

## Thermometry, Russian Federation

VNIIFTRI (Institute for Physical-Technical and Radiotechnical Measurements, Rosstandart)



VNIIM (D.I. Mendeleyev Institute for Metrology, Rosstandart)

Calibration or Measurement Services			Measurand Level or Range			Measurement Conditions/Independent variables		Expanded Uncertainty					NMI Service Provider	Comments	NMI Service Identifier
Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Triple point of Hydrogen	Direct comparison	13.8033	13.8033	K	Cryostat	adiabatic	0.4	mK	2	95%	No	VNIIFTRI	Approved on 29 June 2004	1
Temperature	Triple point of Neon	Direct comparison	24.5561	24.5561	K	Cryostat	adiabatic	0.4	mK	2	95%	No	VNIIFTRI	Approved on 29 June 2004	2
Temperature	Triple point of Oxygen	Direct comparison	54.3584	54.3584	K	Cryostat	adiabatic	0.39	mK	2	95%	No	VNIIFTRI	Approved on 29 June 2004	3
Temperature	Triple point of Argon for capsule SPRT	Direct comparison	83.8058	83.8058	K	Cryostat	adiabatic	0.33	mK	2	95%	No	VNIIFTRI	Approved on 29 June 2004	4
Temperature	Triple point of Argon for long SPRT	Direct comparison	83.8058	83.8058	K			0.85	mK	2	95%	No	VNIIFTRI	Cryostat; Approved on 29 June 2004	5
Temperature	Triple point of Mercury for capsule SPRT	Direct comparison	234.3156	234.3156	K	Cryostat	adiabatic	0.32	mK	2	95%	No	VNIIFTRI	Approved on 29 June 2004	6
Temperature	Triple point of Mercury for long SPRT	Direct comparison	234.3156	234.3156	K			0.4	mK	2	95%	No	VNIIFTRI	Thermostat; Approved on 29 June 2004	7
Temperature	Gallium cell	Direct comparison	29.7646	29.7646	°C	Temperature-controlled furnace	2-zone	0.2	mK	2	95%	No	VNIIM	Approved on 29 June 2004	9
Temperature	Indium cell	Direct comparison	156.5985	156.5985	°C	Temperature-controlled furnace	3-zone	0.8	mK	2	95%	No	VNIIM	Approved on 29 June 2004	10
Temperature	Tin cell	Direct comparison	231.928	231.928	°C	Temperature-controlled furnace	3-zone	0.6	mK	2	95%	No	VNIIM	Approved on 29 June 2004	11
Temperature	Zinc cell	Direct comparison	419.527	419.527	°C	Temperature-controlled furnace	3-zone	1.0	mK	2	95%	No	VNIIM	Approved on 29 June 2004	12
Temperature	Aluminium cell	Direct comparison	660.323	660.323	°C	Temperature-controlled furnace	3-zone	2.0	mK	2	95%	No	VNIIM	Approved on 29 June 2004	13

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Temperature	Water triple point cell	Direct comparison	0.01	0.01	°C	Thermostat	ice bath	0.088	mK	2	0.95	No	VNIIM	Approved on 19 November 2009	8
Temperature	Standard capsule platinum resistance thermometer	Fixed points	13.8033	302.9146	K	Cryostat	isothermal	1.0	mK	2	95%	No	VNIIFTRI	Approved on 29 June 2004	16
Temperature	Standard platinum resistance thermometer	Gallium fixed point	29.7646	29.7646	°C	Temperature-controlled furnace	2-zone	0.2	mK	2	95%	No	VNIIM	Approved on 29 June 2004	18
Temperature	Standard platinum resistance thermometer	Indium fixed point	156.5985	156.5985	°C	Temperature-controlled furnace	3-zone	0.9	mK	2	95%	No	VNIIM	Approved on 29 June 2004	19
Temperature	Standard platinum resistance thermometer	Tin fixed point	231.928	231.928	°C	Temperature-controlled furnace	3-zone	0.7	mK	2	95%	No	VNIIM	Approved on 29 June 2004	20
Temperature	Standard platinum resistance thermometer	Zinc fixed point	419.527	419.527	°C	Temperature-controlled furnace	3-zone	1.0	mK	2	95%	No	VNIIM	Approved on 29 June 2004	21
Temperature	High-temperature standard platinum resistance thermometer	Aluminium fixed point	660.323	660.323	°C	Temperature-controlled furnace	3-zone	2.2	mK	2	95%	No	VNIIM	Approved on 29 June 2004	22
Temperature	High-temperature standard platinum resistance thermometer	Silver fixed point	961.78	961.78	°C	Temperature-controlled furnace	4-zone	3.5	mK	2	95%	No	VNIIM	Approved on 29 June 2004	23
Temperature	SPRT (long stem)	Calibration at fixed points	0.01	29.7646	°C	Fixed points	TPW, Ga	0.1 to 0.30	mK	2	95%	No	VNIIM	Approved on 19 November 2009	18.1
Temperature	SPRT (long stem)	Calibration at fixed points	0.01	156.5985	°C	Fixed points	TPW, In	0.1 to 0.90	mK	2	95%	No	VNIIM	Approved on 19 November 2009	19.1

