

Length, Mexico, CENAM (Centro Nacional de Metrologia)

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	Stabilized laser of the mise en pratique: absolute frequency	Optical beat frequency	474	474	THz			24	kHz	2	95%	No		1
Laser radiations	Other stabilized laser: vacuum wavelength λ_0	Optical beat frequency	633	633	nm			$2E-09 \lambda_0$	nm	2	95%	No		2
End standards	Gauge block: central length L	Interferometry, exact fractions	0.5	100	mm	Material	steel	Q[19, 0.45L], L in mm, values range from 19 nm to 49 nm	nm	2	95%	No	Approved on 27 January 2017	8
End standards	Gauge block: central length L	Interferometry, exact fractions	0.5	100	mm	Material	ceramic	Q[22, 0.42L], L in mm, value ranges 22 nm to 47 nm	nm	2	95%	No	Approved on 27 January 2017	8
End standards	Gauge block: central length L	Interferometry, exact fractions	0.5	100	mm	Material	tungsten carbide	Q[28, 0.33L], L in mm, values range from 28 nm to 44 nm	nm	2	95%	No	Approved on 27 January 2017	8
End standards	Gauge block: central length L	Interferometry, exact fractions	0.5	100	mm	Material	chrome carbide	Q[28, 0.39L], L in mm, values range from 28 nm to 48 nm	nm	2	95%	No	Approved on 27 January 2017	8
End standards	Length bar (long gauge block): central length L	Interferometry, exact fractions	100	300	mm	Material	steel	Q[19, 0.45L], L in mm, values range from 49 nm to 137 nm	nm	2	95%	No	Approved on 27 January 2017	8b

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End standards	Length bar (long gauge block): central length L	Interferometry, exact fractions	100	300	mm	Material	ceramic	$Q[22, 0.42L]$, L in mm, values range from 47 nm to 128 nm	nm	2	95%	No	Approved on 27 January 2017	8b
End standards	Length bar (long gauge block): central length L	Interferometry, exact fractions	100	300	mm	Material	tungsten carbide	$Q[28, 0.33L]$, L in mm, values range from 44 nm to 103 nm	nm	2	95%	No	Approved on 27 January 2017	8b
End standards	Length bar (long gauge block): central length L	Interferometry, exact fractions	100	300	mm	Material	chrome carbide	$Q[28, 0.39L]$, L in mm, values range from 48 nm to 121 nm	nm	2	95%	No	Approved on 27 January 2017	8b
End standards	Gauge block: central length L	Mechanical comparison to gauge block	0.5	100	mm	Material	steel	$Q[29, 0.94L]$, L in mm, values range from 29 nm to 99 nm	nm	2	95%	No	Approved on 27 January 2017	9
End standards	Length bar (long gauge block): central length L	1-D stylus comparator, gauge substitution	0.125	0.25	m			$(0.18 + 0.7L)$, L in m, values range from 0.27 μm to 0.36 μm	μm	2	95%	No	Approved on 27 January 2017	10
End standards	Step gauge: face spacing L	CMM and laser interferometer	0.02	1.2	m			$(0.35 + 0.4L)$, L in m, values range from 0.36 μm to 0.83 μm .	μm	2	95%	No	Approved on 27 January 2017	13
Diameter standards	External cylinder (plug): diameter, L	1-D stylus comparator, gauge substitution	0.005	0.3	m			$(0.18 + 0.4L)$, L in m, values range from 0.18 μm to 0.30 μm .	μm	2	95%	No	Approved on 27 January 2017	16



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Diameter standards	Internal cylinder (ring): diameter L	1-D stylus comparator, gauge substitution	0.005	0.205	m	Maximal external size diameter	300 mm	$(0.23 + 0.5L)$, L in m, values range from $0.23 \mu\text{m}$ to $0.0.33 \mu\text{m}$.	μm	2	95%	No	Approved on 27 January 2017	17
Diameter standards	External cylinder (pin or wire): diameter L	1-D stylus comparator, gauge substitution	0.1	5	mm			$(0.25 + 0.1L)$, L in m, values range from $0.26 \mu\text{m}$ to $0.75 \mu\text{m}$.	μm	2	95%	No	Approved on 27 January 2017	18
Diameter standards	Ball or sphere: diameter L	1-D stylus comparator, gauge substitution	0.005	0.065	m			$(0.18 + 0.4L)$, L in m, values range from $0.18 \mu\text{m}$ to $0.21 \mu\text{m}$.	μm	2	95%	No	Approved on 27 January 2017	19
Angle artefacts	Angle block: included angle	Index table and autocollimator, full closure	1	45	$^{\circ}$ (or ', or ")	Specific angle sizes	1, 2, 3, 5, 10, 15, 20, 30, 45 in $^{\circ}$, or ', or "	0.3	"	2	95%	No	Approved on 27 January 2017	28
Surface texture	Groove or step-height standard: step height, H	2-D profile stylus instrument	0.03	0.1	μm	Grooves	Pt	15	nm	2	95%	No	Approved on 27 January 2017	32
Surface texture	Groove or step-height standard: step height, H	2-D profile stylus instrument	0.03	0.1	μm	Grooves	D	15	nm	2	95%	No	Approved on 27 January 2017	32
Surface texture	Groove or step-height standard: step height, H	2-D profile stylus instrument	0.1	100	μm	Grooves	Pt	$22 + 0.5H$, H in μm . This makes U to vary between 15 nm and 72 nm.	nm	2	95%	No	Approved on 27 January 2017	32

