ACCREDITATION SCOPE

Federal State Unitary Enterprise “The D.I. Mendeleev All-Russian Institute for Metrology”
Ural Research Institute of Metrology – a branch of the Federal State Unitary Enterprise “Russian National Scientific and Research Institute for Metrology named after D.I. Mendeleev” (UNIIM-Affiliated Branch of D.I. Mendeleyev Institute for Metrology)

name of a legal entity or surname, name and patronymic (if any) of an individual entrepreneur

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For compliance with the requirements of GOST ISO/IEC 17025-2019 "General requirements for the competence of testing and calibration laboratories"

name and details of the interstate or national standard establishing the general requirements for the competence of testing and calibration laboratories

Calibration of measurement instruments

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
1	Measurements of geometric quantities	Length	Feeler gauges, thickness gauges	(0,02-10) mm	-	Q[0,25+2,5·L; 0,15] µm	Comparison with slip gauges using an optimeter; direct measurements with an optimeter	L-length, m
2	Measurements of geometric quantities	Length	Special length gauges	(0-25) mm	-	3,5 µm	Direct measurements with a measuring microscope; indirect measurements with a lever-toothed measuring head	
				(0-50) mm		5,8 µm		
				(0-100) mm		6,9 µm		
				(0-150) mm		8,1 µm		
3	Measurements of geometric quantities	Length	Measuring rulers, linear scales	(0-25) mm	-	3,5 µm	Direct measurements with a measuring microscope; direct comparison with a line standard metre	
				(0-50) mm		5,8 µm		
				(0-100) mm		6,9 µm		
				(0-150) mm		8,1 µm		
				(0-1000) mm		Q[1,2+5,8·L; 0,12] µm		L-length, m
4	Measurements of geometric quantities	Length	Measuring magnifiers	(0-30) mm	-	3,5 µm	Direct measurements with a measuring microscope	
5	Measurements of geometric quantities	Length	Measuring tapes, circumference tapes	(1-50) m	-	Q[15+15·L;30] µm	Comparison with a measuring tape using a measuring magnifier	L-length, m

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
6	Measurements of geometric quantities	Length	Measuring linear displacement transducers and converters	(0,5-250) mm	-	Q[0,25+2,5·L; 0,29·d] µm	Direct measurements with parallel slip gauges; direct comparison with the laser measuring system	L-length, m; d- discrete pitch size of a transducer, µm
				(0,5-1000) mm	-	Q[1,5+1,5·L; 0,29·d] µm		
7	Measurements of geometric quantities	Length	Levelling rods	(0-5) m	-	(0,015+0,015·L) mm	Direct comparison with a measuring tape	L-length, m
8	Measurements of geometric quantities	Length	Vernier calipers, vernier height gauges, vernier depth gauges, altimeters	(0-1000) mm	-	Q[0,0075;0,29·d] mm	Direct measurements with parallel slip gauges	d-value per division of a circular scale, a vernier scale or discrete pitch size of a digital device, mm
9	Measurements of geometric quantities	Length	Micrometers, snap gauges, micrometer heads, indicator thickness gauges and pipe wall thickness gauges	(0-400) mm	-	Q[0,25+2,5·L; 0,29·d] µm	Direct measurements with parallel slip gauges	L-length, m; d- readout resolution, µm
10	Measurements of geometric quantities	Length	Indicator bore gauges	(50-100) mm	-	1,8 µm	Direct comparison with a micrometer head; direct measurements with ring gauges	
11	Measurements of geometric quantities	Length	Bridge-type 3D coordinate measuring machines	X (0-1000) mm Y (0-1000) mm Z (0-1000) mm	-	(0,3+2,2·L) µm	Direct measurements with parallel slip gauges	L-length, m
12	Measurements of geometric quantities	Length	Dial test indicators	(0-50) mm	-	1,8 µm	Direct measurements with parallel slip gauges; direct comparison with a micrometer head	
13	Measurements of geometric quantities	Length	Laser rangefinders	(0,05-20) m	-	Q[15+15·L;0,29·d] µm	Direct comparison with a measuring tape	L-length, m; d- discrete pitch size of a laser rangefinder, µm
14	Measurements of geometric quantities	Length	Measures of models and specimens of geometrical defects, control specimens for ultrasonic testing	(0,002-0,006) mm	-	1,2 µm	Direct measurements with a measuring microscope, vernire caliper, measuring head	
				(0,006-25) mm		3,5 µm		
				(25-60) mm		8,0 µm		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
15	Measurements of geometric quantities	Length	Instruments for measuring the road geometric parameters	(0-3000) mm	-	0,30 mm	Direct comparison with a measuring tape	
16	Measurements of geometric quantities	Length	Instruments for measuring the body dimensions	(0-6000) mm	-	0,58 mm	Direct comparison with a measuring tape	
17	Measurements of geometric quantities	Length	Wheels, curvimeters	(0,1-100) m	-	0,001 m	Direct comparison with a measuring tape	
18	Measurements of geometric quantities	Length	Electron, focused-beam, scanning microscopes	$(1\cdot10^{-9}$-$1\cdot10^{-4})$ m	-	$2\cdot10^{-9}$ m	Direct measurements with parallel slip gauges, a special measure of length and period, reference materials	
19	Measurements of geometric quantities	Length	Solid state microstructure analyzers	(0,5-2000) µm	-	0,012 %	Direct measurements with line standard metres, a stage micrometer	
20	Measurements of geometric quantities	Length	Frame, block, builder levels	(50-2000) mm	-	0,0020 mm/m	Indirect measurements with a level checker, ruler	
21	Measurements of geometric quantities	Length	Instruments (complexes) for measuring diameters and deviations from straightness of pipe bores	(32-600) mm	-	1,3 µm	Indirect measurements with parallel slip gauges, a micrometer head	
				[(-5)-(+5)] mm	-	1,0 µm		
22	Measurements of geometric quantities	Length	Measuring channels of gauging and data measuring systems	(0,1-50) m	-	0,14 mm	Indirect measurements with the calibrator of unified signals	
				(1-25000) m	-	0,05 %		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
23	Measurements of geometric quantities	Length	Instruments for determining the physical and mechanical properties of soils	(0-120) mm	-	0,02 mm	Comparison with a bore gauge using installation pipes; direct comparison with a measuring head; comparison with parallel slip gauges using a measuring head	
24	Measurements of geometric quantities	Length	Analyzers of the phase behavior of fluids and equipment for analyzing the properties of plugging materials	(1-250) mm	-	0,05 mm	Direct measurement with a vernier caliper, micrometer	
				(0,5-2) mm	-	0,005 mm		
25	Measurements of geometric quantities	Length	Welding gauges	(0-200) mm	-	0,004 mm	Direct measurements with a measuring microscope, parallel slip gauges	
		Length (groove width)		(0-8) mm	-	0,004 mm		
		Length (depth)		(0-25) mm	-	Q[0,002;0,29·d] mm		d-readout resolution on the scale “I”, mm
		Length (gap width)		(0-4) mm	-	0,034 mm		
		Scale length		(0-100) mm	-	0,006 mm		
26	Measurements of geometric quantities	Length (nominal cell sizes)	Testing sieves	(0-25) mm	-	3,5 µm	Direct measurements with a measuring microscope	
				(0-50) mm		5,8 µm		
				(0-100) mm		6,9 µm		
				(0-125) mm		8,1 µm		
27	Measurements of geometric quantities	Length (track gauge)	Instruments for measuring the geometric parameters of railway tracks	(1510-1550) mm	-	0,60 mm	Direct comparison with a measuring tape; direct measurements with parallel slip gauges	
		Length (rise of one rail above another)		±160 mm	-	0,62 mm		
28	Measurements of geometric quantities	Length in the field of measuring deviations from straightness and flatness	Surface plates, straightedges, bridges, flatness measures, reference gauges, straightness and flatness deviation meters	(0,25-$8\cdot10^3$) µm/m (0-2000) µm	-	0,2·L µm/m	Indirect measurements with GET 130; direct measurements with GET 130; comparison with the hard stone bridge GET 130 using the comparator GET 130	L-length, m
29	Measurements of geometric quantities	Length in the field of measuring deviations from perpendicularity	Calibration 90° squares	(60-400) mm	-	0,017 mm/m	Indirect measurements with a hard stone calibration square and feeler gauges	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
30	Measurements of geometric quantities	Length (crystal lattice parameters)	X-ray diffractometers, measuring means of structural properties	(100-2000) pm	-	$(0,005+5,3\cdot10^{-6}\cdot X)$ pm	Direct measurements with reference materials	X-lattice parameter, pm
31	Measurements of geometric quantities	Geometrical dimension	Measuring instruments and devices for testing building materials, mixtures	(0-500) mm	-	0,035 mm	Direct measurements with a measuring microscope, parallel slip gauges	
32	Measurements of geometric quantities	Needle insertion depth	Measuring instruments and devices for testing building materials, mixtures	(1-25) mm	-	0,004 mm	Direct measurements with a measuring microscope, parallel slip gauges	
				(1-50) mm		0,006 mm		
				(1-60) mm		0,007 mm		
33	Measurements of geometric quantities	Angle	Measuring instruments and devices for testing building materials, mixtures	(0-90)°	-	Q[0,29;0,29·d]′	Direct measurements with angular measures	d-value per division of a scale, angular minutes
34	Measurements of geometric quantities	Angle	Goniometers	(0-360)°	-	Q[0,29;0,29·d]′	Direct measurements with angular measures	d-value per division of a vernier scale or discrete pitch size of a digital device, angular minutes
35	Measurements of geometric quantities	Angle	Measuring channels of gauging and data measuring systems	(0-360)°	-	0,01°	Indirect measurements with the calibrator of unified signals	
36	Measurements of geometric quantities	Angle	Welding gauges	(0-90)º	-	Q[0,29;0,12·d]′	Direct measurements with a measuring microscope, angular measures	d-readout resolution on the scale “Д”, angular minutes
		Chamfer angle	Welding gauges	(0-90)°	-	Q[0,29;0,12·d]′		
37	Measurements of geometric quantities	Diffraction angle	X-ray diffractometers, measuring means of structural properties	[(-180)-(+180)]°	-	$(0,012–6,9\cdot10^{-5}\cdot\lvert X\rvert)$ %	Direct measurements with reference materials	X-diffraction angle,°
38	Measurements of geometric quantities	Contact angle, wetting angle	Instruments for measuring a contact angle, wetting angle	(0-180)°	-	0,18°	Indirect measurements with a measuring microscope	
39	Measurements of geometric quantities	Slope	Instruments for measuring the road geometric parameters	(0-100) mm/m	-	0,020 mm/m	Indirect measurements with a measuring tape, ruler, parallel slip gauges	
40	Measurements of geometric quantities	Surface density	Instruments for measuring the thickness and surface density of coatings by radioisotope method	(0,1-1000) g/m^2	-	$(5–3,0\cdot10^{-3}\cdot\rho)$ %	Direct measurements with certified reference materials	ρ-surface density, g/m^2
		Thickness		(0,1-100) µm	-	(0,02+0,05·h) µm		h-coating thickness, µm

