

Tabel 1. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Akustik dan Getaran

<b>Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi-LIPI, Indonesia</b>											
<b>Area: Acoustics Ultrasonic and Vibrations</b>										<b>Date: 2016-12-30</b>	
Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Free field response	Sound level meter	Substitution method in anechoic room	-	-	dB (reference: 20 µPa)	0.38	dB	2	95%	LK-070-IDN	09 Januari 2012
Sound pressure level	Pistonphone	IEC 60942-1997-11 (by Insert Voltage)	124	124	dB (reference: 20 µPa)	0.1	dB	2	95%	LK-070-IDN	09 Januari 2012
Sound pressure level	Sound calibrator	IEC 60942-1997-11 (by Insert Voltage)	94	114	dB (reference: 20 µPa)	0.1	dB	2	95%	LK-070-IDN	09 Januari 2012
Sound pressure level	Audiometer	Comparison	10	110	dB (reference: 20µPa)	0.6	dB	2	95%		
Pressure sensitivity level	Measement microphone (LS1P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.06	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measement microphone (LS1P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.07	dB	2	95%	LK-070-IDN	09 Januari 2012

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	CIPM MRA AppC
Pressure sensitivity level	Measurement microphone (LS1P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.08	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS1P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.09	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS1P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.1	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.09	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.07	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.06	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.07	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.08	dB	2	95%	LK-070-IDN	09 Januari 2012
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.12	dB	2	95%	LK-070-IDN	09 Januari 2012

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	CIPM MRA AppC
Pressure sensitivity level	Measurement microphone (LS2P)	IEC 61094-2: 2009, ed. 2.0	-	-	dB (reference: 1V/Pa)	0.17	dB	2	95%	LK-070-IDN	09 Januari 2012
Voltage sensitivity	Acceleration measuring chain	ISO 16063-21 Comparison to reference Transducer	-	-	V/(m/s <sup>2</sup> )	1.2	%	2	95%		
Charge sensitivity	Accelerometer	ISO 16063-21 Comparison to reference Transducer	-	-	C/(m/s <sup>2</sup> )	1.2	%	2	95%		
Sound reduction index	Materials or building elements	ISO 140/III (Testing)	STC 0	STC 52	dB (reference: 20 µPa)	0.8	dB	2	95%		
Sound absorption	Materials or building elements	ISO 354 (Testing)	0	1	dB/dB	0.8	%	2	95%		
Charge sensitivity (modulus)	Accelerometer	ISO 16063-11			C/(m/s <sup>2</sup> )	1.2	%	2	95%	LK-070-IDN	
Charge sensitivity (modulus)	Accelerometer	ISO 16063-11			C/(m/s <sup>2</sup> )	0.8	%	2	95%	LK-070-IDN	
Charge sensitivity (modulus)	Accelerometer	ISO 16063-11			C/(m/s <sup>2</sup> )	0.7	%	2	95%	LK-070-IDN	
Charge sensitivity (modulus)	Accelerometer	ISO 16063-11			C/(m/s <sup>2</sup> )	0.8	%	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	CIPM MRA AppC
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-11			V/(m/s <sup>2</sup> )	0.9	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-11			V/(m/s <sup>2</sup> )	0.8	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-11			V/(m/s <sup>2</sup> )	0.7	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-11			V/(m/s <sup>2</sup> )	0.8	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-21			V/(m/s <sup>2</sup> )	1.3	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-21			V/(m/s <sup>2</sup> )	1,1	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-21			V/(m/s <sup>2</sup> )	1.2	%	2	95%	LK-070-IDN	
Voltage sensitivity (modulus)	Acceleration measuring chain	ISO 16063-21			V/(m/s <sup>2</sup> )	1.3	%	2	95%	LK-070-IDN	
Acceleration output (modulus)	Acceleration measuring instrument	ISO 16063-21	5	150	m/s <sup>2</sup>	1.3	%	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	CIPM MRA AppC
Acceleration output (modulus)	Acceleration measuring instrument	ISO 16063-21	5	150	m/s <sup>2</sup>	1.1	%	2	95%	LK-070-IDN	
Acceleration output (modulus)	Acceleration measuring instrument	ISO 16063-21	5	150	m/s <sup>2</sup>	1.2	%	2	95%	LK-070-IDN	
Acceleration output (modulus)	Acceleration measuring instrument	ISO 16063-21	5	150	m/s <sup>2</sup>	1.3	%	2	95%	LK-070-IDN	

Tabel 2. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Radiometri dan Fotometri

<b>Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi-LIPI, Indonesia</b>										
Area: Photometry and Radiometry										Date: 2016-12-30

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Luminous Intensity	Tungsten lamp	Photometric Bench	0	300	cd	0.8	%	2	95%	LK-070-IDN	-
Illuminance	Illuminance meter	Comparison	0	1000	lx	1.0	%	2	95%	LK-070-IDN	-
Luminous flux	Tungsten lamp	Goniophotometer	0	2000	lm	1.4	%	2	95%	LK-070-IDN	-
Luminance	Luminance meter	Photometric Bench	-	1069	cd/m <sup>2</sup>	2.0	%	2	95%	-	-
Responsivity, UV, Broadband Irradiance	UV Radiometer	Photometer Bench	0	6	mW/cm <sup>2</sup>	1.2	%	2	95%	LK-070-IDN	-
Power, Radiant	Laser	Photometer Bench	0	10	mW	0.8	%	2	95%	-	-
Wavelength	Holmium Oxide Glass	Spectrophotometer	240	650	nm	0.1	nm	2	95%	LK-070-IDN	-
Wavelength	Didymium Glass	Spectrophotometer	300	850	nm	0.1	nm	2	95%	LK-070-IDN	-