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	SPRT (long stem)	Calibration at fixed points	0.01	231.928	°C	Fixed points	TPW, In, Sn	0.1 to 1.10	mK	2	95%	No	VNIIM	Approved on 19 November 2009	20.1
Temperature	SPRT (long stem)	Calibration at fixed points	0.01	419.527	°C	Fixed points	TPW, Sn, Zn	0.1 to 1.3	mK	2	95%	No	VNIIM	Approved on 19 November 2009	21.1
Temperature	SPRT (long stem)	Calibration at fixed points	0.01	660.323	°C	Fixed points	TPW, Sn, Zn, Al	0.1 to 3.0	mK	2	95%	No	VNIIM	Approved on 19 November 2009	22.2
Temperature	SPRT (long stem)	Calibration at fixed points	0,01	961.78	°C	Fixed points	TPW, Sn, Zn, Al, Ag	0.1 to 4.5	mK	2	95%	No	VNIIM	Approved on 19 November 2009	23.1
Temperature	Cells for triple point of Water blackbody radiation sources	Comparison by total radiance	0.01	0.01	°C	Crucible diameter	< 120 mm	0.4	K	2	95%	No	VNIIM	Approved on 29 June 2004	66
						Aperture diameter	> 8 mm								
						Wavelength	0.8 μm to 14 μm								
Temperature	Cells for Gallium fixed-point blackbody radiation sources	Comparison by total radiance	29.7646	29.7646	°C	Crucible diameter	50 mm	0.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	67
						Aperture diameter	> 8 mm								
						Wavelength	0.8 μm to 14 μm								
Temperature	Cells for Indium fixed-point blackbody radiation sources	Comparison by total radiance	156.5985	156.5985	°C	Crucible diameter	50 mm	0.8	K	2	95%	No	VNIIM	Approved on 29 June 2004	68
						Aperture diameter	> 8 mm								
						Wavelength	0.3 μm to 50 μm								

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Cells for Tin fixed-point blackbody radiation sources	Comparison by total radiance	231.928	231.928	°C	Crucible diameter	50 mm	0.9	K	2	95%	No	VNIIM	Approved on 29 June 2004	69
						Aperture diameter	> 8 mm								
						Wavelength	0.3 µm to 50 µm								
Temperature	Cells for Zinc fixed-point blackbody radiation sources	Comparison by total radiance	419.527	419.527	°C	Crucible diameter	50 mm	1.3	K	2	95%	No	VNIIM	Approved on 29 June 2004	70
						Aperture diameter	> 8 mm								
						Wavelength	0.3 µm to 50 µm								
Temperature	Cells for Aluminium fixed-point blackbody radiation sources	Comparison by total radiance	660.323	660.323	°C	Crucible diameter	50 mm	1.9	K	2	95%	No	VNIIM	Approved on 29 June 2004	71
						Aperture diameter	> 8 mm								
						Wavelength	0.3 µm to 50 µm								
Temperature	Cells for Copper fixed-point blackbody radiation sources	Comparison by total radiance	1084.62	1084.62	°C	Crucible diameter	50 mm	2.8	K	2	95%	No	VNIIM	Approved on 29 June 2004	72
						Aperture diameter	> 8 mm								
						Wavelength	0.3 µm to 50 µm								
Temperature	Variable temperature blackbody radiation sources	Calibration by tungsten strip lamp or fixed-point blackbody radiator on spectral radiance and extrapolated	800	962	°C	Aperture diameter	> 2 mm	0.5 to 0.4	K	2	95%	No	VNIIM	Approved on 29 June 2004	73
						Wavelength	0.5 µm to 0.7 µm								