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
41	Measurements of geometric quantities	Thickness	Profile thickness gauges	(0,1-1,0) µm	-	(0,002+0,035·h) µm	Direct measurements with certified reference materials	h-coating thickness, µm
				(1,0-100) µm	-	(0,02+0,05·h) µm		h-coating thickness, µm
42	Measurements of geometric quantities	Thickness	Magnetic and eddy-current thickness gauges	(10-20000) µm	-	$(18{,}588 \cdot h^{-0{,}716})$ %	Direct measurements with thickness gauges	h-thickness, µm
43	Measurements of geometric quantities	Thickness	Optical thickness gauges	(10-160) nm	-	6 nm	Direct measurements with reference materials	
44	Measurements of geometric quantities	Thickness	Ultrasonic thickness gauges	(0,2-100) mm	-	$(0{,}744 \cdot h^{-0{,}711})$ %	Direct measurements with thickness gauges	h-thickness, mm
45	Measurements of geometric quantities	Thickness	Radioisotope thickness gauges for sheet and strip materials	(0,1-6) mm	-	3 µm	Direct measurements with thickness gauges	
				(6-150) mm		0,017 mm		
46	Measurements of mechanical quantities	Mass	Static scales	$(1 \cdot 10^{-4}$-0,1) kg	-	$4 \cdot 10^{-6}$ g	Direct measurements with weights	
				(0,1-1,1) kg		$2 \cdot 10^{-5}$ g		
				(1,1-5,1) kg		$2 \cdot 10^{-4}$ g		
				(5,1-41) kg		$2 \cdot 10^{-3}$ g		
				(41-64) kg		$2 \cdot 10^{-2}$ g		
				(64-150) kg		0,2 g		
				(150-1200) kg		2 g		
				(1200-3000) kg		20 g		
47	Measurements of mechanical quantities	Mass	Non-automatic scales	$(1 \cdot 10^{-4}$-0,1) kg	-	$4 \cdot 10^{-6}$ g	Direct measurements with weights	
				(0,1-1,1) kg		$2 \cdot 10^{-5}$ g		
				(1,1-5,1) kg		$2 \cdot 10^{-4}$ g		
				(5,1-41) kg		$2 \cdot 10^{-3}$ g		
				(41-64) kg		$2 \cdot 10^{-2}$ g		
				(64-150) kg		0,2 g		
				(150-1200) kg		2 g		
				(1200-3000) kg		20 g		
48	Measurements of mechanical quantities	Mass	Automatic scales	$(1 \cdot 10^{-3}$-1) kg	-	$2 \cdot 10^{-5}$ g	Direct measurements with weights; indirect measurements with non-automatic scales	
				(1-5) kg		$2 \cdot 10^{-4}$ g		
				(5-41) kg		$2 \cdot 10^{-3}$ g		
				(41-64) kg		$2 \cdot 10^{-2}$ g		
				(64-150) kg		0,2 g		
				(150-1200) kg		2 g		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
				(1200-3000) kg		20 g		
49	Measurements of mechanical quantities	Mass	Weights	20000 g	-	0,045 g	Comparison with weights using a mass comparator	
				10000 g		0,013 g		
				5000 g		$6,8 \cdot 10^{-3}$ g		
				2000 g		$1,4 \cdot 10^{-3}$ g		
				1000 g		$8 \cdot 10^{-4}$ g		
				500 g		$5 \cdot 10^{-4}$ g		
				200 g		$2,5 \cdot 10^{-4}$ g		
				100 g		$1 \cdot 10^{-4}$ g		
				50 g		$8,4 \cdot 10^{-5}$ g		
				20 g		$6,4 \cdot 10^{-5}$ g		
				5 g, 10 g		$4,8 \cdot 10^{-5}$ g		
				1 g, 2 g		$2,5 \cdot 10^{-5}$ g		
50	Measurements of mechanical quantities	Mass	Mass comparators	$(5 \cdot 10^{-3}$-60) kg	-	$4 \cdot 10^{-5}$ g	Direct measurements with weights	
51	Measurements of mechanical quantities	Mass	Thermogravimetric analyzers	(0-5) g	-	0,14 mg	Direct measurements with weights	
52	Measurements of mechanical quantities	Mass	Measuring instruments and devices for testing building materials, mixtures	up to 10 kg	-	0,00005 g	Direct measurements with non-automatic scales	
53	Measurements of mechanical quantities	Mass	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	(250-350) g	-	0,01 g	Direct measurements with non-automatic scales	
54	Measurements of mechanical quantities	Consistency	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	(0-100) Bc	-	0,2 Bc	Indirect measurements with weights	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
55	Measurements of mechanical quantities	Linear density	Conveyor belt scales to continuous weighing	(1-250) kg/m	-	0,30 %	Comparison with the working measurement standard of mass using linear density measures; indirect measurements with non-automatic scales	
56	Measurements of mechanical quantities	Linear density	Linear density measures	(10-100) kg/m	-	(0,0653–0,005·P) %	Indirect measurements using the 5th category working measurement standard of mass	P-linear density, kg/m
57	Measurements of mechanical quantities	Deformation	Installations with pure bending of constant section beams,	[(-3000)-(+3000)] ppm^{-1}	-	0,090 %	Indirect measurements with parallel slip gauges, an optimeter, a measuring microscope; indirect measurements with resistance strain gauges with the secondary transducer	
			strain measuring systems	[(-39999)-(+39999)] ppm^{-1}	-	$\left[0{,}02 + 0{,}006 \cdot \left(\frac{9999}{N} - 1\right)\right]$ %	Direct comparison with the calibrator of unified signals	N- electrical voltages ratio value, ppm^{-1}
58	Measurements of mechanical quantities	Deformation	Strain-measuring devices, strain sensors, strain gauges	[(-3000)-(+3000)] ppm^{-1} [$(-1\cdot10^6)$-$(+1\cdot10^6)$] ppm^{-1}	-	0,04 %	Indirect measurements with parallel slip gauges, a laser measuring system, a measuring microscope; direct comparison with a laser measuring system	
				$(0{,}005\text{-}10^3)$ mm		(0,02+0,5·L) µm		L-length, m
59	Measurements of mechanical quantities	Force	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	(10-200) kN	-	0,24 %	Direct comparison with a dynamometer	
60	Measurements of mechanical quantities	Force	Testing machines, presses and installations	(0,5-2000,0) kN	-	0,14 %	Direct comparison with a dynamometer	
61	Measurements of mechanical	Force	Measuring channels of gauging and data measuring sys-	$(0\text{-}2\cdot10^6)$ N	-	0,14 %	Indirect measurements with the calibrator of	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
	quantities	Torque	tems	(1-2·10^4) N·m	-	0,1 %	unified signals	
62	Measurements of mechanical quantities	Torque	Meters, torquemeters, transducers, torque measuring channels, calibration units, power nut drivers, power screwdrivers, wrenches, torque screwdrivers, torque multipliers	(1-2500) N·m	-	0,03 %	Direct measurements with GET 149; comparison with GET 149 using torque sensors	
				(2500-20000) N·m		0,06 %		
63	Measurements of mechanical quantities	Torque	Multiplier power wrenches, mechanical torque multipliers	(1-1500) N·m	-	0,8 %	Direct measurements with a torque meter and torque calibration equipment	
64	Measurements of mechanical quantities	Surface (interfacial) tension	Tensiometers, surface (interfacial) tension analyzers	(0,1-1999) mN/m	-	0,10 mN/m	Indirect measurements with weights, thermometer	