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Wavelength	Spectrally-Selective Transmitting Material	Spectrophotometer	250	850	nm	1.0	nm	2	95%	LK-070-IDN	-
Transmittance, Regular, Spectral	Spectally-Neutral material	Spectrophotometer	0	100	%T	0.4	%T	2	95%	LK-070-IDN	-
Reflectance, diffuse, spectral	General Material	Spectrophotometer	-	-	-	1.0	%	2	95%	-	-
Gloss	General Material	Gloss Measurement System	80	100	gloss	1.1	gloss	2	95%	LK-070-IDN	-
Haze	General Material	Integrating Sphere	1.5	20.0	Haze	1.0	%	2	95%	-	-

Tabel 3. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Massa

<b>Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi - LIPI, Indonesia</b>											
Area: Mass and related quantities										Date: 2016-12-30	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Mass	Mass Standard	Comparison in air	1	1	mg	0.5	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	2	2	mg	0.5	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	5	5	mg	0.6	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	10	10	mg	0.7	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	20	20	mg	0.7	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	50	50	mg	0.9	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	100	100	mg	1.1	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	200	200	mg	1.2	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	500	500	mg	1.4	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	1	1	g	2.0	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	2	2	g	2.5	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	5	5	g	2.7	µg	2	95%	LK-070-IDN	21/07/09



Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Mass	Mass Standard	Comparison in air	10	10	g	4	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	20	20	g	5	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	50	50	g	9	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	100	100	g	10	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	200	200	g	18	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	500	500	g	36	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	1	1	kg	60	µg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	2	2	kg	0.15	Mg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	5	5	kg	0.40	Mg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	10	10	kg	1.0	mg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	20	20	kg	3	mg	2	95%	LK-070-IDN	21/07/09
Mass	Mass Standard	Comparison in air	50	50	kg	8	mg	2	95%	LK-070-IDN	21/07/09
Density of solid	Solid density standard	Hydrostatic weighing	1200	2300	kg/m <sup>3</sup>	0.035	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Density of solid	Mass standard 1 kg	Hydrostatic weighing	7700	8300	kg/m <sup>3</sup>	0.24	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Density of solid	Mass standard 500 g	Hydrostatic weighing	7700	8300	kg/m <sup>3</sup>	0.45	kg/m <sup>3</sup>	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Density of solid	Mass standard 200 g	Hydrostatic weighing	7700	8300	kg/m <sup>3</sup>	0.81	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Density of solid	Mass standard 100 g	Hydrostatic weighing	7700	8300	kg/m <sup>3</sup>	1.3	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Density of solid	Mass standard 50 g	Hydrostatic weighing	7700	8300	kg/m <sup>3</sup>	2.1	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Density of solid	Mass standard 20 g	Hydrostatic weighing	7700	8300	kg/m <sup>3</sup>	3.6	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Volume of solid	Solid density standard	Hydrostatic weighing	94	140	cm <sup>3</sup>	2.2	mm <sup>3</sup>	2	95%	LK-070-IDN	
Volume of solid	Mass standard 1 kg	Hydrostatic weighing	120	130	cm <sup>3</sup>	3.7	mm <sup>3</sup>	2	95%	LK-070-IDN	
Volume of solid	Mass standard 500 g	Hydrostatic weighing	60	65	cm <sup>3</sup>	3.5	mm <sup>3</sup>	2	95%	LK-070-IDN	
Volume of solid	Mass standard 200 g	Hydrostatic weighing	24	26	cm <sup>3</sup>	2.5	mm <sup>3</sup>	2	95%	LK-070-IDN	
Volume of solid	Mass standard 100 g	Hydrostatic weighing	12	13	cm <sup>3</sup>	2.1	mm <sup>3</sup>	2	95%	LK-070-IDN	
Volume of solid	Mass standard 50 g	Hydrostatic weighing	6.0	6.5	cm <sup>3</sup>	1.6	mm <sup>3</sup>	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Volume of solid	Mass standard 20 g	Hydrostatic weighing	2.4	2.6	cm <sup>3</sup>	1.1	mm <sup>3</sup>	2	95%	LK-070-IDN	
Density of liquid	Hydrometer	Hydrostatic weighing	600	900	kg/m <sup>3</sup>	0.060	kg/m <sup>3</sup>	2	95%	LK-070-IDN	
Gauge pressure, oil medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	5.0E+05	2.0E+07	Pa	$(99 + 4.1 \times 10^{-5}p + 2 \times 10^{-13}p^2), p$ in Pa	Pa	2	95%	LK-070-IDN	Approved on 23 March 2007
Gauge pressure, oil medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	2.0E+07	2.0E+08	Pa	$(21 + 9.7 \times 10^{-5}p + 5.3 \times 10^{-14}p^2), p$ in Pa	Pa	2	95%	LK-070-IDN	
Gauge pressure, oil medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	2.0E+08	5.0E+08	Pa	$(22 + 9.7 \times 10^{-5}p + 4.5 \times 10^{-14}p^2), p$ in Pa	Pa	2	95%	LK-070-IDN	
Absolute pressure, gas medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	1.0E+04	3.5E+05	Pa	$(0.82 + 3.7 \times 10^{-5}p), p$ in Pa	Pa	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Absolute pressure, gas medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	3.5E+05	7.0E+06	Pa	$(2.6 + 4.2 \times 10^{-5}p), p$ in Pa	Pa	2	95%	LK-070-IDN	
Gauge pressure, gas medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	2.0E+03	3.5E+04	Pa	$(0.15 + 4.7 \times 10^{-5}p), p$ in Pa	Pa	2	95%	LK-070-IDN	
Gauge pressure, gas medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	3.5E+04	3.5E+05	Pa	$(0.006 + 3.8 \times 10^{-5}p), p$ in Pa	Pa	2	95%	LK-070-IDN	
Gauge pressure, gas medium	Pressure Measuring Device, Pressure balance; $p$	Direct comparison with pressure standard: crossfloat	3.5E+05	7.0E+06	Pa	$(2.6 + 4.2 \times 10^{-5}p), p$ in Pa	Pa	2	95%	LK-070-IDN	
Force: Tension & compression	Force measuring device	Direct comparison	40	1000	N	0.0084 %		2	95%	LK-070-IDN	
Force: Tension & compression	Force measuring device	Direct comparison	200	20000	N	0.0062 %		2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Force: Tension & compression	Force measuring device	Direct comparison	2	1000	kN	0.015 %		2	95%	LK-070-IDN	
Force: Compression	Force measuring device	Direct comparison	100	5000	kN	0.050 %		2	95%	LK-070-IDN	
Force: Tension & compression	Uniaxial testing machine	Direct comparison	1	10	kN	0.12 %		2	95%	LK-070-IDN	
Force: Tension & compression	Uniaxial testing machine	Direct comparison	10	500	kN	0.10 %		2	95%	LK-070-IDN	
Force: Compression	Uniaxial testing machine	Direct comparison	500	5000	kN	0.25 %		2	95%	LK-070-IDN	
Torque: clockwise & counterclockwise	Torque measuring device	Direct comparison	1	50	N-m	0.11 %		2	95%	LK-070-IDN	
Torque: clockwise & counterclockwise	Torque measuring device	Direct comparison	5	100	N-m	0.042 %		2	95%	LK-070-IDN	
Torque: clockwise & counterclockwise	Torque measuring device	Direct comparison	100	2000	N-m	0.032 %		2	95%	LK-070-IDN	
Torque: clockwise & counterclockwise	Reference torque wrench	Direct comparison	20	100	N-m	0.15 %		2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Torque: clockwise & counterclockwise	Torque wrench tester	Direct comparison	20	100	N·m	0.40 %		2	95%	LK-070-IDN	
Torque: clockwise & counterclockwise	Torque wrench tester	Direct comparison	100	1000	N·m	0.25 %		2	95%	LK-070-IDN	
Torque: clockwise & counterclockwise	Hand torque wrench	Direct comparison	1	2000	N·m	2.0 %		2	95%	LK-070-IDN	
Gas flow rate	Gas meter	Volumetric (flying start/sop)	250	1200	L/min	0.8%		2	95%	LK-070-IDN	
Water flow rate	Water meter	Volumetric (flying start/sop)	4	167	L/min	0.4%		2	95%	LK-070-IDN	
Water flow rate	Water meter	Reference flowmeter	4	167	L/min	0.8%		2	95%	LK-070-IDN	
Volume	Burettes	Gravimetric	1	2	mL	0.0043	mL	2	95%	LK-070-IDN	
Volume	Burettes	Gravimetric	10	10	mL	0.009	mL	2	95%	LK-070-IDN	
Volume	Burettes	Gravimetric	25	25	mL	0.022	mL	2	95%	LK-070-IDN	
Volume	Burettes	Gravimetric	50	50	mL	0.043	mL	2	95%	LK-070-IDN	
Volume	Burettes	Gravimetric	100	100	mL	0.086	mL	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Volume	Graduated pipettes	Gravimetric	0.05	1	mL	0.0043	mL	2	95%	LK-070-IDN	
Volume	Graduated pipettes	Gravimetric	2	2	mL	0.0085	mL	2	95%	LK-070-IDN	
Volume	Graduated pipettes	Gravimetric	5	5	mL	0.022	mL	2	95%	LK-070-IDN	
Volume	Graduated pipettes	Gravimetric	10	25	mL	0.043	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	1	1	mL	0.0026	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	2	2	mL	0.0032	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	5	5	mL	0.0041	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	10	10	mL	0.0057	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	20	20	mL	0.0077	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	25	25	mL	0.011	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	50	50	mL	0.019	mL	2	95%	LK-070-IDN	
Volume	One-mark pipettes	Gravimetric	100	100	mL	0.024	mL	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Volume	One-mark pipettes	Gravimetric	200	200	mL	0.036	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	5	10	mL	0.0097	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	25	25	mL	0.016	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	50	50	mL	0.025	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	100	100	mL	0.058	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	200	200	mL	0.069	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	500	500	mL	0.16	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	1000	1000	mL	0.21	mL	2	95%	LK-070-IDN	
Volume	Volumetric flasks	Gravimetric	2000	2000	mL	0.33	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	5	5	mL	0.042	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	10	10	mL	0.087	mL	2	95%	LK-070-IDN	



Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Volume	Graduated measuring cylinders	Gravimetric	25	25	mL	0.22	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	50	50	mL	0.43	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	100	100	mL	0.46	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	250	250	mL	1.0	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	500	500	mL	2.2	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	1000	1000	mL	4.3	mL	2	95%	LK-070-IDN	
Volume	Graduated measuring cylinders	Gravimetric	2000	2000	mL	8.6	mL	2	95%	LK-070-IDN	

Tabel 4. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Kelistrikan

Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi - LIPI, Indonesia											
Area: Electricity and Magnetism										Date: 2016-12-30	
Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
DC voltage source single values	Standard cell, solid state voltage standard	Chemical or electronic	1.018	10	V	2.7 to 14	$\mu\text{V}$	2	95%	LK-070-IDN	31/10/2016
DC voltage source: low value ranges	DC voltage source, multifunction calibrator	Electronic	0.01	2.2	V	6.6 to 19	$\mu\text{V}/\text{V}$	2	95%	LK-070-IDN	31/10/2016
DC voltage source: intermediate values	DC voltage source, multifunction calibrator	Electronic	2.2	1100	V	4.5 to 8.9	$\mu\text{V}/\text{V}$	2	95%	LK-070-IDN	31/10/2016
DC voltage meter: Intermediate values	Multimeter	Electronic, comparison	0.1	1000	V	5 to 11	$\mu\text{V}/\text{V}$	2	95%	-	-
DC resistance standards and sources: low values	Fixed resistor	Air or oil immersed , comparison using DCC bridge	0.001	0.1	$\Omega$	1.5E+00 to 2.3E+00	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	-