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Variable temperature blackbody radiation sources	Calibration by tungsten strip lamp or fixed-point blackbody radiator on spectral radiance and extrapolated	962	2500	°C	Aperture diameter	> 8 mm	0.4 to 6.0	K	2	95%	No	VNIIM	Approved on 29 June 2004	74
						Wavelength	0.3 µm to 50 µm								
Temperature	Variable temperature blackbody radiation sources	Calibration by tungsten strip lamp or fixed-point blackbody radiator on spectral radiance and extrapolated	-50	80	°C	Aperture diameter	> 8 mm	0.3 to 0.6	K	2	95%	No	VNIIM	Approved on 29 June 2004	75
						Wavelength	0.8 µm to 14 µm								
Temperature	Variable temperature blackbody radiation sources	Calibration by tungsten strip lamp or fixed-point blackbody radiator on spectral radiance and extrapolated	80	1100	°C	Aperture diameter	> 8 mm	0.6 to 2.9	K	2	95%	No	VNIIM	Approved on 29 June 2004	76
						Wavelength	0.8 µm to 14 µm								
Temperature	Tungsten strip lamps	Spectral radiance temperature calibration by fixed-point blackbody radiator and extrapolated	800	962	°C	Wavelength	0.6563 µm	0.3 to 0.2	K	2	95%	No	VNIIM	Approved on 29 June 2004	77

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Tungsten strip lamps	Spectral radiance temperature calibration by fixed-point blackbody radiator and extrapolated	962	2100	°C	Wavelength	0.6563 μm	0.2 to 2.0	K	2	95%	No	VNIIM	Approved on 29 June 2004	78
Temperature	Tungsten strip lamps	Spectral radiance temperature calibration by fixed-point blackbody radiator and extrapolated	800	962	°C	Wavelength	0.47 μm to 0.7 μm	0.5 to 0.4	K	2	95%	No	VNIIM	Approved on 29 June 2004	79
Temperature	Tungsten strip lamps	Spectral radiance temperature calibration by fixed-point blackbody radiator and extrapolated	962	2100	°C	Wavelength	0.47 μm to 0.7 μm	0.4 to 4.0	K	2	95%	No	VNIIM	Approved on 29 June 2004	80
Temperature	Tungsten strip lamps	Two-color temperature calibration by tungsten strip lamp	900	962	°C	Wavelength	0.47 μm to 0.7 μm	2.8 to 2.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	81
Temperature	Tungsten strip lamps	Two-color temperature calibration by tungsten strip lamp	962	2800	°C	Wavelength	0.47 μm to 0.7 μm	2.5 to 9.0	K	2	95%	No	VNIIM	Approved on 29 June 2004	82
Temperature	Tungsten strip lamps	Two-color temperature calibration by tungsten strip lamp	900	962	°C	Wavelength	0.8 μm to 2 μm	4.5 to 4	K	2	95%	No	VNIIM	Approved on 29 June 2004	83

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Temperature	Tungsten strip lamps	Two-color temperature calibration by tungsten strip lamp	962	2800	°C	Wavelength	0.8 μm to 2 μm	4 to 17	K	2	95%	No	VNIIM	Approved on 29 June 2004	84
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	800	962	°C	Target diameter	< 20 mm	2.5 to 2	K	2	95%	No	VNIIM	Approved on 29 June 2004	85
						Angular aperture	1 : (>=) 30								
						Distance	> 0.6 m								
						Wavelength	0.5 μm to 10 μm								
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	962	1500	°C	Target diameter	< 20 mm	2 to 4	K	2	95%	No	VNIIM	Approved on 29 June 2004	86
						Angular aperture	1 : (>=) 30								
						Distance	> 0.6 m								
						Wavelength	0.5 μm to 10 μm								
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	800	962	°C	Target diameter	< 50 mm	2.5 to 2	K	2	95%	No	VNIIM	Approved on 29 June 2004	87
						Angular aperture	1 : (>=) 50								
						Distance	> 1 m								
						Wavelength	0.5 μm to 10 μm								