65	Measurements of mechanical quantities	Energy	Pendulum impact testing machines	(10-2000) J	-	0,30 J	Indirect measurements with non-automatic scales, vernier caliper, digital level, stopwatch	
			Impact tension machines	(10-1·10^5) J		0,30 J		
66	Measurements of mechanical quantities	Hardness	Brinell hardness testing machines	(8-450) HB	-	1,4 %	Direct measurements with test blocks	
				(95-650) HBW		0,9 %		
			Rockwell hardness testing machines	(70-93) HRA		0,5 %		
				(25-100) HRB		0,8 %		
				(20-70) HRC		0,7 %		
			Super Rockwell hardness testing machines	(70-94) HRN15		0,3 %		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
				(40-86) HRN30		0,9 %		
				(20-78) HRN45		1,6 %		
				(15-82) HRT30		1,5 %		
			Vickers hardness testing machines	(8-2000) HV		0,4 %		
67	Measurements of mechanical quantities	Displacement velocity	Measuring instruments and devices for testing materials, mixtures	up to 100 mm/min	-	0,5 mm/min	Indirect measurements using a stopwatch, vernier caliper, measuring microscope, parallel slip gauges, angular measures	
68	Measurements of mechanical quantities	Rotational velocity	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	(10-60000) min^{-1}	-	0,05 %	Direct measurements with a tachometer; direct comparison with a tachometer	
69	Pressure measurements, vacuum measurements	Pressure	Instruments for determining the physical and mechanical properties of soils	(0,057-50) MPa	-	0,15 %	Indirect measurements with a dynamometer, vernier caliper	
				(50-1000) kPa	-	0,5 %	Direct comparison with a pressure gauge	
70	Pressure measurements, vacuum measurements	Pressure	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	(20-250) MPa	-	0,1 %	Direct comparison with a pressure gauge	
				(0-20) MPa	-	0,02 MPa		
71	Measurement of flow parameters, consumption, level, volume of substances	Dilution ratio	Diluents and substance meters	1:100-1:1	-	0,5 %	Indirect measurements with non-automatic scales, weights, thermometer	
		Volume		$(1 \cdot 10^{-2}\text{-}2 \cdot 10^{5})$ mm^3		0,5 %		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
72	Measurement of flow parameters, consumption, level, volume of substances	Volume	Measures of capacity and batch measuring boxes: - burettes, pipettes, laboratory flasks, cylinders, capacity measures	$(1 \cdot 10^{-3}$-2000) cm^3	-	$(0{,}08 \cdot V^{-0{,}421})$ %	Indirect measurements with non-automatic scales, weights, thermometer, pressure gauge	V-volume, cm^3
			- batch measuring boxes, microsyringe	$(1 \cdot 10^{-4}$-2000) cm^3	-	$(0{,}08 \cdot V^{-0{,}421})$ %		
73	Measurement of flow parameters, consumption, level, volume of substances	Volumetric flow rate	Measuring channels of measuring systems and informational-measuring systems	$(0{,}001\text{-}10^6)$ m^3/h	-	0,1 %	Indirect measurements with the calibrator of unified signals	
		Mass flow rate		$(0{,}001\text{-}10^6)$ kg/h	-	0,1 %		
74	Pressure measurements, vacuum measurements	Pressure	Measuring channels of measuring systems and informational-measuring systems	[(-0,1)-(+100)] MPa	-	0,06 %	Indirect measurements with the calibrator of unified signals	
				(10-110) kPa	-	1 %		
75	Measurements of physico-chemical composition and properties of substances	Density	Density measuring instruments (gas pycnometers, liquid density meters, gas density meters, automatic density meters)	(0,01-500) kg/m^3	-	0,001 kg/m^3	Indirect measurements with a thermometer and pressure gauge; direct measurements with reference materials; indirect measurements with non-automatic scales, thermometer	
				(500-2000) kg/m^3		0,05 kg/m^3		
				(2000-23000) kg/m^3		0,04 kg/m^3		
76	Measurements of physico-chemical composition and properties of substances	Kinematic viscosity	Capillary, vibration, rotary, falling-sphere viscometers	(4·10-7-2·10-2) m^2/s	20; 40; 60; 80 °C	0,2 %	Direct measurements with reference materials	
				$(2 \cdot 10^{-2}\text{-}1 \cdot 10^{-1})$ m^2/s		0,3 %		
		Dynamic viscosity		$(4 \cdot 10^{-4}\text{-}2 \cdot 10^{1})$ Pa·s		0,2 %		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
				$(2 \cdot 10^{1}$-$1{,}5 \cdot 10^{2})$ Pa·s		0,3 %		
				$(4 \cdot 10^{-4}$-$1 \cdot 10^{5})$ Pa·s	-	$0{,}005 \cdot k \cdot N^{-1}$ Pa·s	Indirect measurements with reference materials, tachometer (stopwatch) and non-automatic scales	k-constant, Pa·s (r/min); N- rotor speed, r/min
		Relative viscosity		(10-300) s		0,7 s	Indirect measurements with reference materials, stopwatch	
77	Measurements of physico-chemical composition and properties of sub-stances	Particle size	Instruments for measuring the dispersed parameters of suspensions and powder materials	$(0{,}5$-$3{,}5 \cdot 10^{3})$ μm	-	5 %	Direct measurements with reference materials	
78	Measurements of physico-chemical composition and properties of sub-stances	Specific adsorption	Porosity, permeability and sorption properties analyzers	(0,001-250) mol/kg	-	1,7 %	Direct comparison with GET 210; direct measurements with reference materials	
		Specific surface area		(0,1-4000) m^2/g		1,7 %		
		Specific pore volume		(0,05-2,00) cm^3/g		1,7 %		
		Pore size		(0,4-100) nm		2,6 %		
		Permeability, permeability coefficient		$(0{,}05$-$10^{4})$ 10^{-3}· μm^2 (mD)		0,9 %		
		Porosity		(0,1-60) %		0,05 % abs.		
		Gas volume in pores		(10-1300) cm^3		0,25 %		
		Residual water saturation coefficient		(5,5-96) %		(3,4–0,014·X) % rel.	Direct measurements with reference materials	X-residual water saturation coefficient, %
79	Measurements of physico-chemical composition and properties of sub-stances	Flash point	Oil and petroleum products properties analyzers	(20-60) °C	-	1 °C	Direct measurements with reference materials	
				(60-300) °C	-	2 °C		
		Flow point, cloud point and freezing point		[(-60)-(0)] °C	-	1,5 °C	Direct measurements with reference materials; indirect measurements	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
		Fractional composition		(0,1-99) %	-	0,5 % abs.	with reference materials	
				(30-400) °C		1,5 °C		
		Saturated steam pressure		(0-1000) kPa	-	1,0 kPa	Direct measurements using reference materials; direct comparison with a pressure gauge	
		Solvent equivalent		(2-100) %	-	0,14 % rel.	Indirect measurements with non-automatic scales, stopwatch	
		Peptization value		(1-6) rel. units	-	0,0013 rel. units		
