Supplement No. 1 to the Scope of Accreditation

DI. Mendeleev Institute for Metrology (VNIIM)

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

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unique accreditation record number in the register of accredited persons

190005, St. Petersburg, Moskovsky pr., 19
198412, St.Petersburg, Lomonosov, Fedyuninsky , 2

address of the place of business

Calibration of measuring instruments

IM

calibration stamp code

No.	Measurements, type (group) of measuring instruments	Metrological requirements		Note
		Measurement range	Uncertainty (error, class)	
1	2	3	4	5
190005, ab. Petersburg, Moskovsky pr., 19				
MECHANICAL MEASUREMENTS				
1	**Instruments measuring mass**			
1.1	Secondary (working) standards of the unit of mass	$5\ 10^{-2}$ mg; 0.1 mg; 0.2 mg 0.5 mg; 1 mg	$U_{0,95} = 5 \cdot 10^{-4}$ mg $U_{0,95} = 5 \cdot 10^{-4}$ mg	Combined measurement method using comparator
1.2	Measures of mass (weights)	$5\ 10^{-2}$ mg; 0.1 mg; 0.2 mg 0.5 mg; 1 mg	$U_{0,95} = 5 \cdot 10^{-4}$ mg $U_{0,95} = 5 \cdot 10^{-4}$ mg	Comparison using comparator
1.3	Non-automatic scales	from $1\ 10^{-5}$ to 6 g	$U_{0,95} = 3,5 \cdot 10^{-3}$ mg 1)	Direct measurement method
1.4	Mass comparators	up to 1 g	$U_{0,95} = 3,1 \cdot 10^{-4}$ mg	Multiple measurements method
1.5	Thinners (dilutors) gravimetric (stirring balances)	$(1\ 10^{-3}$ - 10) kg	$U^{o}_{0,95} = 0,03$ %	Direct measurement method
MEASUREMENTS OF FLOW, FLOW RATE, LEVEL, VOLUME OF SUBSTANCES				
2	**Instruments measuring volume, capacity**			
2.1	Capacity measures of glass and plastic, dispensers, pipettes, burettes, syringes, dispensers, diluters , measuring utensils	0.1 to 0.5 µl incl. 0.5 to 1.0 µl incl. 1.0 to 10 µl incl. 10 to 100 µl incl. 0.1 to 50 ml incl. 0.05 to 10 l incl.	$U^{o}_{0,95} = 2$ % $U^{o}_{0,95} = 1$ % $U^{o}_{0,95} = 0,3$ % $U^{o}_{0,95} = 0,2$ % $U^{o}_{0,95} = 0,1$ % $U^{o}_{0,95} = 0,04$ %	Gravimetric method using distilled water
PRESSURE MEASUREMENTS, VACUUM MEASUREMENTS				
3	**Instruments measuring absolute pressure**			
3.1	Secondary and working standards	$1 \cdot 10^{-1}$ to $1 \cdot 10^{3}$ Pa	$U_{0,95} = 7,2 \cdot 10^{-3}$ Pa + $1,0 \cdot 10^{-4} \cdot p$, where p is the measured pressure, Pa	Direct comparison with GET 101

