

Length, Brazil, INMETRO (Instituto Nacional de Metrologia, Qualidade e Tecnologia)

Note: Approval dates are shown only for the CMCs published after 24 May 2004



Calibration or Measurement Services			Measurand Level or Range			Measurement Conditions/Independent variables		Expanded Uncertainty					Comments	NMI Service Identifier
Class	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?		
Laser radiations	Frequency stabilized laser: absolute frequency	Optical beat frequency, matrix method	474	474	THz			25	kHz	2	95%	No	Approved on 13 January 2017	1
Laser radiations	Frequency stabilized laser: vacuum wavelength	Optical beat frequency, matrix method	633	633	nm			0.03	fm	2	95%	No	Approved on 13 January 2017	1
Laser radiations	Frequency stabilized laser: absolute frequency	Optical beat frequency	474	474	THz			25	kHz	2	95%	No	Approved on 13 January 2017	2
Laser radiations	Frequency stabilized laser: vacuum wavelength	Optical beat frequency	633	633	nm			0.03	fm	2	95%	No	Approved on 13 January 2017	2
Laser radiations	Frequency stabilized laser: absolute frequency	Absolute frequency measurement by means of an optical frequency comb	474	563	THz			8.2E-12		2	95%	Yes	Approved on 13 January 2017	8129
Laser radiations	Frequency stabilized laser: vacuum wavelength	Absolute frequency measurement by means of an optical frequency comb	532	633	nm			8.2E-12		2	95%	Yes	Approved on 13 January 2017	8129

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Laser radiations	Frequency stabilized laser: absolute frequency	Absolute frequency measurement by means of an optical frequency comb	474	563	THz			8.2E-12		2	95%	Yes	Approved on 13 January 2017	8120
Laser radiations	Frequency stabilized laser: vacuum wavelength	Absolute frequency measurement by means of an optical frequency comb	532	633	nm			8.2E-12		2	95%	Yes	Approved on 13 January 2017	8120
End standards	Gauge block: central length L	Interferometry, exact fractions	0.5	101.6	mm			Q[28, 0.5L], L in mm, values range from 28 nm to 58 nm	nm	2	95%	No	Approved on 13 January 2017	4
End standards	Gauge block: central length L	Mechanical comparison to gauge block	0.5	100	mm			Q[55, 0.9L], L in mm, values range from 55 nm to 106 nm	nm	2	95%	No		5
End Standards	Gauge block: length difference of gauge block pairs	Interferometry, exact fractions (Twyman-Green interferometer)	0	20	μm	Nominal length (individual blocks)	0.5 mm to 100 mm	16	nm	2	95%	No	Approved on 13 January 2017	8113

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End standards	Length bar (long gauge block): central length L	Interferometry, exact fractions	125	500	mm	Support	horizontal on Airy points, Koesters interference with refractometer	$Q[32, 0.14L]$, L in mm	nm	2	95%	No	Approved on 14 June 2004	6a
End standards	Length bar (long gauge block): central length L	Interferometry, exact fractions	> 500	1000	mm	Support	horizontal on Airy points, Koesters interference with refractometer	$Q[54, 0.19L]$, L in mm	nm	2	95%	No	Approved on 14 June 2004	6b
End standards	Step gauge: face spacing L	CMM, length interferometer and mechanical probe	5	1020	mm			$Q[0.32, 1E-03L]$, L in mm, values range from 0.32 μm to 1.07 μm	μm	2	95%	No	Approved on 04 October 2013	9
Flatness standard	Optical flat: surface flatness	Fizeau interferometer & master flat	10	300	nm	Maximum diameter	75 mm	30	nm	2	95%	No	Approved on 14 June 2004	21
						Support mode	horizontal							
Surface texture	Groove or step-height standard: step height, H	2-D profile stylus instrument	0.05	20	μm			$(20 + 2H)$	nm	2	95%	No	Approved on 14 June 2004	27
Surface texture	Roughness standard: roughness parameters	2-D profile stylus instrument	0.01	20	μm	Roughness parameter, P	R_a, R_z, R_{max}	$(10 + 20P)$	nm	2	95%	No	Approved on 14 June 2004	29

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CMM artefacts	Ball bar: ball spacing <i>L</i>	CMM and stylus, with gauge substitution	10	450	mm			Q[0.32, 1E-03 <i>L</i>], <i>L</i> in mm, values range from 0.34 μm to 0.55 μm	μm	2	95%	No	Approved on 24 May 2015	34
Diameter standards	External cylinder (plug): diameter, <i>L</i>	CMM and laser with gauge substitution	1	200	mm			Q[0.22, 0.0012 <i>L</i>], <i>L</i> in mm, range from 0.22 μm to 0.33 μm	μm	2	95%	No	Approved on 13 December 2010	8550
Diameter standards	Internal cylinder (ring): diameter, <i>L</i>	CMM and laser with gauge substitution	1	200	mm			Q[0.22, 0.0012 <i>L</i>], <i>L</i> in mm, range from 0.22 μm to 0.33 μm	μm	2	95%	No	Approved on 13 December 2010	8546
Diameter standards	Ball or sphere: diameter, <i>L</i>	CMM and laser with gauge substitution	5	200	mm			Q[0.22, 0.0012 <i>L</i>], <i>L</i> in mm, range from 0.22 μm to 0.33 μm	μm	2	95%	No	Approved on 13 December 2010	8557
Roundness standards	External cylinder (plug): roundness	Stylus-on-spindle roundness instrument	0	400	μm	Diameter	2 mm to 200 mm	0.05	μm	2	95%	No	Approved on 13 December 2010	
Roundness standards	Internal cylinder (ring): roundness	Stylus-on-spindle roundness instrument	0	400	μm	Diameter	4 mm to 200 mm	0.05	μm	2	95%	No	Approved on 13 December 2010	

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Roundness standards	Ball or sphere (hemisphere): roundness	Stylus-on-spindle roundness instrument	0	200	µm	Diameter	2 mm to 100 mm	0.012	µm	2	95%	No	Approved on 13 December 2010	
End standards	Length bar (long gauge block): central length <i>L</i>	Mechanical comparison using a 1-D measuring machine, a linear interferometric laser system and reference gauge blocks)	125	1000	mm			Q[0.10, 0.0007 <i>L</i>], <i>L</i> in mm	µm	2	95%	No	Approved on 09 March 2012	8543
Angle by circle dividers	Optical polygon: face angle	Error separation technique using an auxiliary rotary table, a precision indexing table and an autocollimator	10	90	°	Number of faces	4 to 36 faces, with nominally equal integer angles between faces	0.3	"	2	95%	No	Approved on 24 May 2015	8580
Angle by circle dividers	Index table: index angle	Error separation technique using an auxiliary rotary table, an optical polygon and an autocollimator	0	360	°	Index angle	in accordance with the number of faces of the optical polygon used	0.3	"	2	95%	No	Approved on 24 May 2015	8588