80	Measurements of physico-chemical composition and properties of substances	Mass (volume, molar) fraction	Titrimetric, spectrum, radioisotopic, X-ray fluorescence, X-ray radiometric, mass analyzers; conductivity apparatus, salinometer, oximeters, coulometers, voltammetric analyzers, polarograph, potentiostats, integrators	$(1 \cdot 10^{-8}$-100) %	-	0,02 % rel.	Direct measurements with reference materials; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	
81	Measurements of physico-chemical composition and properties of substances	Mass (volume, molar) fraction	Gas and liquid chromatographs, chromatography mass spectrometers, mass spectrometers	$(1 \cdot 10^{-8}$-100) %	-	0,1 % rel.		
82	Measurements of physico-chemical composition and properties of substances	Mass fraction	Gas-forming elements analyzers (C, S, H, O, N, H_2O)	$(1 \cdot 10^{-6}$-100) %	-	$(0{,}9276 \cdot X^{-0{,}317})$ % rel.	Direct measurements with reference materials; indirect measurements with reference materials, pressure gauge, thermometer, non-automatic scales; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	X-mass fraction of the component, %
83	Measurements of physico-chemical composition and properties of substances	Mass fraction	Measuring channels of gauging and data measuring systems	(1-100) %	-	1 % rel.	Indirect measurements with the calibrator of unified signals	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
84	Measurements of physico-chemical composition and properties of substances	Mass concentration	Titrimetric, spectrum, radioisotopic, X-ray fluorescence, X-ray radiometric, mass analyzers; salinometer, oximeters, coulometers, voltammetric analyzers, polarograph, potentiostats, integrators	$(1 \cdot 10^{-8}$-100) g/dm^3	-	0,04 %	Direct measurements with reference materials; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	
85	Measurements of physico-chemical composition and properties of substances	Mass concentration	Gas and liquid chromatographs, chromatography mass spectrometers, mass spectrometers	$(1 \cdot 10^{-8}$-100) g/dm^3	-	0,2 %	Direct measurements with reference materials; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	
86	Measurements of physico-chemical composition and properties of substances	Molar concentration	Titrimetric, spectrum, radioisotopic, X-ray fluorescence, X-ray radiometric, mass analyzers; conductivity apparatus, salinometer, oximeters, coulometers, voltammetric analyzers, polarograph, potentiostats, integrators	$(1 \cdot 10^{-9}$-2) mol/dm^3	-	0,04 %	Direct measurements with reference materials; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	
87	Measurements of physico-chemical composition and properties of substances	Mass (atomic) fraction of isotopes	Mass analyzers	(10^{-6}-100) %	-	0,012 % rel.	Direct measurements with reference materials; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	
88	Measurements of physico-chemical composition and properties of substances	Mass number	Mass analyzers	(1-8000) u	-	0,0001 %	Direct measurements with reference materials; direct comparison with GET 176, GVET 196-1, GVET 176-1, GVET 208-1	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
89	Measurements of physico-chemical composition and properties of sub-stances	Electrical conductivity	Conductivity apparatus, salinometers	(10^{-8}-100) S/m	-	0,25 %	Direct measurements with reference materials; direct comparison with the conductometric calibration equipment; indirect measurements with electrical resistivity measures	
90	Measurements of physico-chemical composition and properties of sub-stances	Electrical conductivity	Electrical conductivity me-ters for metals and alloys	(0,5-2,2) MS/m	-	3 %	Direct measurements with reference materials, electrical resistivity measures	
				(2,2-37,4) MS/m	-	2 %		
				(37,4-60) MS/m	-	3 %		
91	Measurements of physico-chemical composition and properties of sub-stances	pH	pH meters	(0-14) pH	-	0,01 pH	Direct measurements with working pH stand-ards	
92	Measurements of physico-chemical composition and properties of sub-stances	pX	Ionomers	(0-7) pX	-	0,15 pX	Indirect measurements with reference materials	
93	Measurements of physico-chemical composition and properties of sub-stances	pH, pX	Measuring transducers of pH meters, ionomers	[(-20)-(+20)] pX, pH	-	0,001 pX, pH	Indirect measurements with a voltage calibrator	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
94	Measurements of physico-chemical composition and properties of sub-stances	Electrical resistivity	Instruments for measuring the electrical resistivity of semiconductor materials	$(6{,}3\cdot10^{-6}$-$6{,}3\cdot10^{2})\ \Omega\cdot m$	-	0,036 %	Direct measurements with reference materials; indirect measurements with electrical resistivity measures	
95	Measurements of physico-chemical composition and properties of sub-stances	Mass fraction	Humidity measuring instruments	(0,005-0,1) %	-	10 % rel.	Direct measurements with reference materials; direct comparison with GET 173	X-mass fraction of moisture (humidity),%
				(0,1-100) %	-	$(0{,}8\cdot X^{-0{,}73})$ % rel.		
		Relative humidity		(0-100) %	-	1,0 % abs.	Direct comparison with a hygrometer	
		Mass ratio		(0,5-5,0) %	-	2,0 % rel.	Direct measurements with reference materials; direct comparison with GET 173	
				(5,0-20,0) %		1,0 % rel.		
				(20-80) %		0,2 % rel.		
96	Measurements of physico-chemical composition and properties of sub-stances	Effect concentration	Component activity analyzers	(0-1) c.u. (Aw)	-	0,003 c.u. (Aw)	Indirect measurements with non-automatic scales	
		Molality		(0-3000) mmol/kg	-	0,13 %	Direct measurements with reference materials; indirect measurements with reference materials	
97	Measurements of physico-chemical composition and properties of sub-stances	Amount of gluten	Measuring instruments for quality indices of food prod-ucts and food raw materials	(0-151) c.u.	-	0,4 %	Direct measurements with reference materials	
		Mass fraction of moisture (humidity)		(0,001-0,1) % (0,1-100) %	-	10 % rel. $(0{,}8\cdot x^{-0{,}73})$ % rel.		x-mass fraction of mois-ture, %
		Mass fraction of milk solids non-fat (MSNF)		(0,001-100) %	-	$(0{,}64\cdot x^{-1{,}46}+0{,}13\cdot y^{-0{,}64})^{0{,}5}$ % rel.	Indirect measurements using GET 173, GVET 176-1, GVET 208-1	x-mass fraction of mois-ture, %; y-mass fraction of protein, %