1	2	3	4	5
		$1\cdot10^3$ to $1.3\cdot10^5$ Pa $7\cdot10^3$ to $1\cdot10^6$ Pa	$U_{0,95} = 1{,}0\cdot10^{-1}$ Pa + $1{,}0\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa $U_{0,95} = 0{,}9$ Pa + $2{,}1\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa	
3.2	Piston pressure gauges	$7\cdot10^3$ to $1\cdot10^6$ Pa	$U_{0,95} = 0{,}9$ Pa + $2{,}1\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa	Direct comparison with GET 101
3.3	Calibrators (setters , generators, controllers) pressure; digital pressure converters, pressure sensors; digital manometers;	$1\cdot10^{-1}$ to $1\cdot10^3$ Pa $1\cdot10^3$ to $1.3\cdot10^5$ Pa $7\cdot10^3$ to $1\cdot10^6$ Pa	$U_{0,95} = 7{,}2\cdot10^{-3}$ Pa + $1{,}0\cdot10^{-4}\cdot p$, where p is the measured pressure, Pa $U_{0,95} = 1{,}0\cdot10^{-1}$ Pa + $1{,}0\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa $U_{0,95} = 0{,}9$ Pa + $2{,}1\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa	Direct comparison with GET 101
3.4	Vacuum gauges, absolute pressure measuring transducers	$1\cdot10^{-1}$ to $1\cdot10^3$ Pa $1\cdot10^3$ to $1.3\cdot10^5$ Pa $7\cdot10^3$ to $1\cdot10^6$ Pa	$U_{0,95} = 7{,}2\cdot10^{-3}$ Pa + $1{,}0\cdot10^{-4}\cdot p$, where p is the measured pressure, Pa $U_{0,95} = 1{,}0\cdot10^{-1}$ Pa + $1{,}0\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa $U_{0,95} = 0{,}9$ Pa + $2{,}1\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa	Direct comparison with GET 101
3.5	Barometers	$5\ 10^2$ to $7\cdot10^3$ $7\cdot10^3$ to $1\cdot10^6$ Pa	$U_{0,95} = 1{,}0\cdot10^{-1}$ Pa + $1{,}0\cdot10^{-5}\cdot p$, where p is the measured pressure, Pa $U_{0,95} = 2{,}1\cdot10^{-5}\cdot p + 0{,}9$ Pa, where p is the measured pressure, Pa	Direct comparison with GET 101
4	**Instruments measuring differential pressure**			
4.1	Working (secondary) standards for the pressure and the unit for pressure difference	$2\ 10^1$ to $1\ 10^2$ Pa $1\ 10^2$ to $5\ 10^3$ Pa $5\ 10^3$ to $1.6\ 10^4$ Pa	$U_{0.95} = 0.06$ Pa $U_{0.95} = 0.14$ Pa $U_{0.95} = 0.55$ Pa	Direct comparison with GET 95
MEASUREMENTS OF THE PHYSICO-CHEMICAL COMPOSITION AND PROPERTIES OF SUBSTANCES				
5	**Instruments measuring viscosity of liquids**			
5.1	Standard (reference) glass capillary viscometers	$1.6\ 10^{-9}$ to $5.5\ 10^{-5}$ m^2/s^2	$U_{0,95}$ = (0,0109 ln (C) + + 0,2714) %, where C is the nominal value of the viscometer constant, m^2/s^2	Comparison with reference viscome-ters from GET 17 using comparator (calibration liq-uid)