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
DC resistance standards and sources: low values	Fixed resistor, resistance box	Air or oil immersed , comparison using DCC bridge	0.1	1	$\Omega$	3.1 to 17	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	31/10/2016
DC resistance standards and sources: low values	Fixed resistor, resistance box	Electronic, substitution using resistor standar Thomas type	1	1	$\Omega$	0.15	$m\Omega/\Omega$	2	95%	LK-070-IDN	31/10/2016
DC resistance standards and sources: intermediate values	Fixed resistor, resistance box	Air or oil immersed , comparison using DCC bridge	10	1.00E+06	$\Omega$	4.6 to 29	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	31/10/2016
DC resistance standards and sources: intermediate values	Fixed resistor, resistance box	Electronic, substitution using resistor standar Thomas type	1.9	1.90E+05	$\Omega$	12 to 1.40E+02	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	31/10/2016
DC resistance standards and sources: high values	Fixed resistor, resistance box	Air or oil immersed , comparison using DCC bridge	10	10	$M\Omega$	41	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	31/10/2016
DC resistance standards and sources: high values	Fixed resistor, resistance box, three terminal resistor	Electronic, substitution using resistor standar Thomas type	1	100	$M\Omega$	28 to 1.40E+02	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	31/10/2016

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
DC resistance standards and sources: high values	Fixed resistor, resistance box, three terminal resistor	Air or oil immersed , comparison using DCC bridge	1	1	GΩ	37	μΩ/Ω	2	95%	LK-070-IDN	-
DC resistance standards: high values	Fixed resistor, resistance box	Air, substitution using teraohmmeter	10	10	GΩ	0.3	mΩ/Ω	2	95%	-	-
DC resistance standards: high values	Fixed resistor, resistance box	Air, substitution using teraohmmeter	100	100	GΩ	1	mΩ/Ω	2	95%	-	-
DC resistance standards: very high values	Fixed resistor, resistance box	Air, substitution using teraohmmeter	1	1	TΩ	2	mΩ/Ω	2	95%	-	-
DC resistance standards: very high values	Fixed resistor, resistance box	Air, substitution using teraohmmeter	10	10	TΩ	4	mΩ/Ω	2	95%	-	-
DC resistance standards: very high values	Fixed resistor, resistance box	Air, substitution using teraohmmeter	100	100	TΩ	6	mΩ/Ω	2	95%	-	-
DC resistance standards: very high values	Fixed resistor, resistance box	Air, substitution using teraohmmeter	1	1	PΩ	25	mΩ/Ω	2	95%	-	-
DC resistance standards and sources: Multiple range	Multifunction calibrator	Direct or substitution measurement method	0.01	1.00E+06	Ω	4.7E+00 to 3.5E+03	μΩ/Ω	2	95%	LK-070-IDN	-

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
DC resistance meters: Low values	Microohmmeter, multimeter	Direct measurement method	0.001	1.00E+00	$\Omega$	9.3E+00 to 1.7E+02	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	-
DC resistance meters: Intermediate values	Ohmmeter, multimeter	Direct measurement method	10	1.00E+09	$\Omega$	4.7E+00 to 5.5E+01	$\mu\Omega/\Omega$	2	95%	LK-070-IDN	-
DC current sources: low values	Current generator, multifunction calibrator	Electronic	0.01	0.22	mA	0.12	mA/A	2	95%	LK-070-IDN	31/10/2016
DC current sources: intermediate values	Current generator, multifunction calibrator	Electronic	2.20E-04	20	A	55 to 2.00E+02	$\mu\text{A}/\text{A}$	2	95%	LK-070-IDN	31/10/2016
DC current meter: Low values	Multimeter	Electronic, comparison	100	100	$\mu\text{A}$	0.00003	$\mu\text{A}/\text{A}$	2	95%	-	-
DC current meter: Intermediate values	Multimeter	Electronic, comparison	0.001	10	A	0.026 to 489	$\mu\text{A}/\text{A}$	2	95%	-	-
DC current meter	Clampmeter	Electronic, direct	60	1000	A	5.1 to 7.2	mA/A	2	95%	-	-

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Capacitance: capacitance and dissipation factor for low loss capacitors	Standard capacitor	Air capacitor	1	1.00E+06	pF	6.5 to 1.50E+02	μF/F	2	95%	LK-070-IDN	31/10/2016
Capacitance: capacitance and dissipation factor for dielectric capacitors	Fixed capacitor, capacitance box	Direct measurement method	1	1.00E+06	pF	2.8E+01 to 1.4E+04	μF/F	2	95%	LK-070-IDN	-
Capacitance: meters	LCR meters	Direct measurement method	10	1.00E+06	pF	9.1E+01 to 4.4E+03	μF/F	2	95%	LK-070-IDN	-
Inductance: self inductance and equivalent series resistance, low values	Fixed inductor, variable inductor, inductance box	Air inductor	100	100	μH	15	nH	2	95%	LK-070-IDN	31/10/2016
Inductance: self inductance and equivalent series resistance, intermediate	Fixed inductor, variable inductor, inductance box	Air inductor	100	100	mH	15	μH	2	95%	LK-070-IDN	31/10/2016