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
		Mass fraction of fat		(0,01-80) %	-	$(0,36 \cdot z^{-0,80})$ % rel.	Direct measurements with reference materials	z-mass fraction of fat, %
		Mass fraction of protein		(0,01-60) %	-	8,8 % rel.	Direct measurements with reference materials; direct comparison with GVET 176-1	
		Density		(1000-1100) kg/m^3	-	0,04 kg/m^3	Indirect measurements with non-automatic scales	
98	Thermophysical and temperature measurements	Temperature of the phase transition	Measuring instruments for the complex determination of thermophysical properties: - thermal analyzers; - thermogravimetric analyzers	(300-1040) K	-	0,24 K	Direct measurements with reference materials	
		Specific heat of the phase transition		(25-360) kJ/kg	-	0,54 kJ/kg		
99	Thermophysical and temperature measurements	Temperature	Laboratory thermostats (liquid thermostats, air thermostats, muffle furnaces)	[(-80)-(-10)] °C	-	0,05 °C	Direct comparison with a thermometer; direct measurements with a thermometer	
				[(-10)-(60)] °C	-	0,05 °C		
				(60-500) °C	-	0,05 °C		
				(500-1250) °C	-	$(0,008 \cdot t)$ °C		t-temperature, °C
100	Thermophysical and temperature measurements	Temperature	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	[(-20)-(300)] °C	-	0,1 °C	Direct comparison with a thermometer	
101	Thermophysical and temperature measurements	Temperature	Measuring channels of measuring systems and informational-measuring systems	[(-100)-(800)] °C	-	0,1 °C	Indirect measurements with the calibrator of unified signals	
102	Time and frequency measurements	Frequency	Frequency measuring instruments, generators, oscilloscopes	$(0,1\text{-}1 \cdot 10^5)$ Hz	-	$5,8 \cdot 10^{-7} \cdot f$	Direct measurements with a frequency meter; direct comparison with a frequency meter	f-frequency, Hz
103	Time and frequency measurements	Frequency	Eddy current flaw detectors, magnetic-field flaw detectors, probe-type magnetic-field flaw detectors	(0,1-20) MHz	-	$1,7 \cdot 10^{-6}$ %	Direct measurements with a frequency synthesizer, oscilloscope	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
104	Time and frequency measurements	Frequency	Measuring channels of gauging and data measuring systems	$(0,1\text{-}2\cdot10^{8})$ Hz	-	$5,8\cdot10^{-7}\cdot f$	Direct measurements with an oscilloscope, a frequency meter; direct comparison with a frequency meter	f-frequency, Hz
		Time		$(5\cdot10^{-7}\text{-}1\cdot10^{8})$ s	-	0,11 μs		
105	Time and frequency measurements	Time	Means for measuring time intervals, technical clocks, oscilloscopes	$(5\cdot10^{-7}\text{-}1\cdot10^{5})$ s	-	$(5\cdot10^{-8}\cdot t+5\cdot10^{-9})$ s	Direct measurements with a frequency meter; direct comparison with a frequency meter	t-time lengths, s
106	Time and frequency measurements	Time	Measuring DC sources (high-precision)	(1-100) s	-	$9\cdot10^{-6}$ s	Direct measurements with a frequency meter	
				(100-300) s	-	$5\cdot10^{-5}$ s		
				(300-600) s	-	$1,3\cdot10^{-4}$ s		
				(600-750) s	-	$1,6\cdot10^{-4}$ s		
107	Time and frequency measurements	Time	Data acquisition and processing devices	(1-86400) s	-	0,1 μs	Direct comparison with the time standard of the UTC scale, pulse counter, frequency meter	
108	Measurements of electric and magnetic quantities	Electromotive force	pH meters, ionomers, transducers, conductivity apparatus, salinometers	[(-4000)-(+4000)] mV	-	0,006 mV	Direct measurements with a voltage calibrator	
109	Measurements of electric and magnetic quantities	Electrical resistivity	Instruments for measuring the electrical resistivity	$(1\cdot10^{-4}\text{-}5,0\cdot10^{7})$ Ω · m	-	1,3 %	Direct measurements with reference materials; indirect measurements with electrical resistance measures	
110	Measurements of electric and magnetic quantities	Electrical resistivity	Instruments for measuring the coating electrical resistivity	(0-6000) Ω · cm^2	-	(0,05+0,033·R) Ω · cm^2	Indirect measurements with a resistance box, ammeter, micrometer	R-electrical resistivity value, Ω · cm^2
111	Measurements of electric and magnetic quantities	Electrical resistivity	Soil corrosivity analyzers including AKAG type	(1-999) Ω · m	-	0,10 %	Indirect measurements with an electrical calibrator	
		Current density		(1-500) mA/m^2	-	0,20 %		
112	Measurements of electric and magnetic quantities	Power, reactive power	Measuring channels of gauging and data measuring systems	$(0,01\text{-}7,5\cdot10^{3})$ W, var	-	0,2 %	Indirect measurements with the calibrator of unified signals	
113	Measurements of electric and magnetic quantities	Electrical resistance	Measuring channels of gauging and data measuring systems	$(10^{-7}\text{-}10^{9})$ Ω	-	0,005 %	Direct measurements with an electrical calibrator	
114	Measurements of	Electrical resistance	Measuring instrument of soil	(10-2000) Ω	-	0,10 %	Direct measurements	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
	electric and magnetic quantities		samples corrosion activity including PIKAP type	(2000-10000) Ω	-	0,10 %	with an electrical calibrator	
115	Measurements of electric and magnetic quantities	Electrical resistance	Instruments for measuring the parameters of electrical circuits	$(1\cdot10^{-7}$-$1\cdot10^{-3})$ Ω	(0-10) kHz	0,05 %	Comparison with a resistance coil using a multimeter, comparison calibrator	
				$(1\cdot10^{-3}$-$1\cdot10^{5})$ Ω	(0-10) kHz	0,005 %		
				$(1\cdot10^{5}$-$1\cdot10^{7})$ Ω	-	0,05 %		
				$(1\cdot10^{7}$-$1\cdot10^{9})$ Ω	-	0,5 %		
		Inductance		$(1\cdot10^{-8}$-1600) H	(0,1-10) kHz	0,3 %	Direct measurements with the RLC meter	
		Capacitance		(0,0001-1) μF	(0,04-10) kHz	0,3 %	Direct measurements with a capacitance box; direct measurements with the RLC meter	
				(1-111) μF	(0,04-10) kHz	0,5 %		
				(111-160) μF	(0,1-10) kHz	1,0 %		
116	Measurements of electric and magnetic quantities	DC voltage	Voltage measuring instruments	$(5\cdot10^{-6}$-1) V	-	0,004 %	Direct measurements with a multimeter, electrical calibrator; direct comparison with a multimeter	
				1 V	-	0,0005 %		
				(1-2) V	-	0,004 %		
				(2-20) V	-	0,0035 %		
				(20-200) V	-	0,005 %		
				(200-1000) V	-	0,008 %		
117	Measurements of electric and magnetic quantities	DC voltage	Measuring channels of gauging and data measuring systems	[(-10)-(+10)] V	-	0,005 %	Direct measurements with a multimeter, electrical calibrator; direct comparison with a multimeter	
118	Measurements of electric and magnetic quantities	DC voltage	Measuring instrument of soil samples corrosion activity including PIKAP type	(10-2000) mV	-	0,013 %	Direct measurements with an electrical calibrator	
119	Measurements of electric and magnetic quantities	DC (AC) voltage	Measuring transducers (instrument transformers, instruments for measuring the current ratio and phase displacement, dividers, amplifiers): - voltage	$(0,1\text{-}220/\sqrt{3})$ kV	-	$3,8\cdot10^{-5}$	Comparisons with a measuring standard using a comparator	
		Phase displacement		(0-0,1) rad	-	$4,4\cdot10^{-5}$ rad		
		DC (AC)		$(0,5\text{-}3\cdot10^{3})$ A	-	$5\cdot10^{-6}$		
				$(3\cdot10^{3}$-$10\cdot10^{3})$ A	-	$10\cdot10^{-6}$		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
			- current	$(10 \cdot 10^3$-$50 \cdot 10^3)$ A	-	$15 \cdot 10^{-6}$		
				$(50 \cdot 10^3$-$250 \cdot 10^3)$ A	-	$1 \cdot 10^{-4}$		
				$(250 \cdot 10^3$-$400 \cdot 10^3)$ A	-	$5 \cdot 10^{-4}$		
120	Measurements of electric and magnetic quantities	DC	Measuring DC sources (high-precision)	(0,001-0,05) A	-	$1 \cdot 10^{-6}$ A	Indirect measurements with a voltmeter and resistance measure	
				(0,05-0,1) A	-	$5 \cdot 10^{-6}$ A		
				(0,1-0,2) A	-	$6 \cdot 10^{-6}$ A		
				(0,2-0,5) A	-	$1{,}8 \cdot 10^{-6}$ A		
				(0,5-1) A	-	$3 \cdot 10^{-6}$ A		
121	Measurements of electric and magnetic quantities	DC	Measuring instrument of soil samples corrosion activity including PIKAP type	(10-510) μA	-	0,50 %	Direct measurements with an electrical calibrator	
122	Measurements of electric and magnetic quantities	DC	Measuring channels of gauging and data measuring systems	(0-20) mA	-	0,005 %	Direct measurements with an electrical calibrator	
123	Measurements of electric and magnetic quantities	DC	Current measuring instruments	$(5 \cdot 10^{-9}$-$2 \cdot 10^{-2})$ A	-	0,008 %	Direct comparison with a multimeter; indirect measurements with a resistance coil, multimeter	
				$(2 \cdot 10^{-2}$-2) A	-	0,015 %		
				(2-20) A	-	0,05 %		
				(20-1000) A	-	0,1 %		