1	2	3	4	5
5.2	Standard reference complexes designed for storage and dissemination of the unit of kinematic viscosity of liquid (1st class working standards for the unit of kinematic viscosity of liquid)	up to $3.4\ 10^{-6}\ m^2/s$ $1\cdot 10^{-6}$ to $1\cdot 10^{-5}\ m^2/s$ $3.4\cdot 10^{-6}$ to $3.4\cdot 10^{-5}\ m^2/s$ $8\cdot 10^{-6}$ to $8\cdot 10^{-5}\ m^2/s$ $1\cdot 10^{-5}$ to $1\cdot 10^{-4}\ m^2/s$ $1.6\cdot 10^{-5}$ to $1.6\cdot 10^{-4}\ m^2/s$ $3.4\cdot 10^{-5}$ to $3.4\cdot 10^{-4}\ m^2/s$ $5.4\cdot 10^{-5}$ to $5.4\cdot 10^{-4}\ m^2/s$ $1\cdot 10^{-4}$ to $1\cdot 10^{-3}\ m^2/s$ $2.4\cdot 10^{-4}$ to $2.4\cdot 10^{-3}\ m^2/s$ $3.4\cdot 10^{-4}$ to $3.4\cdot 10^{-3}\ m^2/s$ $1\cdot 10^{-3}$ to $1\cdot 10^{-2}\ m^2/s$ $3.4\cdot 10^{-3}$ to $3.4\cdot 10^{-2}\ m^2/s$ $1\cdot 10^{-2}$ to $1\cdot 10^{-1}\ m^2/s$	$U_{0.95}$ = 0.10 % $U_{0.95}$ = 0.11 % $U_{0.95}$ = 0.12 % $U_{0.95}$ = 0.13 % $U_{0.95}$ = 0.14 % $U_{0.95}$ = 0.14 % $U_{0.95}$ = 0.15 % $U_{0.95}$ = 0.16 % $U_{0.95}$ = 0.17 % $U_{0.95}$ = 0.17 % $U_{0.95}$ = 0.18 % $U_{0.95}$ = 0.18 % $U_{0.95}$ = 0.19 % $U_{0.95}$ = 0.20 %	Comparison with GET 17 using comparator (calibration liquid)
5.3	Liquid viscosity standards (calibration liquids)	up to $2\ 10^{-6}\ m^2/s$ $0.6\cdot 10^{-7}$ to $1\cdot 10^{-5}\ m^2/s$ $2\cdot 10^{-6}$ to $2\cdot 10^{-5}\ m^2/s$ $1\cdot 10^{-5}$ to $1\cdot 10^{-4}\ m^2/s$ $2\cdot 10^{-5}$ to $2\cdot 10^{-4}\ m^2/s$ $1\cdot 10^{-4}$ to $1\cdot 10^{-3}\ m^2/s$ $2\cdot 10^{-4}$ to $2\cdot 10^{-3}\ m^2/s$ $1\cdot 10^{-3}$ to $1\cdot 10^{-2}\ m^2/s$ $2\cdot 10^{-3}$ to $2\cdot 10^{-2}\ m^2/s$ $1\cdot 10^{-2}$ to $1\cdot 10^{-1}\ m^2/s$	$U_{0.95}$ = 0.05 % $U_{0.95}$ = 0.05 % $U_{0.95}$ = 0.06 % $U_{0.95}$ = 0.07 % $U_{0.95}$ = 0.09 % $U_{0.95}$ = 0.10 % $U_{0.95}$ = 0.11 % $U_{0.95}$ = 0.12 % $U_{0.95}$ = 0.14 % $U_{0.95}$ = 0.15 %	Method of direct measurements by GET 17
5.4	Glass capillary viscometers	$7\cdot 10^{-10}$ to $3\cdot 10^{-4}\ m^2/s^2$	$U_{0.95}$ = 0.2 %	Comparison with working standard of the 1st class using comparator (calibration liquid)
5.5	Glass viscometers, capillary, automatic viscometers	up to $1\cdot 10^{-1}\ m^2/s$	$U_{0.95}$ = 0.2 %	Comparison with working standard of the 1st class using comparator (calibration liquid)
5.6	Ball viscometers	0,008 to 35,0 $mPa\cdot sm^{-3}\cdot g^{-1}$ $0,5\cdot 10^{-3}$ to 100 Pa·s	$U_{0.95}$ = 0.5 %	Method of direct measurements using CRMs of liquid viscosity (calibration liquid)
5.7	Liquids viscosity converters (1st classworking standards)	up to 1.10^{-2} Pa s from $1\cdot 10^{-2}$ to 10 Pa s	$U_{0.95} = 6.5\cdot 10^{-5}$ Pa s $U_{0.95}$ = 0.5 %	Method of direct comparison with GET 17
5.8	Flow viscometers, viscosity converters	from $5\cdot 10^{-4}$ to $1\cdot 10^{-2}$ ab.$1\cdot 10^{-2}$ to 100 Pa s	$U_{0.95} = 2\cdot 10^{-5}$ Pa s $U_{0.95}$ = 1 %	Method of direct comparison with working standard of the 1st class Method of direct density measurements on DMA 5000M