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
values											
Inductance: self inductance and equivalent series resistance, high values	Fixed inductor, variable inductor, inductance box	Air inductor	10	10	H	2	mH	2	95%	LK-070-IDN	31/10/2016
Inductance: meters	LCR meters	Direct measurement method	0.0001	10	H	1.3E+02 to 1.9E+02	μH/H	2	95%	LK-070-IDN	-
AC-DC voltage transfer, AC-DC transfer difference at medium voltages	Thermal converter (directly connected), AC-DC transfer standard	AC-DC comparison, build up/down comparison method	0.6	4	V	5 to 228	μV/V	2	95%	LK-070-IDN	31/10/2016
AC-DC voltage transfer, AC-DC transfer difference at higher voltages	Thermal converter with range extender, AC-DC transfer standard	AC-DC comparison, build up/down comparison method	6	600	V	5 to 319	μV/V	2	95%	LK-070-IDN	31/10/2016
AC voltage up to 1100 V, sources	Multifunction calibrator	AC/DC transfer standard, comparison	0.22	220	V	8 to 263	μV/V	2	95%	LK-070-IDN	31/10/2016

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
AC voltage up to 1100 V: source	Multifunction calibrator	Electronic, direct	0.22	1000	V	0.16 to 192	μV/V	2	95%	-	-
AC voltage up to 1100 V: meter	Multimeter	Electronic, comparison	0.1	1000	v	0.22 to 823	μV/V	2	95%	-	-
AC-DC current transfer, AC-DC transfer difference	Thermal converter plus shunt, AC-DC transfer standard plus shunt	AC-DC comparison, build up/down comparison method	0.01	10	A	78 to 206	μA/A	2	95%	LK-070-IDN	31/10/2016
AC current up to 100 A, sources	Multifunction calibrator	AC/DC transfer standard, comparison	0.02	10	A	78 to 239	μA/A	2	95%	LK-070-IDN	31/10/2016
AC current up to 100 A: source	Multifunction calibrator	Electronic, direct	0.001	10	A	0.17 to 6200	μA/A	2	95%	-	-
AC current up to 100 A: meter	Multimeter	Electronic, comparison	0.001	10	A	0.55 to 6357	μA/A	2	95%	-	-
AC current meter	Clampmeter	Electronic, direct	20	600	A	5.1 to 7.2	mA/A	2	95%	-	-
AC current meter	Clampmeter	Electronic, direct	600	1000	A	5.1 to 3.6	mA/A	2	95%	-	-
AC power and energy: single phase	Power source	Digital sampling type, direct measurement	32	21168	W	373	μW/VA	2	95%	-	-



Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
		method									
AC power and energy: single phase	Power source	Digital sampling type, direct measurement method	320	80640	W	485	μW/VA	2	95%	-	-
AC power and energy: single phase	Power source	Digital sampling type, direct measurement method	32	21168	W	461	μW/VA	2	95%	-	-
AC power and energy: single phase	Power source	Digital sampling type, direct measurement method	320	80640	W	555	μW/VA	2	95%	-	-
AC power and energy: single phase	Power meter	Digital sampling type, direct measurement method	0.06	7680	W	200	μW/VA	2	95%	-	-
AC power and energy: single phase	Energy meter	Digital sampling type, direct measurement method	60	7.68E+06	W	200	μJ/VAs	2	95%	-	-
High DC voltage: high voltage source	DC kilovolt source	Comparison with divided voltage	1	100	kV	0.1	%	2	95%	-	-

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
High AC voltage: high voltage source	AC kilovolt source	Comparison with divided voltage	1	100	kV	1	%	2	95%	-	-

Tabel 5. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Waktu dan Frekuensi

Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi - LIPI, Indonesia											
Area: Time and Frequency										Date: 2016-12-30	
Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Frequency	General Frequency Source	Direct Frequency Measurement	10	1E+9	Hz	4E-11	Hz/Hz	2	95%	LK-070-IDN	
Frequency	Frequency Counter	Direct Frequency Measurement	10	1E+7	Hz	6E-12	Hz/Hz	2	95%	LK-070-IDN	
Frequency	Frequency Counter	Direct Frequency Measurement	1E+7	3.2E+9	Hz	6E-12	Hz/Hz	2	95%	LK-070-IDN	
Frequency	Local Frequency Standard	Phase Time Measurement	1	1	MHz	2E-13	Hz/Hz	2	95%	LK-070-IDN	
Frequency	Local Frequency Standard	Phase Time Measurement	5	5	MHz	2E-13	Hz/Hz	2	95%	LK-070-IDN	
Frequency	Local Frequency Standard	Phase Time Measurement	10	10	MHz	2E-13	Hz/Hz	2	95%	LK-070-IDN	
Time Interval	Time Difference Source	Double Channel Time Interval Counter	1.00E-09	10	s	2	ns	2	95%	LK-070-IDN	
Time Interval	Pulse Width Source	Time Interval Measurement	1E-8	1	s	2	ns	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Time Interval	Period Source	Time Interval Measurement	1E-8	1	s	1	ns	2	95%	LK-070-IDN	
Time Interval	Pulse Rise Fall Source	Time Interval Counter	1E-8	1E-6	s	2	ns	2	95%	LK-070-IDN	
Time Interval	Delay Source	Double Channel Time Interval Counter	1.00E-09	10	s	2.00E+00	ns	2	95%	LK-070-IDN	
Time Interval	Tachometer Calibration	Time Interval Counter	30	99000	rpm	6E-4	rpm	2	95%		
Time Interval	Stopwatch-Timer Calibration	Time Interval Counter	10	3600	s	0.038	s	2	95%		
Time Interval	Stroboscope Calibration	Time Interval Counter	30	99000	rpm	5.4E-4	rpm	2	95%		
Frequency	Optical Wavelength (632.9 nm) Calibration of Stabilized He Ne Laser Using Beat Frequency Measurement	Beat Frequency	633	633	nm	6.7E-11	Hz/hz	2	95%	ILC-CCL-K11 Draft B	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty					Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Accred-ited	CIPM MRA App.C
Frequency	General Frequency Source	Direct comparition method	10	1.00E+05	Hz	100 to 400	μHz/Hz	2	95%	Yes		
Frequency	General Frequency Source	Direct comparition method	0.1	225	MHz	1.30E+03	μHz/Hz	2	95%	Yes		
Frequency	Frequency Meter	Direct comparition method	10	3.00E+07	Hz	100 to 2.00E+06	μHz/Hz	2	95%	Yes		
Frequency	Tachometer	Direct comparition method	30	900	rpm	0,01	rpm/rpm	2	95%	Yes		
Frequency	Tachometer	Electronic, direct comparition method	1000	99000	rpm	0,1 to 1	rpm/rpm	2	95%	Yes		
Time Interval	Stopwatch	Time Interval Measurement	10	60	s	260	ms	2	95%	no		
Time Interval	Oscilloscope	Time Interval Measurement	1.00E-08	5	s	10 to 1E+05	ns	2	95%	no		

