

Thermometry, Thailand, NIMT (National Institute of Metrology (Thailand))



Calibration or Measurement Services			Measurand Level or Range			Measurement Conditions/Independent variables		Expanded Uncertainty							
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?	Matrix	Comments	NMI Service Identifier
Temperature	Water triple point cell	Comparison with reference cell(s)	0.01	0.01	°C	Temperature	bath	0.3	mK	2	95%	No		Approved on 27 February 2018	11010-11110
Temperature	Aluminium freezing point cell	Comparison with reference cell(s)	660.323	660.323	°C	Temperature	seal cell and furnace	8	mK	2	95%	No		Approved on 05 June 2014 Modified on 09 February 2015	11010-11110
Temperature	SPRT	Triple point of water cell	0.01	0.01	°C	Temperature	seal cell and liquid bath	0.5	mK	2	95%	No		Approved on 27 February 2018	11010-11320
Temperature	SPRT	Mercury triple point cell	-38.8344	-38.8344	°C	Temperature	seal cell and cryostat	0.8	mK	2	95%	No		Approved on 06 September 2013 Modified on 09 February 2015	11010-11320
Temperature	SPRT	Gallium melting point cell	29.7646	29.7646	°C	Temperature	seal cell and thermostat	0.8	mK	2	95%	No		Approved on 06 September 2013 Modified on 09 February 2015	11010-11320
Temperature	SPRT	Tin freezing point cell	231.928	231.928	°C	Temperature	seal cell and furnace	1.5	mK	2	95%	No		Approved on 06 September 2013 Modified on 09 February 2015	11010-11320
Temperature	SPRT	Zinc freezing point cell	419.527	419.527	°C	Temperature	seal cell and furnace	2	mK	2	95%	No		Approved on 06 September 2013 Modified on 09 February 2015	11010-11320
Temperature	SPRT	Aluminium freezing point cell	660.323	660.323	°C	Temperature	seal cell and furnace	8	mK	2	95%	No		Approved on 27 February 2018	11010-11320
Temperature	IPRT	Comparison with SPRT in LN ₂ comparator	-196	-196	°C			16	mK	2	95%	No		Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in cryo calibrator	-100	-80	°C			20	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221

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Temperature	IPRT	Comparison with SPRT in ethanol bath	-80	-60	°C			25	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in ethanol bath	-60	-40	°C			10	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in liquid bath	-40	100	°C			10	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in oil bath	100	250	°C			16	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221

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Temperature	IPRT	Comparison with SPRT in salt bath	250	400	°C			30	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in salt bath	400	500	°C			35	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in salt bath	500	550	°C			40	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221
Temperature	IPRT	Comparison with SPRT in furnace	550	660	°C			50	mK	2	95%	No		Uncertainty due to hysteresis and interpolation equation included. Approved on 27 February 2018	11020-12221

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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?	Matrix	Comments	NMI Service Identifier
Temperature	Temperature sensors with display unit	Comparison with SPRT in ethanol bath	-80	-60	°C			25	mK	2	95%	No		Type of sensors : PRT and RTD. Hysteresis is not included, point only. Approved on 27 February 2018	11020-12710
Temperature	Temperature sensors with display unit	Comparison with SPRT in ethanol bath	-60	-40	°C			15	mK	2	95%	No		Type of sensors : PRT and RTD. Hysteresis is not included, point only. Approved on 27 February 2018	11020-12710
Temperature	Digital thermometer with resistance temperature sensor	Comparison with SPRT in cryobath, water bath and oil bath	-40	90	°C			15	mK	2	95%	No		Approved on 06 September 2013. Hysteresis not included in CMC. Uncertainty of interpolation equation	11020-12710
Temperature	Digital thermometer with resistance temperature sensor	Comparison with SPRT in oil bath	90	250	°C			20	mK	2	95%	No		Approved on 06 September 2013. Hysteresis not included in CMC. Uncertainty of interpolation equation	11020-12710
Temperature	Digital thermometer with resistance temperature sensor	Comparison with SPRT in salt bath, furnace	250	450	°C			50	mK	2	95%	No		Approved on 06 September 2013. Hysteresis not included in CMC. Uncertainty of interpolation equation	11020-12710

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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?	Matrix	Comments	NMI Service Identifier
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	231.928	231.928	°C			0.1	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, point only	11020-12311
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	419.527	419.527	°C			0.1	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, point only	11020-12311
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	660.323	660.323	°C			0.2	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, point only	11020-12311
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	961.78	961.78	°C			0.2	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, point only	11020-12311
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	1084.62	1084.62	°C			0.3	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, point only	11020-12311
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	0	660	°C			0.2	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, range	1120-12312
Temperature	Noble metal thermocouple Type S, R, B	Fixed point calibration	660	1100	°C			0.3	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, range	1120-12312
Temperature	Noble metal thermocouple Type S, R, B	Comparison with SPRTs in baths	0	250	°C			0.1	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, range	1120-12312
Temperature	Noble metal thermocouple Type S, R, B	Comparison with SPRTs in baths / furnace	250	500	°C			0.2	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, range	1120-12312
Temperature	Noble metal thermocouple Type S, R, B	Comparison with HSPRTs/ TCs in furnace	500	700	°C			0.5	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, range	1120-12312