1	2	3	4	5
5.9	Stabinger viscometers	up to 40 Pa s up to $4 \cdot 10^{-2}$ m^2/s from 650 to 3000 kg/m^3	$U_{0,95}$ = 0,2 % $U_{0,95}$ = 0,2 % $U_{0,95}$ = 0,5 kg/m^3	Comparison with the working standard of the 1st class using comparator (calibration fluid). Method of direct density measurements on DMA 5000M. Method of direct measurements using standard samples of liquid viscosity and CRMs of liquid density (calibration liquid)
6	**Instruments measuring density of liquids**			
6.1	Secondary standards for the density unit Installations for hydrostatic weighing	650 to 23000 kg/m^3	$U_{0.95} = 5.0 \cdot 10^{-3}$ kg/m^3	Comparison with GET 18 using comparator (density measures - transfer standards)
6.2	Liquids density standards (calibration liquids)	from 650 to 1630 kg/m^3	$U_{0.95} = 2.0 \cdot 10^{-3}$ %	Method of direct measurements on GET 18
6.3	Automatic in-line and submersible density meters, density converters, density measurement channels of mass flow meters and measuring systems	from 0.17 to 170 kg/m^3 (from 0.1 to 10 MPa)	$U_{0.95} = 2.7 \cdot 10^{-2}$ %	Direct measurement method (pure gases)
6.4	Laboratory densitometers (automatic)	from 0.17 to 170 kg/m^3 (from 0.1 to 10 MPa)	$U_{0.95} = 2.7 \cdot 10^{-2}$ %	Direct measurement method (pure gases)
6.5	Glass pycnometers	from 5 to 24 cm^3 above 24 to 49 cm^3 ab. 49 to 99 cm^3 ab. 99 to 2000 cm^3	$U_{0.95} = 1.3 \cdot 10^{-3}$ % $U_{0.95} = 7.5 \cdot 10^{-4}$ % $U_{0.95} = 5.0 \cdot 10^{-4}$ % $U_{0.95} = 3.6 \cdot 10^{-4}$ %	Comparison with GET 18 using comparator (calibration liquids)
6.6	Pressure metal pycnometers	from 100 to 399 cm^3 from 400 to 2000 cm^3	$U_{0.95} = 7{,}6 \cdot 10^{-4}$ % $U_{0.95} = 1{,}1 \cdot 10^{-3}$ %	Comparison with GET 18 using comparator (calibration liquids)
6.7	Pycnometric plants	from 500 to 2000 kg/m^3	$U_{0,95} = 1{,}0 \cdot 10^{-1}$ kg/m^3	Comparison with GET 18 using comparator (calibration liquids)

1	2	3	4	5
7	**Instruments measuring mass concentration of components in liquid media**			
7.1	Atomic absorption spectrometers, atomic emission spectrometers with SPS spectrum excitation sources, mass spectrometers, spectrofluorimeters , luminescent spectrometers and analyzers (fluorescent, chemiluminescent, etc.)	from 1 - to $5 \cdot 10^4$ mg/m³	$U_{0.95}$ = 1.6 %	Direct measurement method
8	**Instruments for measuring the mass fraction of elements in solid materials**			
8.1	X-ray fluorescent spectrometers	from 0.001 % to 0.010 % ab. 0.010 % to 0.10 % ab. 0.10 % to 1.0 % ab. 1.0 % to 89.19 %	$U_{0.95}$ = 20 % (rel.) $U_{0.95}$ = 15 % (rel.) $U_{0.95}$ = 10 % (rel.) $U_{0.95}$ = 4 % (rel.)	Direct measurement method
THERMOPHYSICAL AND TEMPERATURE MEASUREMENTS				
9	**Instruments measuring gas humidity**			
9.1	Instruments measuring humidity of gases, including hygrometers, psychrometers, humidity sensors, thermohygrometers	Relative humidity (5 - 97) % (97 - 100) %	$U_{0.95}$ = 1 % abs . 5 % abs .	Direct measurement method
10	**Instruments measuring temperature**			
10.1	Reference blackbody emitters, reference ABB emitters, extended black bodies	(20 - 45) °C	$U_{0,95}$ = 0,06 °C	Direct comparison method
11	**Instruments measuring specific heat capacity, specific enthalpy, amount of heat, specific heat of phase and structural transformations**			
11.1	Instruments measuring specific heat capacity of solids Reference standards of specific heat capacity	(135 - 2900) J/(kg K) (260 - 870) K (50 – 2900) J/(kg K) (260 - 870) K	$U^o_{0,95}$ = 0,5 % $U^o_{0,95}$ = 0,5 %	Direct measurement method Comparison with comparator
11.2	Differential scanning calorimeters	Temperature (260 - 870) K Quantity of heat (5 – 1200) J Specific enthalpy of solids and specific heat of phase and structural transformations (10 – 1300) kJ/kg specific heat (135 – 2900) J/(kg·K)	$U^o_{0,95}$ = 1 % $U^o_{0,95}$ = 1,5 % $U^o_{0,95}$ = 1,5 % $U^o_{0,95}$ = 1,5 %	Direct measurement method
11.3	Secondary standards of specific heat, measures Calorimeters	(50 – 2900) J/(kg·K) (260 - 870) K (135 – 2900) J/(kg·K) (260 - 870) K	$U^o_{0,95}$ = 0,27 % $U^o_{0,95}$ = 0,5 %	Measurement by GET 60