Tabel 6. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Panjang

<b>Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi - LIPI, Indonesia</b>										
Area: Length and Dimensional										Date: 2016-12-30

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
End standards	Gauge block: central length $L$	Mechanical comparison to gauge block	0.5	100	mm	$Q[0.046, 0.00099L]$ , $L$ in mm, values range from 0.05 $\mu\text{m}$ to 0.11 $\mu\text{m}$	$\mu\text{m}$	2	95%	LK-070-IDN	Approved May 2008  $U=Q[0.078, 0.0014L]$ , $L$ in mm, values range from 0.08 $\mu\text{m}$ to 0.16 $\mu\text{m}$
End standards	Gauge block: central length $L$	Mechanical comparison to gauge block	125	1000	mm	$Q[0.17, 0.0009L]$ , $L$ in mm, values range from 0.2 $\mu\text{m}$ to 0.9 $\mu\text{m}$	$\mu\text{m}$	2	95%	LK-070-IDN	Approved May 2008  $U=Q[0.34, 0.0019L]$ , $L$ in mm, values range from 0.4 $\mu\text{m}$ to 1.9 $\mu\text{m}$
End standards	Step gauge: face spacing	Measuring machine	10	600	mm	$Q[1.3, 0.0016L]$ , $L$ in mm	$\mu\text{m}$	2	0.95		Approved May 2008

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
End standards	Step gauge: face spacing	Direct measurement	10	400	mm	$Q[1.2, 0.00081L]$ , $L$ in mm, values range from 1.2 $\mu\text{m}$ to 1.7 $\mu\text{m}$	$\mu\text{m}$	2	95%		
End standards	Step gauge: face spacing	Direct measurement	10	400	mm	$Q[1.2, 0.82L]$ , $L$ in m	$\mu\text{m}$	2	95%		
Angle by circle-dividers	Optical polygon: face angle	Auto-collimators, full closure	$360/n$ ( $n = 36$ )	$360/n$ ( $n = 3$ )	$^\circ$	0.60	"	2	95%	LK-070-IDN	Approved May 2008 $U=1''$
Angle by circle dividers	Optical polygon: face angle	Rotary encoder (SelfA)	$360/n$ ( $n = 36$ )	$360/n$ ( $n = 3$ )	$^\circ$	0.50	"	2	95%	LK-070-IDN	
Line standards	Precision line scale: line spacing	Interferometry	1	400	mm	$Q[0.50, 0.04L]$ , $L$ in mm	$\mu\text{m}$	2	0.95		Approved May 2008
Line standards	Precision line scale: line spacing	Direct measurement	1	400	mm	$Q[1.3, 1.4L]$ , $L$ in m	$\mu\text{m}$	2	95%		
End standards	Gauge block: central length $L$	Interferometry, exact fractions	0.5	100	mm	$Q[25, 0.40L]$ , $L$ in mm, values range from 24,53 nm to 46.60 nm	nm	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
						Q[29, 0.29L], L in mm, values range from 28.40 nm to 40.24 nm	nm	2	95%	LK-070-IDN	
						Q[29, 0.28L], L in mm, values range from 28.46 nm to 39.80 nm	nm	2	95%	LK-070-IDN	
End standards	Gauge block: central length $L$	Interferometry, exact fractions	125	1000	mm	Q[53, 0.094L], L in mm, values range from 54.32 nm to 108.32 nm	nm	2	95%	LK-070-IDN	
Surface texture	Depth or step height standard (ISO 5436-1 Type A)	Stylus instrument	0.24	75	$\mu\text{m}$	0.025	$\mu\text{m}$	2	95%		
Length Instruments	Gauge block comparator: error of indicated displacement	Comparison to gauge blocks	0	100	mm	0.03	$\mu\text{m}$	2	95%		
Length Instruments	One-dimension displacement transducer (LVDT): error of indicated displacement	Direct measurement using measuring machine and laser interferometer	0	25	mm	0.19	$\mu\text{m}$	2	95%		



Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Length Instruments	Calibration tester: error of indicated displacement	Direct measurement	0	25	mm	0.26	µm	2	95%		
Angle artefacts	Angle block: included angle	Coordinat method (2D measuring system)	1/4	30	"	11	"	2	95%		
Angle by circle-dividers	Index table: index angle	Autocollimator and polygon	0	360	°	0,5	"	2	95%		
Angle Instruments	Autocollimator: error of indicated angle	Inclination	0	± 400	"	0.8	"	2	95%		
Angle Instruments	Autocollimator: error of indicated angle	Rotary encoder (SelfA)	72	1000	"	0.20	"	2	95%		
Angle Instruments	Electronic level: error of indicated inclination angle	Inclination table	0	± 1650	"	0.41	"	2	95%		
Angle Instruments	Electronic level: error of indicated inclination angle	Rotary encoder (SelfA)	0	± 400	"	0,17	"	2	95%		
Roundness standards	Sphere: roundness	Stylus-on-spindle roundness measurement	0	1	mm	0.04	µm	2	95%		