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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?	Matrix	Comments	NMI Service Identifier
Temperature	Noble metal thermocouple Type S, R, B	Comparison with HSPRTs / TCs in furnace	700	1100	°C			1.0	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.02 %, range	1120-12312
Temperature	Base metal thermocouple Type T, E, J, N, K	Comparison with SPRTs / TCs in baths or furnace	0	100	°C			0.2	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.1 %, uncertainty does not include UUC hysteresis, range	11020-12321
Temperature	Base metal thermocouple Type T, E, J, N, K	Comparison with SPRTs / TCs in baths or furnace	100	250	°C			0.3	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.1 %, uncertainty does not include UUC hysteresis, range	11020-12321
Temperature	Base metal thermocouple Type T, E, J, N, K	Comparison with SPRTs / TCs in baths or furnace	250	400	°C			0.5	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.1 %, uncertainty does not include UUC hysteresis, range	11020-12321
Temperature	Base metal thermocouple Type E, J, N, K	Comparison with HSPRTs / TCs in furnace	500	700	°C			0.8	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.1 %, uncertainty does not include UUC hysteresis, range	11020-12321

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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?	Matrix	Comments	NMI Service Identifier
Temperature	Base metal thermocouple Type E, J, N, K	Comparison with HSPRTs / TCs in furnace	700	1000	°C			1.0	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.1 %, uncertainty does not include UUC hysteresis, range	11020-12321
Temperature	Base metal thermocouple Type N, K	Comparison with HSPRTs / TCs in furnace	1000	1100	°C			1.2	°C	2	95%	No		Approved on 05 June 2014. Inhomogeneity 0.1 %, uncertainty does not include UUC hysteresis, range	11020-12321
Temperature	Liquid-in-glass thermometer	Comparison with SPRT in liquid bath	-40	110	°C			20	mK	2	95%	No		Approved on 06 September 2013. Total immersion, Mercury, 0.1 °C/div	11020-12410
Temperature	Liquid-in-glass thermometer	Comparison with SPRT in liquid bath	110	250	°C			50	mK	2	95%	No		Approved on 06 September 2013. Total immersion, Mercury, 0.1 °C/div	11020-12410
Temperature	Liquid-in-glass thermometer	Comparison with SPRT in cryobath, water bath and oil bath	-40	110	°C			60	mK	2	95%	No		Approved on 06 September 2013. Partial immersion, Mercury, < 0.1 °C/div	11020-12410
Temperature	Liquid-in-glass thermometer	Comparison with SPRT in cryobath, water bath and oil bath	110	250	°C			100	mK	2	95%	No		Approved on 06 September 2013. Partial immersion, Mercury, < 0.1 °C/div	11020-12410
Temperature	Radiation thermometer	Calibration by reference blackbody	1084.62	1084.62	°C	Wavelength / μm	0.9	0.55	°C	2	95%	No			11030-11411

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Temperature	Radiation thermometer	Calibration by reference blackbody	961.78	961.78	°C	Wavelength / μm	0.9	0.4	°C	2	95%	No			11030-11411
Temperature	Radiation thermometer	Calibration by reference blackbody	660.323	660.323	°C	Wavelength / μm	0.9	0.4	°C	2	95%	No			11030-11412
Temperature	Radiation thermometer	Calibration by reference blackbody	419.527	419.527	°C	Wavelength / μm	0.9	0.5	°C	2	95%	No			11030-11413
Temperature	Radiation thermometer	Comparison using variable temperature blackbody furnace	1000	2500	°C	Wavelength / μm	0.65	2 to 5	°C	2	95%	No	Matrix for Rad Therm. 65		11030-12542
Temperature	Radiation thermometer	Comparison using variable temperature blackbody furnace	420	1000	°C	Wavelength / μm	0.9	1.5	°C	2	95%	No		Approved on 27 February 2018	11030-12542
Temperature	Radiation thermometer	Direct scale realization by interpolation between fixed points	420	1100	°C	Wavelength / μm	0.9	0.55	°C	2	95%	No		Approved on 27 February 2018	11030-11411
Temperature	Radiation thermometer	Direct scale realization by interpolation between fixed points	420	1100	°C	Wavelength / μm	1.6	0.6	°C	2	95%	No		Approved on 27 February 2018	11030-11411
Temperature	Radiation thermometer	Comparison using variable temperature blackbody furnace	0	420	°C	Wavelength / μm	8 to 12	0.6 to 1.3	°C	2	95%	No	Matrix 8-12 μm	Approved on 27 February 2018	11030-12541, 11030-12542
Temperature	Variable temperature blackbody furnace	Comparison using radiation thermometer	420	1100	°C	Wavelength / μm	1.6	0.7 to 1.6	°C	2	95%	No	Matrix for VTBB 16	Approved on 27 February 2018	11030-12522
Temperature	Fixed-point blackbody furnace (Cu)	Comparison using radiation thermometer	1084.62	1084.62	°C	Wavelength / μm	0.65	0.3	°C	2	95%	No		Approved on 27 February 2018	11030-11121
Temperature	Fixed-point blackbody furnace (Cu)	Comparison using radiation thermometer	1084.62	1084.62	°C	Wavelength / μm	0.9	0.3	°C	2	95%	No		Approved on 27 February 2018	11030-11122
Temperature	Fixed-point blackbody furnace (Ag)	Comparison using radiation thermometer	961.78	961.78	°C	Wavelength / μm	0.9	0.3	°C	2	95%	No		Approved on 27 February 2018	11030-11122

