	
		Ø(4 - 100) mm	α = 55° 60°: (3.6 – 7) µm		
		Ø(4 - 100) mm	α = 90°: (3.1 – 6) µm		
DM 9 0	Angle measurement				HLO
	Angle gauge block	0° - 180°	2 arcsec		

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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
	Cylindrical square	up to Ø300 mm, up to height 500 mm	0.9 µm + 2.1•10^{-6}•/ + 0.02•A	A = measured squareness	
	Square	up to 500 mm leg length	0.7 µm + 2.2x10^{-6}•/ + 0.02•A	A = measured squareness	
	Angle plate	90°	0.5 arcsec		
	Autocollimator	up to 12.5 mm/m	0.5 µm/m + 0.001•H + 0.7•R		
		up to 2600 arcsec	0.1 arcsec + 0.001•H + 0.7•R		
	Spirit level	up to 12.5 mm/m	0.5 µm/m + 0.001•H + 0.7•R		
		up to 2600 arcsec	0.1 arcsec + 0.001•H + 0.7•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 arcsec + 0.7•R	f.i. rotary heads and rotary table	
DM 9 4	Angle measurement				HLO, OS
	Clinometer	up to 360°	5 arcsec		
MW 1 0	Mass				HLO, OS
MW 1 2	Weighing instruments	(0 – 33) kg	2.5·10^{-5}·m + last digit + h/2	h = Repeatability	
		(0 – 2 500) kg	6·10^{-5}·m + last digit + h/2	h = Repeatability	

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HCS code	Measured quantity, Instrument, Measure	Frequency	CMC[1]	Remarks	Location
LF 0 0	DC / LF				
LF 1 0	Direct voltage				HLO, OS
	0 mV – 200mV		1.0 •10^{-5}•U, minimum 0.15 µV	Measuring	
	0.2 V – 2 V		7•10^{-6}•*U*	Measuring	
	2 V – 20 V		5•10^{-6}•*U*	Measuring	
	20 V – 200 V		7•10^{-6}•*U*	Measuring	
	200 V – 1000 V		8•10^{-6}•*U*	Measuring	
	0 mV – 220 mV		2.0•10^{-5}•*U*, minimum 1.5 µV	Generate	
	0.22 V – 2,2 V		7•10^{-6}•*U*	Generate	
	2.2 V – 22 V		1.0•10^{-5}•*U*	Generate	
	22 V – 220 V		1.5•10^{-5}•*U*	Generate	
	220 V – 1100 V		1.0•10^{-5}•*U*	Generate	
LF 2 0	Direct current				HLO, OS
	1 µA – 200 µA		1•10^{-4}•*I*, minimum 0.5 nA	Measuring	
	200 µA – 20 mA		3•10^{-5}•*I*	Measuring	
	20 mA – 200 mA		7•10^{-5}•*I*	Measuring	
	0.2 A – 2 A		2.5•10^{-4}•*I*	Measuring	
	2 A – 20 A		6•10^{-4}•*I*	Measuring	
	0 µA – 220 mA		1.0•10^{-4}•*I*, minimum 0.5 nA	Generate compliance < 0,5 V	
	0.22 A – 2.2 A		1•10^{-4}•*I*	Generate compliance < 0,5 V	
	2.2 A – 20 A		2.0•10^{-4}•*I*	Generate compliance < 0,5 V	

HCS code	Measured quantity, Instrument, Measure	Frequency	CMC[1]	Remarks	Location
	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	
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

HCS code	Measured quantity, Instrument, Measure	Frequency	CMC[1]	Remarks	Location
	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	
	0 Ω		70 µΩ	Generate	
	100 µΩ, 1 mΩ, 10 mΩ		$1 \cdot 10^{-4} \cdot R$	Generate	
	100 mΩ		$4 \cdot 10^{-5} \cdot$R	Generate	
	1 Ω, 1.9 Ω		$8 \cdot 10^{-5} \cdot R$	Generate	
	10 Ω		$2.5 \cdot 10^{-5} \cdot R$	Generate	
	19 Ω, 100 Ω , 190 Ω, 1 kΩ, 1.9 kΩ, 10 kΩ , 19 kΩ, 100 kΩ, 190 kΩ		$2.0 \cdot 10^{-5} \cdot R$	Generate	
	1 MΩ, 1.9 MΩ		$3 \cdot 10^{-5} \cdot$R	Generate	
	10 MΩ		$4 \cdot 10^{-5} \cdot$R	Generate	
	19 MΩ, 100 MΩ		$6 \cdot 10^{-5} \cdot R$	Generate	

HCS code	Measured quantity, Instrument, Measure	Frequency	CMC[1]	Remarks	Location
LF 6 5	LF Capacity				HLO, OS
	2 nF, 10 nF, 20 nF, 200 nF	1 kHz	$1.0 \cdot 10^{-3} \cdot C$	Generate only sine-shaped signals	

HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
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 + $\lvert 25 \cdot 10^{-5} \cdot (p$-100 kPa)) $\rvert$		
		(1.1 – 60.1) MPa a	$\lvert 1 \cdot 10^{-3} \cdot (p$-0.1 MPa)) $\rvert$	By comparison with digital pressure indicators	HLO, OS
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 hPa + $1 \cdot 10^{-3} \cdot (p$-100 kPa)	By comparison with digital pressure indicators	HLO, OS
		(0.3 – 70.1) MPa a	0.3 hPa + $25 \cdot 10^{-5} \cdot (p$-0.1 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	$25 \cdot 10^{-5} \cdot p_e$		

Annex to declaration of accreditation (scope of accreditation)
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Registration number: **K 018**

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This annex is valid from: **08-09-2021** to **01-12-2024** Replaces annex dated: **21-01-2021**

HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
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		
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 µs – 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

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HCS code	Measured quantity, Instrument, Measure	Range	CMC[1]	Remarks	Location
	Torque wrenches	0.1 - 1350 Nm	$1.5 \cdot 10^{-2} \cdot M + 0.5R$		

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.
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