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Flatness standards	Optical flat: flatness	Direct measurement	0	2	μm	0.05	μm	2	95%		
Flatness standards	Optical parallel: parallelism	Gauge block comparator	0	2	μm	0.05	μm	2	95%		
Flatness standards	Surface plate: flatness	Direct measurement	0	2000	mm	1.6	μm	2	95%		
Length Instruments	1D measuring machine	Comparison to gauge blocks	0	100	mm	0.15	μm	2	95%		
Length Instruments	1D measuring machine	Interferometry	0	400	mm	Q[0.51, 0.96 L], L in m	μm	2	95%		

Tabel 7. Kemampuan Kalibrasi dan Pengukuran Subbidang Metrologi Suhu

<b>Calibration and Measurement Capability (CMC) Declarations Puslit Metrologi - LIPI, Indonesia</b>										
Area: Temperature										Date: 2016-12-30

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	Long-stem SPRT	Hg triple point	-189.3442	-189.3442	°C	6	mK	2	95%		
Temperature	Long-stem SPRT	Hg triple point	-38.8344	-38.8344	°C	2	mK	2	95%	LK-070-IDN	
Temperature	Long-stem SPRT	H <sub>2</sub> O triple point	0.01	0.01	°C	1	mK	2	95%	LK-070-IDN	
Temperature	Long-stem SPRT	Ga melting point	29.7646	29.7646	°C	3	mK	2	95%	LK-070-IDN	
Temperature	Long-stem SPRT	In freezing point	156.5985	157.5985	°C	4	mK	2	95%	LK-070-IDN	
Temperature	Long-stem SPRT	Sn freezing point	231.928	231.928	°C	4	mK	2	95%	LK-070-IDN	6/28/07
Temperature	Long-stem SPRT	Zn freezing point	419.527	419.527	°C	4	mK	2	95%	LK-070-IDN	6/28/07
Temperature	High Temperature SPRT	Al freezing point	660.323	660.323	°C	6	mK	2	95%	LK-070-IDN	
Temperature	High Temperature SPRT	Ag freezing point	961.78	961.78	°C	7	mK	2	95%	LK-070-IDN	
Temperature	IPRT	Comparison	-40	150	°C	0.02	°C	2	95%	LK-070-IDN	
Temperature	IPRT	Comparison	100	250	°C	0.02	°C	2	95%	LK-070-IDN	
Temperature	IPRT	Comparison	250	500	°C	0.04	°C	2	95%	LK-070-IDN	
Temperature	IPRT	Comparison	0	100	°C	0.025	°C	2	95%	LK-070-IDN	3/16/11

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	IPRT	Comparison	0	420	°C	0.080	°C	2	95%	LK-070-IDN	3/16/11
Temperature	Liquid-in-glass thermometer (res: 0.01 °C)	Comparison	-40	0	°C	0.02	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.01 °C)	Comparison	0	125	°C	0.02	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.01 °C)	Comparison	125	250	°C	0.02	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	0	100	°C	0.04	°C	2	95%		3/16/11 (U=0.069 °C)
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	100	250	°C	0.08	°C	2	95%		3/16/11 (U=0.081 °C)
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	250	420	°C	0.21	°C	2	95%		3/16/11 (U=0.21 °C)
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	-40	0	°C	0.05	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	0	125	°C	0.05	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	125	250	°C	0.05	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.1 °C)	Comparison	250	500	°C	0.09	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer	Comparison	-40	0	°C	0.09	°C	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
	(res: 0.2 °C)										
Temperature	Liquid-in-glass thermometer (res: 0.2 °C)	Comparison	0	125	°C	0.08	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.2 °C)	Comparison	125	250	°C	0.08	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.2 °C)	Comparison	250	500	°C	0.11	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.5 °C)	Comparison	-40	0	°C	0.2	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.5 °C)	Comparison	0	125	°C	0.2	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.5 °C)	Comparison	125	250	°C	0.2	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 0.5 °C)	Comparison	250	500	°C	0.2	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 1 °C)	Comparison	-40	0	°C	0.4	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 1°C)	Comparison	0	125	°C	0.4	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 1°C)	Comparison	125	250	°C	0.4	°C	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer (res: 1 °C)	Comparison	250	500	°C	0.4	°C	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	Temperature sensor with display unit	Comparison	-40	0	°C	0.04	°C	2	95%	LK-070-IDN	
Temperature	Temperature sensor with display unit	Comparison	0	100	°C	0.03	°C	2	95%	LK-070-IDN	
Temperature	Temperature sensor with display unit	Comparison	100	250	°C	0.03	°C	2	95%	LK-070-IDN	
Temperature	Temperature sensor with display unit	Comparison	250	500	°C	0.08	°C	2	95%	LK-070-IDN	
Temperature	Temperature sensor with display unit	Comparison	0	1000	°C	0.3	°C	2			
Temperature	Temperature sensor with display unit	Comparison	500	1000	°C	1.2	°C	2	95%		
Temperature	Type thermocouple	Calibration at Pd melting point in air	1553.4	1553.4	°C	0.9	°C	2	95%	LK-070-IDN	
Temperature	Noble Metal thermocouple	Calibration at fixed points	0	1000	°C	$0.17+0.00007t, t$ in °C	°C	2	95%	LK-070-IDN	
Temperature	Noble Metal thermocouple	Calibration at fixed points	1000	1500	°C	$-1.1 + 0.0013t, t$ in °C	°C	3	95%	LK-070-IDN	
Temperature	Noble Metal thermocouple (special)	Comparison	0	1000	°C	$0.22+0.00023t, t$ in °C	°C	2	95%	LK-070-IDN	3/16/11 ( $U=0.17+0.00034t, t$ in °C)
Temperature	Noble Metal thermocouple	Comparison	1000	1500	°C	$0.13+0.00059t, t$ in °C	°C	2	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	Base-metal thermocouple	Comparison	0	250	°C	$0.11+0.0002t$ , $t$ in °C	°C	2	95%		
Temperature	Base-metal thermocouple	Comparison	0	500	°C	$0.5+0.0012t$ , $t$ in °C	°C	2	95%		3/16/11 (U = 0.17+0.0012t), $t$ in °C
Temperature	Base-metal thermocouple	Comparison	0	1000	°C	$0.67+0.0005t$	°C	2	95%		3/16/11 (U = 0.17+0.0012t), $t$ in °C
Temperature	Industrial radiation thermometer	Comparison	50	420	°C	1.3 to 2.3	°C	2	95%	LK-070-IDN	6/5/14
Temperature	Industrial radiation thermometer	Comparison	200	500	°C	1.4 to 2.8	°C	2	95%	LK-070-IDN	6/5/14
Temperature	Industrial radiation thermometer	Comparison	50	500	°C	2.4 to 5.6	°C	1.96	95%	LK-070-IDN	
Temperature	Industrial radiation thermometer	Comparison	450	1000	°C	2.5 to 2.6	°C	1.96	95%	LK-070-IDN	
Temperature	Industrial radiation thermometer	Comparison	1000	1500	°C	1.8 to 2.6	°C	2	95%	LK-070-IDN	6/5/14
Temperature	Industrial radiation thermometer	Comparison	1000	1500	°C	2.8 to 2.9	°C	1.96	95%	LK-070-IDN	