1	2	3	4	5
11.4	Combined thermal analysis devices, thermal analyzers , synchronous thermogravimeters , devices for thermogravimetric and differential thermal analysis	Temperature (260 - 870) k Quantity of heat (5 – 1200) j Specific enthalpy of solids and specific heat of phase and structural transformations (10 – 1300) kj/kg Specific heat (135 – 2900) j/(kg·k) Weight from 10 mg to 5 g	$U^{o}_{0,95}$ = 1,0 % $U^{o}_{0,95}$ = 1,5 % $U^{o}_{0,95}$ = 1,5 % $U^{o}_{0,95}$ = 1,5 % $U^{o}_{0,95}$ = 3 %	Direct measurement method
12	**Instruments measuring linear expansion temperature coefficient (TCLE)**			
12.1	Interference dilatometers, comparator , optical and pusher dilatometers	TCLE in the temperature range from 90 to 400 K: $\pm (0.05\cdot10^{-6} - 0.5\cdot10^{-6})$ K^{-1} $\pm (0.5\cdot10^{-6} - 5\cdot10^{-6})$ K^{-1} $\pm (5\cdot10^{-6} - 27\cdot10^{-6})$ K^{-1} $\pm (27\cdot10^{-6} - 40\cdot10^{-6})$ K^{-1} $\pm (40\cdot10^{-6} - 100\cdot10^{-6}$ K^{-1} In the temperature range from 400 to 1900 K: $\pm (0.5\cdot10^{-6} - 5\cdot10^{-6})$ K^{-1} $\pm (5\cdot10^{-6} - 10\cdot10^{-6})$ K^{-1} $\pm (10\cdot10^{-6} - 16\cdot10^{-6})$ K^{-1} $\pm (16\cdot10^{-6} - 27\cdot10^{-6})$ K^{-1} $\pm (27\cdot10^{-6} - 40\cdot10^{-6})$ K^{-1} $\pm (40\cdot10^{-6} - 100\cdot10^{-6})$ K^{-1} In the temperature range from 1900 to 3000 K: $\pm (3\cdot10^{-6} - 10\cdot10^{-6})$ K^{-1} $\pm (10\cdot10^{-6} - 17\cdot10^{-6})$ K^{-1} $\pm (17\cdot10^{-6} - 30\cdot10^{-6})$ K^{-1} $\pm (30\cdot10^{-6} - 100\cdot10^{-6})$ K^{-1}	 $U_{0,95} = 0,1\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,12\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,17\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,24\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,30\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,5\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,8\cdot10^{-7}$ K^{-1} $U_{0,95} = 1\cdot10^{-7}$ K^{-1} $U_{0,95} = 1,4\cdot10^{-7}$ K^{-1} $U_{0,95} = 2\cdot10^{-7}$ K^{-1} $U_{0,95} = 2,5\cdot10^{-7}$ K^{-1} $U_{0,95} = 0,5\cdot10^{-7}$ K^{-1} $U_{0,95} = 2\cdot10^{-7}$ K^{-1} $U_{0,95} = 4\cdot10^{-7}$ K^{-1} $U_{0,95} = 8\cdot10^{-7}$ K^{-1}	Direct measurement method
		Relative extension ± 0.3	$U_{0,95} = 0,3\cdot10^{-3}$	
		Linear increment (minus 0.2 - 2) mm	$U_{0,95} = 4\cdot10^{-6}$ mm	
13	**Measuring instruments for complex analysis of thermomechanical quantities**			
13.1	Instruments for analysis of thermomechanical properties of materials	Temperature from 90 to 600 K ab. 600 to 850 K ab. 850 to 1000 K ab. 1000 to 1500 K ab. 1500 to 3000 K	 $U_{0.95}$ = 0.2 K $U_{0.95}$ = 1 K $U_{0.95}$ = 2 K $U_{0.95}$ = 4 K $U_{0.95}$ = 9 K	Direct measurement method
		Relative extension ± 0.3	$U_{0,95} = 0,3\cdot10^{-3}$	
		Linear increment (minus 0.2 - 2) mm	$U_{0,95} = 4\cdot10^{-6}$ mm	