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?				
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	962	1500	°C	Target diameter	< 50 mm	2 to 4	K	2	95%	No	VNIIM	Approved on 29 June 2004	88	
						Angular aperture	1 : (>=) 50									
						Distance	> 1 m									
						Wavelength	0.5 µm to 10 µm									
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	800	962	°C	Target diameter	< 8 mm	2.5 to 2	K	2	95%	No	VNIIM	Approved on 29 June 2004	89	
						Angular aperture	1 : (>=) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 µm to 1.8 µm									
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	962	2500	°C	Target diameter	< 8 mm	2 to 6.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	90	
						Angular aperture	1 : (>=) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 µm to 1.8 µm									



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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?				
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	800	962	°C	Target diameter	< 2 mm	2.5 to 2	K	2	95%	No	VNIIM	Approved on 29 June 2004	91	
						Angular aperture	1 : (>=) 10									
						Distance	> 0.3 m									
						Wavelength	0.5 µm to 1.8 µm									
Temperature	Radiation thermometers	Spectral radiance temperature calibration by standard blackbody radiator	962	2500	°C	Target diameter	< 2 mm	2 to 6.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	92	
						Angular aperture	1 : (>=) 10									
						Distance	> 0.3 m									
						Wavelength	0.5 µm to 1.8 µm									
Temperature	Radiation thermometers	Partial radiance temperature calibration by standard blackbody radiator	-30	0	°C	Target diameter	< 8 mm	2 to 0.8	K	2	95%	No	VNIIM	Approved on 29 June 2004	93	
						Angular aperture	1 : (>=) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 µm to 1.8 µm									
Temperature	Radiation thermometers	Partial radiance temperature calibration by standard blackbody radiator	0	1100	°C	Target diameter	< 8 mm	0.8 to 2.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	94	

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?				
						Angular aperture	1 : ( $\geq$ ) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 $\mu$ m to 1.8 $\mu$ m									
Temperature	Radiation thermometers	Partial radiance temperature calibration by standard blackbody radiator	1100	2500	$^{\circ}$ C	Target diameter	< 8 mm	2.5 to 6.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	95	
						Angular aperture	1 : ( $\geq$ ) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 $\mu$ m to 1.8 $\mu$ m									
Temperature	Radiation thermometers	Total radiance temperature calibration by standard blackbody radiator	-30	0	$^{\circ}$ C	Target diameter	< 8 mm	2 to 0.8	K	2	95%	No	VNIIM	Approved on 29 June 2004	96	
						Angular aperture	1 : ( $\geq$ ) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 $\mu$ m to 1.8 $\mu$ m									
Temperature	Radiation thermometers	Total radiance temperature calibration by standard blackbody radiator	0	1100	$^{\circ}$ C	Target diameter	< 8 mm	0.8 to 2.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	97	
						Angular aperture	1 : ( $\geq$ ) 30									
						Distance	> 0.3 m									
						Wavelength	0.5 $\mu$ m to 1.8 $\mu$ m									

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Radiation thermometers	Total radiance temperature calibration by standard blackbody radiator	1100	2500	°C	Target diameter	< 8 mm	2.5 to 6.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	98
						Angular aperture	1 : (>=) 30								
						Distance	> 0.3 m								
						Wavelength	0.5 µm to 1.8 µm								
Temperature	Radiation thermometers	Total radiance temperature calibration by standard blackbody radiator	800	1100	°C	Target diameter	< 8 mm	2 to 2.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	99
						Angular aperture	1 : (>=) 30								
						Distance	> 0.3 m								
						Wavelength	0.5 µm to 1.8 µm								
Temperature	Radiation thermometers	Total radiance temperature calibration by standard blackbody radiator	1100	2500	°C	Target diameter	< 8 mm	2.5 to 6.5	K	2	95%	No	VNIIM	Approved on 29 June 2004	100
						Angular aperture	1 : (>=) 30								
						Distance	> 0.3 m								
						Wavelength	0.5 µm to 1.8 µm								
Temperature	Industrial resistance thermometers	Comparison method	-196	-196	°C	Liquid N <sub>2</sub>	cryostat	0.02	°C	2	95%	No	VNIIFTRI	Approved on 28 June 2007	43.1
Temperature	Industrial resistance thermometers	Comparison method	-196	-80	°C	Cryostats		0.02	°C	2	95%	No	VNIIFTRI	Approved on 28 June 2007	43.2
Temperature	Industrial resistance thermometers	Comparison method	-80	0	°C	Cryostats		0.01	°C	2	95%	No	VNIIFTRI	Approved on 28 June 2007	43.3