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	Calibration Media of Industrial Radiation Thermometer	Comparison	50	500	°C	2.7 to 5.7	°C	1.96	95%	LK-070-IDN	
Dew point	Chilled mirror dew point hygrometer	Comparison with standard	-35	-25	°C	0.1	°C	2	95%	LK-070-IDN	
Dew point	Chilled mirror dew point hygrometer	Comparison with standard	-20	-5	°C	0.1	°C	2	95%	LK-070-IDN	
Dew point	Chilled mirror dew point hygrometer	Comparison with standard	5	20	°C	0.1	°C	2	95%	LK-070-IDN	
Dew point	Chilled mirror dew point hygrometer	Comparison with standard	25	45	°C	0.1	°C	2	95%	LK-070-IDN	
Dew point	Chilled mirror dew point hygrometer	Comparison with standard	50	65	°C	0.1	°C	2	95%	LK-070-IDN	
Relative humidity	Probe hygrometer	Comparison with standard	10	95	%RH	0.6	%RH	2	95%	LK-070-IDN	
Temperature	Liquid-in-glass thermometer	Comparison	300	400	°C	0.29	°C	2	95%		
Temperature	Temperature indicator with sensor	Comparison	-40	0	°C	0.06	°C	2	95%		
Temperature	Temperature indicator with sensor	Comparison	0	250	°C	0.01	°C	2	95%		



Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	Temperature indicator with sensor	Comparison	0	500	°C	0.08	°C	2	95%		
Temperature	Temperature indicator with sensor	Comparison	0	1000	°C	0.3	°C	2	95%		
Temperature	Indicator without sensor	Simulation	-200	660	°C	0.01	°C	2	95%		
Temperature	Indicator without sensor	Simulation	-200	1600	°C	0.08 to 0.01	°C	2	95%		
Relative humidity	Indicator with sensor	Comparison with standard	40	90	%RH	3.0	%RH	2	95%		
Temperature	Indicator with sensor	Comparison with standard	10	40	°C	0.34	°C	2	95%		
Temperature	Rare-metal thermocouple (R and S)	Comparison with SPRT	0	400	°C	$(0.24 + 0.0075\% t);$ t in °C	°C	2	95%		
Temperature	Rare-metal thermocouple (R and S)	Comparison with type S thermocouple	400	1000	°C	$(0.11 + 0.097\% t);$ t in °C	°C	2	95%		
Temperature	Base-metal thermocouple (E, J and K)	Comparison with SPRT	0	400	°C	$(0.067 + 0.082\% t);$ t in °C	°C	2	95%		
Temperature	Base-metal thermocouple (E, J and K)	Comparison with type S thermocouple	400	1000	°C	$(0.02 + 0.14\% t);$ t in °C	°C	2	95%		
Temperature	Base-metal thermocouple (T)	Comparison with SPRT	0	400	°C	$(0.063 + 0.083\% t);$ t in °C	°C	2	95%		

Calibration or measurement service			Measurand Level or Range			Expanded Uncertainty				Notes	
Quantity	Instrument or artifact	Instrument type or method	Minimum value	Maximum value	Unit	value	Units	Coverage Factor	Level of Confidence	Accredited	Appendix C CIPM MRA
Temperature	Liquid bath	Comparison with standard	-40	400	°C	0.02	°C	2	95%		
Temperature	Dry block	Comparison with standard	50	1000	°C	1.0 to 0.1	°C	2	95%		
Temperature	Furnace	Comparison with standard	150	1000	°C	0.5 to 0.2	°C	2	95%		
Temperature	Enclosure	Comparison with standard	ambient	400	°C	0.9 to 0.7	°C	2	95%		
Relative humidity	Enclosure	Comparison with standard	40	90	%RH	2.4	%RH	2	95%		