1	2	3	4	5
		TCLE in the temperature range from 90 to 400 K: $\pm (0.05 \cdot 10^{-6} - 0.5 \cdot 10^{-6})$ K^{-1} $\pm (0.5 \cdot 10^{-6} - 10 \cdot 10^{-6})$ K^{-1} $\pm (10 \cdot 10^{-6} - 27 \cdot 10^{-6})$ K^{-1} $\pm (27 \cdot 10^{-6} - 100 \cdot 10^{-6})$ K^{-1} In the temperature range from 400 to 1900 K: $\pm (0.5 \cdot 10^{-6} - 5 \cdot 10^{-6})$ K^{-1} $\pm (5 \cdot 10^{-6} - 16 \cdot 10^{-6})$ K^{-1} $\pm (16 \cdot 10^{-6} - 27 \cdot 10^{-6})$ K^{-1} $\pm (27 \cdot 10^{-6} - 40 \cdot 10^{-6})$ K^{-1} $\pm (40 \cdot 10^{-6} - 100 \cdot 10^{-6})$ K^{-1} In the temperature range from 1900 to 3000 K: $\pm (3 \cdot 10^{-6} - 10 \cdot 10^{-6})$ K^{-1} $\pm (10 \cdot 10^{-6} - 17 \cdot 10^{-6})$ K^{-1} $\pm (17 \cdot 10^{-6} - 30 \cdot 10^{-6})$ K^{-1} $\pm (30 \cdot 10^{-6} - 100 \cdot 10^{-6})$ K^{-1}	$U_{0,95} = 0,2 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 0,3 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 0,34 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 0,42 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 0,5 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 1,2 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 1,8 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 2,5 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 3 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 0,7 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 2,1 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 4,5 \cdot 10^{-7}$ K^{-1} $U_{0,95} = 10 \cdot 10^{-7}$ K^{-1}	
		Elastic modulus from $1 \cdot 10^{-3}$ to 0.1 pa ab. 0.1 to $1 \cdot 10^{2}$ pa ab. $1 \cdot 10^{2}$ to $1 \cdot 10^{5}$ pa ab. $1 \cdot 10^{5}$ to $1 \cdot 10^{9}$ pa ab. $1 \cdot 10^{9}$ to $1 \cdot 10^{16}$ pa	$U_{0,95} = 5 \cdot 10^{-5}$ Па $U_{0,95} = 5 \cdot 10^{-3}$ Па $U_{0,95} = 0,1$ Па $U_{0,95} = 1 \cdot 10^{3}$ Па $U_{0,95} = 5 \cdot 10^{4}$ Па	
		Loss tangent (0.00005 - 100)	$U^{o}_{0,95} = 3$ %	
		Force from $1 \cdot 10^{-4}$ to $1 \cdot 10^{-2}$ n ab. $1 \cdot 10^{-2}$ to 0.1 n ab. 0.1 to $5 \cdot 10^{6}$ n	$U^{o}_{0,95} = 5$ % $U^{o}_{0,95} = 3$ % $U^{o}_{0,95} = 1$ %	
		Weight From $1 \cdot 10^{-3}$ to 1 10^{2} g ab. $1 \cdot 10^{2}$ to $1 \cdot 10^{3}$ g	$U^{o}_{0,95} = 3$ % $U^{o}_{0,95} = 1$ %	
		Frequency of mechanical vibrations (1 – 200) hz	$U^{o}_{0,95} = 3$ %	
		Specific enthalpy of solids and specific heat of phase and structural transformations (10 – 1300) kj/kg	$U^{o}_{0,95} = 1,5$ %	
		Quantity of heat (5 – 1200) j	$U^{o}_{0,95} = 1,5$ %	
		Specific heat (135 – 2900) j/(kg·k)	$U^{o}_{0,95} = 1,5$ %	