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Temperature	Industrial platinum resistance thermometer	Comparison method	0	0	°C	Ice bath		0.004	°C	2	95%	No	VNIIM	Approved on 28 June 2007	44.1
Temperature	Industrial platinum resistance thermometer	Comparison method	0	95	°C	Thermostat	water	0.01	°C	2	95%	No	VNIIM	Approved on 28 June 2007	44.3
Temperature	Industrial platinum resistance thermometer	Comparison method	95	275	°C	Temperature-controlled bath	oil	0.02	°C	2	95%	No	VNIIM	Approved on 28 June 2007	45.1
Temperature	Industrial platinum resistance thermometer	Comparison method	275	850	°C	Temperature-controlled furnaces		0.02 to 0.1	°C	2	95%	No	VNIIM	Approved on 28 June 2007	45.2
Temperature	Thermistors	Comparison method	-50	0	°C	Cryostat	stability 0.01 K	0.007 to 0.01	°C	2	95%	No	VNIIM	Approved on 28 June 2007	46.1
Temperature	Thermistors	Comparison method	0	0	°C	Ice bath		0.004	°C	2	95%	No	VNIIM	Approved on 28 June 2007	46.2
Temperature	Thermistors	Comparison method	0	95	°C	Thermostat	water	0.010	°C	2	95%	No	VNIIM	Approved on 28 June 2007	46.4
Temperature	Thermocouple S and R	Ice point	0	0	°C	Thermostat	ice bath	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.1
Temperature	Thermocouple type S and R	Tin fixed point	231.928	231.928	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.2
Temperature	Thermocouple type S and R	Zinc fixed point	419.527	419.527	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.3
Temperature	Thermocouple type S and R	Aluminium fixed point	660.323	660.323	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.4
Temperature	Thermocouple type S and R	Silver fixed point	961.78	961.78	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.5

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Thermocouple type S and R	Gold fixed point	1064.18	1064.18	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.6
Temperature	Thermocouple type S and R	Copper fixed point	1084.62	1084.62	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	48.7
Temperature	Thermocouple type S and R	Calibration at fixed points	0	1100	°C	Ice, Zn, Al, Ag, Cu	3-zone	0.8	K	2	95%	No	VNIIM	Approved on 28 June 2007	49
Temperature	Thermocouple type B	Aluminium fixed point	660.323	660.323	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	50.1
Temperature	Thermocouple type B	Silver fixed point	961.78	961.78	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	50.2
Temperature	Thermocouple type B	Gold fixed point	1064.18	1064.18	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	50.3
Temperature	Thermocouple type B	Copper fixed point	1084.62	1084.62	°C	Temperature-controlled furnace	3-zone	0.6	K	2	95%	No	VNIIM	Approved on 28 June 2007	50.4
Temperature	Thermocouple type B	Pd fixed point (wire-bridge method)	1554.8	1554.8	°C	Temperature-controlled furnace	1-zone	0.9	K	2	95%	No	VNIIM	Approved on 28 June 2007	51
Temperature	Thermocouple type B	Pt fixed point (wire-bridge method)	1768.1	1768.1	°C	Temperature-controlled furnace	1-zone	1.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	52
Temperature	Thermocouple type B	Calibration at fixed points	660	1100	°C	Al, Ag, Cu		0.7	K	2	95%	No	VNIIM	Approved on 28 June 2007	53
Temperature	Thermocouple type B	Calibration at fixed points	1100	1800	°C	Cu, Pd, Pt		1.5	K	2	95%	No	VNIIM	Approved on 28 June 2007	54
Temperature	Thermocouple Pt/Pd	Tin fixed point	231.928	231.928	°C	Temperature-controlled furnace	3-zone	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	55.1
Temperature	Thermocouple Pt/Pd	Zinc fixed point	419.527	419.527	°C	Temperature-controlled furnace	3-zone	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	55.2
Temperature	Thermocouple Pt/Pd	Aluminium fixed point	660.323	660.323	°C	Temperature-controlled furnace	3-zone	0.3	K	2	95%	No	VNIIM	Approved on 28 June 2007	55.3