124	Measurements of electric and magnetic quantities	AC	Current measuring instruments	$(2 \cdot 10^{-6}$-$2 \cdot 10^{-1})$ A	$(0{,}1$-$2 \cdot 10^2)$ Hz	0,03 %	Direct comparison with a multimeter; indirect measurements with a current transformer, multimeter	
				$(2 \cdot 10^{-6}$-$2 \cdot 10^{-1})$ A	$(2 \cdot 10^2$-$1 \cdot 10^3)$ Hz	0,04 %		
				$(2 \cdot 10^{-6}$-$2 \cdot 10^{-1})$ A	$(1 \cdot 10^3$-$1 \cdot 10^4)$ Hz	0,1 %		
				(0,2-20) A	$(0{,}1$-$2 \cdot 10^2)$ Hz	0,04 %		
	Measurements of electric and magnetic quantities	AC	Current measuring instruments	(0,2-20) A	$(2 \cdot 10^2$-$1 \cdot 10^3)$ Hz	0,08 %		
				(0,2-20) A	$(1 \cdot 10^3$-$1 \cdot 10^4)$ Hz	0,15 %		
				$(20$-$4 \cdot 10^5)$ A	$(30$-$1 \cdot 10^3)$ Hz	0,15 %		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
				(20-30) A	$(1 \cdot 10^3\text{-}5 \cdot 10^3)$ Hz	0,3 %		
125	Measurements of electric and magnetic quantities	AC voltage	Voltage measuring instruments	$(1 \cdot 10^{-3}\text{-}2)$ V	$(0{,}1\text{-}2 \cdot 10^4)$ Hz	0,01 %	Direct measurements with a multimeter, electrical calibrator; direct comparison with a multimeter	
				$(1 \cdot 10^{-3}\text{-}2)$ V	$(2 \cdot 10^4\text{-}3 \cdot 10^5)$ Hz	0,06 %		
				$(1 \cdot 10^{-3}\text{-}2)$ V	$(3 \cdot 10^5\text{-}1 \cdot 10^6)$ Hz	0,3 %		
				(2-20) V	$(0{,}1\text{-}2 \cdot 10^4)$ Hz	0,01 %		
				(2-20) V	$(2 \cdot 10^4\text{-}3 \cdot 10^5)$ Hz	0,06 %		
				(2-20) V	$(3 \cdot 10^5\text{-}1 \cdot 10^6)$ Hz	0,3 %		
				(20-200) V	$(0{,}1\text{-}2 \cdot 10^4)$ Hz	0,01 %		
				(20-200) V	$(2 \cdot 10^4\text{-}5 \cdot 10^4)$ Hz	0,06 %		
				(20-200) V	$(5 \cdot 10^4\text{-}1 \cdot 10^5)$ Hz	0,3 %		
				(200-700) V	$(0{,}1\text{-}1 \cdot 10^4)$ Hz	0,015 %		
				(200-700) V	$(1 \cdot 10^4\text{-}2 \cdot 10^4)$ Hz	0,25 %		
				(200-700) V	$(2 \cdot 10^4\text{-}3 \cdot 10^4)$ Hz	0,04 %		
126	Measurements of electric and magnetic quantities	Electric charge	Electric charge measuring instruments	$(10^{-12}\text{-}10^{-3})$ C	-	0,7 %	Indirect measurements with an oscilloscope	
127	Measurements of electric and magnetic quantities	Coercivity	Coercive force meters	(50-10000) A/m	-	2,3 %	Direct measurements with reference materials	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
128	Measurements of electric and magnetic quantities	Magnetic phase content	Measuring instruments of the content of magnetic phase	(0,1-20) %	-	3,5 %	Direct measurements with reference materials	
129	Measurements of electric and magnetic quantities	Magnetic field strength	Measuring instruments of the magnetic induction of a static field, pulsed field	(70-$4\cdot10^5$) A/m	-	0,5 %	Direct measurements with GET 198, magnetic induction gauges	
				($4\cdot10^5$-$1,6\cdot10^6$) A/m	-	0,1 %		
130	Measurements of electric and magnetic quantities	Magnetic field strength	Installations for measuring the magnetic properties of soft magnetic materials	(50-25000) A/m	-	0,3 %	Direct measurements with reference materials	
131	Measurements of electric and magnetic quantities	Magnetic field strength	Installations for measuring the magnetic properties of hard magnetic materials	(0-$25\cdot10^5$) A/m	-	($3,3514\cdot H^{-0,342}$) %	Direct measurements with reference materials	H-strength, A/m
132	Measurements of electric and magnetic quantities	Magnetic field induction	Measuring instruments of the magnetic induction of a static field, pulsed field	($1\cdot10^{-5}$-0,5) T	-	0,5 %	Direct measurements with GET 198, magnetic induction gauges	
				(0,5-2,5) T	-	0,1 %		
133	Measurements of electric and magnetic quantities	Magnetic field induction	Measuring instruments of the magnetic induction of a pulsed field	(0,05-1,0) T	-	6 %	Direct measurements with GET 198, magnetic induction gauges	
				(1,001-11) T	-	1,2 %		
134	Measurements of electric and magnetic quantities	Magnetic field induction	Measuring instruments of the magnetic induction of an alternating field	($1,0\cdot10^{-5}$-$1,0\cdot10^{-3}$) T	-	1,2 %	Direct measurements with GET 198, magnetic induction gauges	
				($1,0\cdot10^{-3}$-0,2) T	-	0,14 %		
135	Measurements of electric and magnetic quantities	Specific magnetic losses	Installations for measuring the magnetic properties of soft magnetic materials	(0,3-20,0) W/kg	-	0,5 %	Direct measurements with reference materials	
				(20,0-160,0) W/kg	-	1,0 %		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
		Magnetic induction		(0,01-2,5) T	-	1,0 %		
136	Measurements of electric and magnetic quantities	Magnetic induction	Magnets (separators)	(10-25) mT	-	1,7 %	Direct measurements with a teslameter	
				(25-2000) mT	-	0,12 %		
137	Measurements of electric and magnetic quantities	Magnetic flux	Measuring instruments for the magnetic flux	$(1\cdot10^{-6}\text{-}1\cdot10^{-1})$ Wb	-	0,07 %	Indirect measurements with mutual-reactor coils	
138	Measurements of electric and magnetic quantities	Magnetic flux	Installations for measuring the magnetic properties of hard magnetic materials	$(10^{-9}\text{-}1{,}0)$ Wb	-	$(0{,}02\cdot\Phi^{-0{,}246})$ %	Direct measurements with reference materials	Φ-magnetic flux, Wb
		Maximum energy product		(5-500) kJ/m^3	-	$(1{,}1319\cdot e^{-0{,}008\cdot(BH)})$ %		(BH)-energy product, kJ/m^3
		Specific magnetization		(20-50) A·m^2/kg	-	0,36 %		
139	Measurements of electric and magnetic quantities	Coil constant	Measuring coils	$(1\cdot10^{-4}\text{-}1)$ Wb/T	-	0,4 %	Indirect measurements with GET 198	
140	Measurements of electric and magnetic quantities	Magnetic field gradient	Measuring instruments for the magnetic field gradient (IMA, IMPOC)	(200-50000) A/m^2	-	0,7 %	Indirect measurements with a teslameter, vernier caliper	
141	Measurements of acoustical quantities	Propagation velocity of ultrasonic waves	Ultrasonic velocity analyzers	(500-10000) m/s	-	10 m/s	Direct measurements with reference materials, measures	
142	Measurements of acoustical quantities	Propagation velocity of ultrasonic waves	Control specimens for the ultrasonic testing	(2500-6500) m/s	-	0,1 %	Indirect measurements with a flaw detector, vernier caliper	
143	Measurements of acoustical quantities	Propagation velocity of ultrasonic waves	Analyzers of the phase behavior of fluids and equipment for the analysis of the properties of plugging materials	(500-5000) m/s	-	10 m/s	Direct measurements with reference materials, measures	
				(1400-2000) m/s		0,5 m/s	Indirect measurements with a pressure gauge, thermometer	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique [2]	Note
144	Optico-physical measurements	Spectral directional transmittance	Photometric measuring instruments (spectrophotometers, photoelectric colorimeters, flame photometers, etc.)	(0-2) %	-	0,5 % abs.	Direct measurements with optical filters	D-optical density, B
				(2-20) %		0,2 % abs.		
				(20-100) %		0,25 % abs.		
		Optical density		(0-0,7) B	-	$0,43 \cdot 0,0025 \cdot 10^{D}$ B		
				(0,7-1,7) B		$0,43 \cdot 0,002 \cdot 10^{D}$ B		
				(1,7-3) B		$0,43 \cdot 0,005 \cdot 10^{D}$ B		
		Wave length		(190-850) nm	-	0,05 nm		
				(850-2700) nm		0,3 nm		
145	Optico-physical measurements	Formazin turbidity	Turbidimeters	(0-4000) FMU	-	2,0 %	Direct measurements with reference materials	
146	Optico-physical measurements	Wave number (wave length)	Infrared and raman spectrometers	(350-7800) cm^{-1}	-	0,5 cm^{-1}	Direct measurements with wavenumber measures, pure substances	
147	Optico-physical measurements	Refractive index	Instruments for measuring the parameters of an optical medium: - refractometers	(1,2-2,0)	-	$2 \cdot 10^{-5}$	Direct measurements with reference materials; indirect measurements with reference materials	
		Mass fraction of sucrose according to the Brix scale		(0-85) % (°Bx)	-	0,01 % abs. (°Bx)		
		Sugar degrees according to the ICUMSA International Sugar Scale	- polarimetric saccharimeters	[(-100)-(+100)] °Z	-	0,022 °Z	Indirect measurements with non-automatic scales	
148	Radio engineering and radio electronic measurements	Volume (amount) of digital information (data)	Measuring channels of gauging and data measuring systems	$(1\text{-}1 \cdot 10^{9})$ byte	-	0,1 bit	Direct measurements with a pulse generator; direct comparison with a reference data set	
149	Radio engineering and radio electronic measurements	Volume (amount) of digital information (data)	Data collection and processing devices	$(1\text{-}1 \cdot 10^{9})$ byte	-	1 bit	Direct measurements with a pulse generator; direct comparison with a reference data set	