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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?	Matrix	Comments	NMI Service Identifier
Temperature	Fixed-point blackbody furnace (Al)	Comparison using radiation thermometer	660.323	660.323	°C	Wavelength / μm	0.9	0.4	°C	2	95%	No		Approved on 27 February 2018	11030-11122
Temperature	Fixed-point blackbody furnace (Zn)	Comparison using radiation thermometer	419.527	419.527	°C	Wavelength / μm	0.9	0.5	°C	2	95%	No		Approved on 27 February 2018	11030-11122
Temperature	Fixed-point blackbody furnace (Ag)	Comparison using radiation thermometer	961.78	961.78	°C	Wavelength / μm	1.6	0.35	°C	2	95%	No		Approved on 27 February 2018	11030-11123
Temperature	Fixed-point blackbody furnace (Al)	Comparison using radiation thermometer	660.323	660.323	°C	Wavelength / μm	1.6	0.4	°C	2	95%	No		Approved on 27 February 2018	11030-11123
Temperature	Fixed-point blackbody furnace (Zn)	Comparison using radiation thermometer	419.527	419.527	°C	Wavelength / μm	1.6	0.5	°C	2	95%	No		Approved on 27 February 2018	11030-11123
Humidity	Dew-point hygrometer	2T2P	-60	-50	°C	Pressure	ambient	0.32	°C	2	95%	No		Approved on 27 February 2018	11040-13111
Humidity	Dew-point hygrometer	2T2P	-50	-40	°C	Pressure	ambient	0.3	°C	2	95%	No		Approved on 27 February 2018	11040-13111
Humidity	Dew-point hygrometer	2T2P	-40	-30	°C	Pressure	ambient	0.3	°C	2	95%	No		Approved on 27 February 2018	11040-13111
Humidity	Dew-point hygrometer	2T2P	-30	-20	°C	Pressure	ambient	0.3	°C	2	95%	No		Approved on 27 February 2018	11040-13111 11040-13112
Humidity	Dew-point hygrometer	2T2P or 2P	-20	1	°C	Pressure	ambient	0.2	°C	2	95%	No		Approved on 27 February 2018	11040-13112
Humidity	Dew-point hygrometer	2P	1	5	°C	Pressure	ambient	0.16	°C	2	95%	No		Approved on 27 February 2018	11040-13113
Humidity	Dew-point hygrometer	2P	5	15	°C	Pressure	ambient	0.18	°C	2	95%	No		Approved on 27 February 2018	11040-13113
Humidity	Dew-point hygrometer	2P	15	25	°C	Pressure	ambient	0.2	°C	2	95%	No		Approved on 27 February 2018	11040-13113
Humidity	Dew-point hygrometer	2P	25	30	°C	Pressure	ambient	0.2	°C	2	95%	No		Approved on 27 February 2018	11040-13114
Humidity	Dew-point hygrometer	2P	30	60	°C	Pressure	ambient	0.2	°C	2	95%	No		Approved on 27 February 2018	11040-13115

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Matrix for RT65

	0.65 μm
1000 °C to 1500 °C	2
> 1500 °C to 2000 °C	3
> 2000 °C to 2500 °C	5

The expanded uncertainties given in this table are expressed in °C.

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Matrix 8-12 μm

	8 μm to 12 μm
> 0 °C to 50 °C	0.6
> 50 °C to 200 °C	0.8
> 200 °C to 420 °C	1.3

The expanded uncertainties given in this table are expressed in °C.

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Matrix for VTBB 16

	1.6 μm
420 °C to 450 °C	0.8
> 450 °C to 600 °C	0.9
> 600 °C to 700 °C	1.0
> 700 °C to 800 °C	1.2
> 800 °C to 900 °C	1.3
> 900 °C to 1000 °C	1.5
> 1000 °C to 1100 °C	1.6

The expanded uncertainties given in this table are expressed in °C.