1	2	3	4	5
ELECTRICAL AND MAGNETIC MEASUREMENTS				
14	**Instruments measuring EMF and DC voltage**			
14.1	EMF and DC voltage standards	(0.1 - 1) V	EMF standards (1 V): $U_{0,95} = (0{,}03^2 + N^2)^{0,5}$, μV; Votlage standards, (0.1-1) V: $U_{0,95} = (0{,}05^2 + N^2)^{0,5}$, μV, where N is the noise of the calibrated measuring instrument, μV	Comparisons with comparator Direct measurement method
14.2	Secondary standards of the volt	(0.1 - 1) V	$U_{0,95} = (0{,}05^2 + N^2)^{0,5}$, μV, where N is the noise of the calibrated measuring instrument, μV	Comparisons with comparator Direct measurement method
15	**Instruments measuring electrical resistance**			
15.1	Multivalue resistance standards	$(1 - 9.9)\ 10^{12}$ $(1 - 9.9)\ 10^{13}$ $(1 - 9.9)\ 10^{14}$ $1 \cdot 10^{15}$	$U^o_{0,95} = 0{,}03$ % $U^o_{0,95} = 0{,}08$ % $U^o_{0,95} = 0{,}5$ % $U^o_{0,95} = 3$ %	Method of direct measurements. Comparison method using comparator. Method of indirect measurements
15.2	Resistance calibrators	$(1 – 9.9)\ 10^{10}$ $(1 - 9.9)\ 10^{11}$ $(1 - 9.9)\ 10^{12}$ $(1 - 9.9)\ 10^{13}$ $(1 - 9.9)\ 10^{14}$ $1 \cdot 10^{15}$	$U^o_{0,95} = 0{,}002$ % $U^o_{0,95} = 0{,}007$ % $U^o_{0,95} = 0{,}03$ % $U^o_{0,95} = 0{,}08$ % $U^o_{0,95} = 0{,}5$ % $U^o_{0,95} = 3$ %	Method of direct measurements. Method of comparison using comparator. Method of indirect measurements
16	**Instruments measuring electric power**			
16.1	Secondary standards for the unit of electric power and standards of the 1st and 2nd class	from 10000 to 50000 W at a frequency of 40 to 150 Hz	$U^o_{0,95} = 30 \cdot 10^{-4}$ %	Comparison with GET 153
16.2	Wattmeters and varmeters	from 30000 to 150000 W/var at a frequency of 40 to 150 Hz	$U^o_{0,95} = 30 \cdot 10^{-4}$ %	Comparison with GET 153 or with a standard of the 1st class
16.3	Power measuring transducers	from 30000 to 150000 W/var at a frequency of 40 to 150 Hz	$U^o_{0,95} = 30 \cdot 10^{-4}$ %	Comparison with GET 153 or with a standard of the 1st class
16.4	Power calibrators	from 30000 to 150000 W/var at frequency 40 to 150 Hz	$U^o_{0,95} = 30 \cdot 10^{-4}$ %	Comparison with GET 153 or with a standard of the 1st class
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GEOMETRIC MEASUREMENTS				
17	**Instruments measuring length**			
17.1	Working standards for the unit of length to measure cloud heights, cloud heigth-lower limit, calibration kits, delay lines	(10 – 50) m (50 - 15000) m	$U_{0,95} = 0{,}55$ м $U^o_{0,95} = 1{,}2$ %	Method of indirect measurements using tape standards and pulse generators

1	2	3	4	5
MECHANICAL MEASUREMENTS				
18	**Instruments measuring linear motion parameters**			
18.1	Instruments measuring linear speed, bullet flight speed recorders, ballistic recorders	$(1\cdot10^{-2}$ - 1) m/s	$U^{o}_{0,95}$ = 0,1 %	Method of indirect measurements using state working standard of the 3rd class and the state secondary standard for the rotational speed unit
18.2	Instruments measuring linear speed, including laser anemometers	(100 – 2000) m/s	$U^{o}_{0,95}$ = 0,1 %	Method of indirect measurements using the state working standard of the 3 class for the unit of length and the state secondary standard of the unit of speed
19	**Instruments measuring angular motion parameters**			
19.1	Instruments measuring angular speed	(20 – 200) rad/s	$U_{0,95} = 4,4\cdot10^{-9}$ рад/с	Method of direct measurements using GET 108, comparison using comparator from the composition of GET 108
19.2	Setups for verification of gyroscopic devices, setups for reproducing angular speeds	$(5\cdot10^{-8}$ - 200) rad/s	$U_{0,95} = 4,4\cdot10^{-9}$ рад/с	Method of direct measurements using GET 108, comparison using comparator from the composition of GET 108
19.3	Angular accelerometers	$(2\cdot10^{-5} - 25\cdot10^{4})$ rad/s ^{2}	$U^{o}_{0,95}$ = 0,5 %	GOST R ISO 16063-15
19.4	Setups reproducing harmonic angular accelerations	$(2\cdot10^{-5}$ - 500) rad/s ^{2} $(0.01 - 1\cdot10^{3})$ Hz	$U^{o}_{0,95}$ = 0,05 %	GOST R ISO 16063-15, comparison with reference angle transducer
19.5	Rotational speed measuring instruments	(0.1 - 600000) rpm	$U^{o}_{0,95}$ = 0,01 %	Method of direct measurements using the state secondary standard of the unit of speed
		$(1\cdot10^{-2} – 6\cdot10^{4})$ rad/s	$U^{o}_{0,95}$ = 0,01%	
		$(1\cdot10^{-2} - 2.5\cdot10^{4})$ Hz	$U^{o}_{0,95}$ = 0,01 %	
		$(1\cdot10^{-2}$ – 100) m/s	$U^{o}_{0,95}$ = 0,1 %	