Branch Director
position of authorized person

authorized person's signature

E.P.Sobina
initials, surname of the authorized person

[1] The expanded uncertainty is part of the calibration and measurement capabilities and represents the smallest expanded uncertainty achievable for the best available calibration object (type (group) of measuring instruments). The coverage probability corresponds to approximately 95% and the coverage ratio corresponds to k = 2, unless otherwise specified. Uncertainty values without units are relative to the measured value of the quantity, unless otherwise specified. The expanded uncertainty, expressed as a percentage, is indicated in relative form if the abbreviation "rel." is given, or in absolute form if "abs." is indicated. The expanded uncertainty with indication of the quadratic summation operator is calculated by the formula $U = Q(a; b) = \sqrt{a^2 + b^2}$.

[2] Implemented calibration methods (techniques) are indicated. If the document designation establishing the calibration method (technique) is dated, only that particular method is used. If the document designation establishing the calibration method (technique) is not dated, then the latest edition of the specified method (including any changes) is used.

SUPPLEMENT No. 1 TO THE ACCREDITATION SCOPE

Federal State Unitary Enterprise “The D.I. Mendeleev All-Russian Institute for Metrology”
Ural Research Institute of Metrology – a branch of the Federal State Unitary Enterprise “Russian National Scientific and Research Institute for Metrology named after D.I. Mendeleev” (UNIIM-Affiliated Branch of D.I. Mendeleyev Institute for Metrology)

name of a legal entity or surname, name and patronymic (if any) of an individual entrepreneur

620075, Russia, Sverdlovsk region, Ekaterinburg, Krasnoarmeyskaya str., 4

address of the place of activity

For compliance with the requirements of GOST ISO/IEC 17025-2019 "General requirements for the competence of testing and calibration laboratories"

name and details of the interstate or national standard establishing the general requirements for the competence of testing and calibration laboratories