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Surface texture	Groove or step-height standard: step height, H	2-D profile stylus instrument	0.1	100	μm	Grooves	D	$22 + 0.5H$, H in μm . This makes U to vary between 15 nm and 72 nm.	nm	2	95%	No	Approved on 27 January 2017	32
Surface texture	Roughness standard: roughness parameter	2-D profile stylus instrument	0.02	50	μm	Roughness parameter	R_a	$11 + 3R$, R in μm . U between 11 nm and 150 nm.	nm	2	95%	No	Approved on 27 January 2017	33
Surface texture	Roughness standard: roughness parameter	2-D profile stylus instrument	0.02	50	μm	Roughness parameter	R_q	$11 + 3R$, R in μm . U between 11 nm and 150 nm.	nm	2	95%	No	Approved on 27 January 2017	33
Surface texture	Roughness standard: roughness parameter	2-D profile stylus instrument	0.02	50	μm	Roughness parameter	R_z	$25 + 4.6R$, R in μm . U between 26 nm and 260 nm.	nm	2	95%	No	Approved on 27 January 2017	33
Surface texture	Roughness standard: roughness parameter	2-D profile stylus instrument	0.02	50	μm	Roughness parameter	R_t	$25 + 4.6R$, R in μm . U between 26 nm and 260 nm.	nm	2	95%	No	Approved on 27 January 2017	33
CMM artefacts	Ball bar: ball spacing L	CMM and stylus, with gauge substitution	10	1100	mm			$0.4 + 0.6E-03L$, L in mm, values range from 0.41 μm to 1.1 μm .	μm	2	95%	No	Approved on 27 January 2017	36
CMM artefacts	Ball and bore plates, L	CMM and stylus, with gauge substitution and reversal methods	10	650	mm			$0.6 + 0.9E-03L$, L in mm, values range from 0.61 μm to 1.2 μm .	μm	2	95%	No	Approved on 27 January 2017	37

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Line scales	Precision line scale: line spacing	Optical measuring microscope	0.01	150	mm			$Q[0.3, 0.0051L]$, L in mm for $L \leq 150$ mm; ranges from 0.30 to 0.83 μm .	μm	2	95%	No	Approved on 27 January 2017	740-D014A-001-CC
Line scales	Precision line scale: line spacing	Optical measuring microscope	150	300	mm			$Q[0.39, 0.0051L]$, L in mm for $L > 150$ mm to 300 mm; ranges from 0.86 to 1.58 μm .	μm	2	95%	No	Approved on 27 January 2017	740-D014A-003-CC
Roundness standards	Flick standard: roundness, R	Roundness measuring machine	2	300	μm			$Q[197, 8R]$, R in μm where R is the depth of the flick. It ranges from 200 nm for $R = 2$ μm to 2.4 μm for $R = 300$ μm .	nm	2	95%	No	Approved on 27 January 2017	740-D018B-001-CC
Roundness standards	Sphere or hemisphere: roundness, R	Roundness measuring machine	0	5	μm	Diameter	300 mm	20	nm	2	95%	No	Approved on 27 January 2017	740-D018B-001-CC
Roundness standards	External cylinder: roundness, R	Roundness measuring machine	0	5	μm	Height	up to 500 mm	$14.3 + 0.65H$, H in mm; ranges from 14 nm to 18 nm.	nm	2	95%	No	Approved on 27 January 2017	740-D018B-003-CC and 740-D018B-004-CC
Roundness standards	Internal cylinder: roundness, R	Roundness measuring machine	0	5	μm	Height	up to 200 mm	$14.3 + 0.65H$, H in mm; ranges from 14 nm to 18 nm.	nm	2	95%	No	Approved on 27 January 2017	740-D018B-003-CC and 740-D018B-004-CC