1	2	3	4	5
20	**Measuring instruments used in transport**			
20.1	Decelerometers, friction coefficient meters	$(9.81 - 20)$ m/s ^{2} $(0.00 - 1.00)$	$U^o_{0,95} = 0,1$ % $U^o_{0,95} = 1$ %	Method of direct measurements using the state working standard of the 2nd class for the unit of linear acceleration
21	**Instruments measuring parameters of the state of the Earth**			
21.1	Instruments measuring the parameters of seismic vibrations , seismometers. Multichannel seismic stations	$(1\cdot10^{-9} - 1\cdot10^{-7})$ m/s ^{2} $(1\cdot10^{-7} - 1\cdot10^{-4})$ m/s ^{2} $(1\cdot10^{-4} – 1\cdot10^{-2})$ m/s ^{2} $(0.001 - 0.5)$ Hz	$U^o_{0,95} = 2$ % $U^o_{0,95} = 0,5$ % $U^o_{0,95} = 0,1$ %	Method of direct measurements using GET 159
		$(1\cdot10^{-6} - 1\cdot10^{-4})$ m/s ^{2} $(1\cdot10^{-4} - 50)$ m/s ^{2} $(0.5 – 10)$ Hz	$U^o_{0,95} = 2$ % $U^o_{0,95} = 0,5$ % $U^o_{0,95} = 0,1$ %	Comparison with reference accelerometer
		$(1\cdot10^{-3} - 0.01)$ m/s ^{2} $(0, 01 – 50)$ m/s ^{2} $(10 – 1000)$ Hz	$U^o_{0,95} = 5$ % $U^o_{0,95} = 0,1$ %	
21.2	Seismometric installations	$(1\cdot10^{-9} - 50)$ m/s ^{2} $(0.001 – 1000)$ Hz	$U^o_{0,95} = 5$ % $U^o_{0,95} = 0,5$ %	Comparison with reference accelerometer
MEASUREMENT OF FLOW, FLOW RATE (SPEED), LEVEL, VOLUME OF SUBSTANCES				
22	**Instruments measuring speed of air flow**			
22.1	Secondary standards for the unit of air flow speed (aerodynamic measuring setups)	$(0.05 – 100)$ m/s	$U_{0.95} = (0.0003 + 0.003\,V)$ m/s where V is the speed of the air flow, m/s	Total standard uncertainty of comparisons with state primary standard using comparator
22.2	Aerodynamic measuring setups	$(0.05 – 100)$ m/s	$U_{0.95} = (0.0006 +$ $+ 0.006\,V)$ m/s where V is the speed of the air flow, m/s	Comparison with comparator
22.3	Instruments measuring the speed of air flow	$(0.05 – 100)$ m/s	$U_{0.95} = (0.0005 +$ $+ 0.005\,V)$ m/s where V is the speed of air flow, m/s	Direct comparison

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position of authorized person

authorized person's signature

A.N. Pronin
initials, surname of the authorized person

stamp

[1] $U_{0.95}$ is specified for the maximum range load at the lowest possible d for an "ideal tool", where d is the actual scale interval. Intermediate values are calculated according to the calibration procedure.

[2] The Note indicates the implemented methods (procedures) of calibration. If the designation of the document establishing the calibration method(s) is dated, only that particular method is used. If the designation of the document establishing the method (method) of calibration is not dated, the latest edition of the specified method (including any changes) is used.

[3] The expanded measurement uncertainty is expressed in accordance with ILAC - P 14 and EA -4/02, is a part of the CMC and represents the smallest expanded uncertainty achievable for the best available calibration item. The coverage probability corresponds to approximately 95%, and the coverage factor k = 2, unless otherwise indicated. Uncertainty values without units are relative with respect to the measured value of the quantity, unless otherwise stated.