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Thermocouple Pt/Pd	Silver fixed point	961.78	961.78	°C	Temperature-controlled furnace	3-zone	0.3	K	2	95%	No	VNIIM	Approved on 28 June 2007	55.4
Temperature	Thermocouple Pt/Pd	Gold fixed point	1064.18	1064.18	°C	Temperature-controlled furnace	3-zone	0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	55.5
Temperature	Thermocouple Pt/Pd	Copper fixed point	1084.62	1084.62	°C	Temperature-controlled furnace	3-zone	0.6	K	2	95%	No	VNIIM	Approved on 28 June 2007	55.6
Temperature	Thermocouple Pt/Pd	Calibration at fixed points	0	1100	°C	Ice, Zn, Al, Ag, Cu		0.6	K	2	95%	No	VNIIM	Approved on 28 June 2007	56
Temperature	Thermocouple Au/Pt	Gallium fixed point	29.7646	29.7646	°C	Temperature-controlled furnace	2-zone	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	57.1
Temperature	Thermocouple Au/Pt	Indium fixed point	156.5985	156.5985	°C	Temperature-controlled furnace	3-zone	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	57.2
Temperature	Thermocouple Au/Pt	Tin fixed point	231.928	231.928	°C	Temperature-controlled furnace	3-zone	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	57.3
Temperature	Thermocouple Au/Pt	Zinc fixed point	419.527	419.527	°C	Temperature-controlled furnace	3-zone	0.2	K	2	95%	No	VNIIM	Approved on 28 June 2007	57.4
Temperature	Thermocouple Au/Pt	Aluminium fixed point	660.323	660.323	°C	Temperature-controlled furnace	3-zone	0.3	K	2	95%	No	VNIIM	Approved on 28 June 2007	57.5
Temperature	Thermocouple Au/Pt	Silver fixed point	961.78	961.78	°C	Temperature-controlled furnace	3-zone	0.3	K	2	95%	No	VNIIM	Approved on 28 June 2007	57.6
Temperature	Thermocouple Au/Pt	Calibration at fixed points	0	1000	°C	Ga, In, Sn, Zn, Al, Ag		0.4	K	2	95%	No	VNIIM	Approved on 28 June 2007	58
Temperature	Base metal thermocouple	Comparison method	0	660	°C	Temperature-controlled furnace	3-zone	0.8	°C	2	95%	No	VNIIM	Approved on 28 June 2007	59
Temperature	Base metal thermocouple	Comparison method	660	1100	°C	Temperature-controlled furnace	3-zone	1.5	°C	2	95%	No	VNIIM	Approved on 28 June 2007	60
Temperature	Mercury-in-glass total immersion 0.1 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.03	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.1

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Mercury-in-glass total immersion 0.1 °C graduation	Comparison	10	80	°C	Thermostat	water	0.03	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.2
Temperature	Mercury-in-glass total immersion 0.1 °C graduation	Comparison	80	250	°C	Thermostat	oil	0.03	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.3
Temperature	Mercury-in-glass total immersion 0.2 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.07	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.4
Temperature	Mercury-in-glass total immersion 0.2 °C graduation	Comparison	10	80	°C	Thermostat	water	0.07	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.5
Temperature	Mercury-in-glass total immersion 0.2 °C graduation	Comparison	80	250	°C	Thermostat	oil	0.07	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.6
Temperature	Mercury-in-glass total immersion 0.5 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.17	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.7
Temperature	Mercury-in-glass total immersion 0.5 °C graduation	Comparison	10	80	°C	Thermostat	water	0.17	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.8
Temperature	Mercury-in-glass total immersion 0.5 °C graduation	Comparison	80	250	°C	Thermostat	oil	0.17	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.9
Temperature	Mercury-in-glass total immersion 1 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.35	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.10
Temperature	Mercury-in-glass total immersion 1 °C graduation	Comparison	10	80	°C	Thermostat	water	0.33	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.11
Temperature	Mercury-in-glass total immersion 1 °C graduation	Comparison	80	250	°C	Thermostat		0.33	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.12
Temperature	Mercury-in-glass partial immersion 0.1 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.04	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.13
Temperature	Mercury-in-glass partial immersion 0.1 °C graduation	Comparison	10	80	°C	Thermostat	water	0.04	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.14
Temperature	Mercury-in-glass partial immersion 0.1 °C graduation	Comparison	80	250	°C	Thermostat		0.04	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.15