Calibration of measurement instruments

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique[2]	Note
1	Measurements of geometric quantities	Length	Special length gauges, special arbours, special devices, special templets, radius gauges, gauges, tolerance control means, gauges	(0,0001-500) mm	-	(1,5+L/100) μm	Direct measurements with a measuring micro-scope	L-length, mm
				(0,0002-0,1) mm		(1,5+L/100) μm	Indirect measurements with a measuring lever-toothed head	
				(0,0001-200) mm		Q[0,25+2,5·L; 0,15] μm	Comparison with slip gauges using an optime-ter; Direct measurements with an optimeter	
2	Measurements of geometric quantities	Length	Measuring rulers, linear scales, measuring magni-fiers	(0,1-500) mm	-	(1,5+L/100) μm	Direct measurements with a measuring micro-scope	L-length, mm
				(0,1-1000) mm		Q[1,2+5,8·L/1000; 0,12] μm	Direct comparison with a line standard metre	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique[2]	Note
3	Measurements of geometric quantities	Length	Measuring linear displacement transducers and converters	(0,5-5000) mm	-	Q[0,02+0,5·L; 0,29·d] µm	Direct comparison with the laser measuring system	L- length, m; d-discrete pitch size of a transducer, µm
4	Measurements of geometric quantities	Length	Vernier calipers, vernier height gauges, vernier depth gauges, altitude gauges	(1000-2500) mm	-	Q[0,0075; 0,29·d] mm	Direct measurements with parallel slip gauges	d-value per division of a circular scale, a vernier scale or discrete pitch size of a digital device, mm
5	Measurements of geometric quantities	Length	Testing sieves	(0,0001-200) mm	-	(1,5+L/100) µm	Direct measurements with a measuring microscope	L-length, mm
6	Measurements of geometric quantities	Length	Measuring and video measuring microscopes	(0-20) µm	-	Q[0,003; 0,29·d] µm	Direct measurements with a special measure of length and period	L- length, m; d-discrete pitch size of a microscope, µm
				(0-1) mm		Q[0,02+0,2·L; 0,29·d] µm	Direct measurements with line standard meters	
				(0-2000) mm		Q[0,02+0,5·L; 0,29·d] µm	Direct comparison with the laser measuring system	
7	Measurements of geometric quantities	Length	Control (reference) specimens for ultrasonic testing	(0-150) mm	-	6 µm	Direct measurements with a vernier caliper, measuring head, tape measure and goniometer	
				(150-250) mm	-	10 µm		
				(250-320) mm	-	12 µm		
				(320-1000) mm	-	12 µm		
				(1-20) m	-	0,25 mm		
8	Measurements of geometric quantities	Length	Velocity and length meters	(1-99999) m	-	0,06 %	Direct measurements with a KSD stand	
9	Measurements of geometric quantities	Angle	Electron levels	(0-360)°	-	50″	Direct comparison with an optical quadrant	
				(0-1200)″	-	0,5″	Direct measurements with a level checker	
				(0-6) mm/m		0,1 µm/m		
10	Measurements of geometric quantities	Angle	Level checkers	(0-1200)" (0-6) mm/m	-	0,35″ 0,07 µm/m	Indirect measurements with slip gauges and a tape measure	

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique[2]	Note
11	Measurements of geometric quantities	Angle	Special length gauges, special arbours, special devices, special templets, gauges	(0-360)°	-	50″	Direct measurements with a measuring microscope	
12	Measurements of geometric quantities	Angle	Measuring and video-measuring microscopes	(0-360)°	-	3″	Direct measurements with plane angle measures	
13	Measurements of geometric quantities	Angle	Control (reference) specimens for ultrasonic testing	(0-180)°	-	1,7′	Direct measurements with a goniometer	
14	Measurements of geometric quantities	Thickness	Measuring instruments for coating thickness and surface density: - magnetic, eddy-current	(8000-20000) μm	-	$(18{,}588 \cdot h^{-0{,}716})$ %	Direct measurements with thickness gauges	h-thickness, μm
15	Measurements of geometric quantities	Thickness	Thickness gauges: - ultrasonic	(100-300) mm	-	$(0{,}744 \cdot h^{-0.711})$ %	Direct measurements with thickness gauges	h-thickness, mm
16	Measurements of mechanical quantities	Force	Testing machines, presses and installations	$(2 \cdot 10^{-4}$-0,5) kN	-	0,14 %	Direct comparison with a dynamometer	
17	Measurements of mechanical quantities	Velocity	Velocity and length meters	(0,2-50) m/s	-	0,05 %	Direct measurements with a KSD stand	
18	Thermophysical and temperature measurements	Temperature	Channels for measuring the temperature of physico-chemical measuring instruments	(0-100) °C	-	0,2 °C	Direct comparison with a thermometer	
			Secondary temperature transducers for physico-chemical measuring instruments	[(-10)-(150)] °C	-	0,06 °C	Direct comparison with the calibrator of unified signals	
19	Thermophysical and temperature measurements	Phase transition temperature	Measuring instruments for the complex determination of thermophysical properties: - thermal analyzers - thermogravimetric analyzers	(300-450) K	-	0,06 K	Direct measurements with reference materials	
				(450-650) K		0,12 K		
				(650-850) K		0,26 K		
				(850-1050) K		0,60 K		
		Phase transition specific heat		(25-50) kJ/kg	-	0,12 kJ/kg		
				(50-100) kJ/kg		0,25 kJ/kg		
				(100-360) kJ/kg		1,8 kJ/kg		

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique[2]	Note
20	Measurements of physico-chemical composition and properties of substances	Electrical conductivity	Electrical conductivity meters for metals and alloys	(0,5-60) MS/m	-	1,5 %	Direct measurements with electrical conductivity measures	
21	Measurements of physico-chemical composition and properties of substances	Permeability, permeability coefficient	Permeability analyzers	(0,00005-0,05) $10^{-3}\cdot\mu m^2$ (mD)	-	0,9 %	Indirect measurements with working measurement standards of temperature, pressure and non-automatic scales	
22	Measurements of physico-chemical composition and properties of substances	Relative intensity of diffraction peaks	X-ray diffractometers	(8-100) %	-	0,07 % abs.	Direct measurements with reference materials	
23	Measurements of physico-chemical composition and properties of substances	Content (level) of salt on the surface	Salinometers	(0-25) $\mu g/cm^2$	-	2 %	Indirect measurements with reference materials, non-automatic scales, vernier callipers	
24	Optico-physical measurements	Wave number (wavelength)	Infrared and raman spectrometers	(7800-12000) cm^{-1}	-	0,5 cm^{-1}	Direct measurements with wavenumber measures, pure substances	
25	Measurements of electric and magnetic quantities	Magnetic phase content	Instruments for measuring of the magnetic phase content	(20-28) %	-	3,5 % rel.	Direct measurements with reference materials; indirect measurements with reference materials	
26	Measurements of electric and magnetic quantities	Specific magnetic losses	Installations for measuring the magnetic properties of soft magnetic materials	(0,1-0,3) W/kg	-	0,5 %	Direct measurements with reference materials	
		Magnetizing current		(0,002-5) A	-	0,1 %	Direct measurements with an ammeter	
		Magnetic flux		$(5\cdot10^{-5}$-0,1) Wb	-	0,05 %	Indirect measurements with mutual-inductance coils and multimeter	
27	Measurements of electric and magnetic quantities	Maximum energy product	Installations for measuring the magnetic properties of hard magnetic	(5-500) kJ/m^3	-	$(1{,}1319\cdot e^{-0{,}008\cdot(BH)})$ %	Direct measurements with reference materials	(BH)-energy product, kJ/m^3

No.	Measurements	Measured value	Calibration object	Measurement range	Complementary parameters	Expanded measurement uncertainty[1]	Calibration methods/ technique[2]	Note
		Specific magnetization	materials	(20-50) A·m^2/kg	-	0,36 %		
28	Measurements of electric and magnetic quantities	Coil constant	Measuring coils, magnetic induction measures	($1\cdot10^{-4}$-1) Wb/T (m^2)	-	0,01 %	Indirect measurements with GET 198; direct comparison with a standard	
				($5\cdot10^{-5}$-$5\cdot10^{4}$) T/A (m^{-1})	-	0,01 %		

Branch Director
position of authorized person

authorized person's signature

E.P.Sobina
initials, surname of the authorized person

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