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Mercury-in-glass partial immersion 0.2 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.11	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.16
Temperature	Mercury-in-glass partial immersion 0.2 °C graduation	Comparison	10	80	°C	Thermostat	water	0.10	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.17
Temperature	Mercury-in-glass partial immersion 0.2 °C graduation	Comparison	80	250	°C	Thermostat		0.12	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.18
Temperature	Mercury-in-glass partial immersion 0.5 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.18	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.19
Temperature	Mercury-in-glass partial immersion 0.5 °C graduation	Comparison	10	80	°C	Thermostat	water	0.17	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.20
Temperature	Mercury-in-glass partial immersion 0.5 °C graduation	Comparison	80	250	°C	Thermostat		0.18	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.21
Temperature	Mercury-in-glass partial immersion 1 °C graduation	Comparison	-38	10	°C	Thermostat	ethanol	0.35	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.22
Temperature	Mercury-in-glass partial immersion 1 °C graduation	Comparison	10	80	°C	Thermostat	water	0.33	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.23
Temperature	Mercury-in-glass partial immersion 1 °C graduation	Comparison	80	250	°C	Thermostat	oil	0.40	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.24
Temperature	Liquid-in-glass spirit total immersion 1 °C graduation	Comparison	-80	10	°C	Thermostat	ethanol	0.35	°C	2	95%	No	VNIIM	Approved on 28 June 2007	62.25
Temperature	Digital Thermometer Thermistor	Comparison	10	80	°C	Thermostat	water	0.009	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.1
Temperature	Digital Thermometer IPRT	Comparison	-80	10	°C	Thermostat	ethanol	0.01	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.2
Temperature	Digital Thermometer IPRT	Comparison	10	80	°C	Thermostat	water	0.01	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.3



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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?			
Temperature	Digital Thermometer IPRT	Comparison	80	250	°C	Thermostat	oil	0.02	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.4
Temperature	Digital Thermometer IPRT	Comparison	250	500	°C	Temperature-controlled furnace		0.04	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.5
Temperature	Digital Thermometer Thermocouple	Comparison	-80	10	°C	Thermostat	ethanol	0.4	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.6
Temperature	Digital Thermometer Thermocouple	Comparison	10	80	°C	Thermostat	water	0.4	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.7
Temperature	Digital Thermometer Thermocouple	Comparison	80	250	°C	Thermostat	oil	0.4	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.8
Temperature	Digital Thermometer Thermocouple	Comparison	250	500	°C	Temperature-controlled furnace		0.6	°C	2	95%	No	VNIIM	Approved on 28 June 2007	84.9
Humidity	Dew-point hygrometer	Direct measurement	-55	15	°C	Saturation temperature	-55 °C to 15 °C	0.11 to 0.12	°C	2	95%	No	VNIIFTRI	Approved on 29 June 2017	1
Humidity	Dew-point hygrometer	Direct measurement	-33	30	°C	Saturation temperature	1 °C to 30 °C	0.11	°C	2	95%	No	VNIIFTRI	Approved on 29 June 2017	1
Humidity	Dew-point hygrometer	Direct measurement	-55	-10	°C	Sample flow pressure	ambient	0.11	°C	2	95%	No	VNIIFTRI	Approved on 29 June 2017	2
Humidity	Dew-point generators	Comparison	-55	15	°C	Saturation temperature	-55 °C to 15 °C	0.17	°C	2	95%	No	VNIIFTRI	Approved on 29 June 2017	6
Humidity	Dew-point generators	Comparison	-33	30	°C	Saturation temperature	1 °C to 30 °C	0.17	°C	2	95%	No	VNIIFTRI	Approved on 29 June 2017	6
Humidity	Dew-point generators	Comparison	-55	-10	°C	Sample flow pressure	ambient	0.17	°C	2	95%	No	VNIIFTRI	Approved on 29 June 2017	7