



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

TRESCAL CALIBRACIÓN MÉXICO S.A. DE C.V.
Av. Colinas del Cimatarío No 381,
Col. Colinas del Cimatarío
CP 76090, Santiago de Querétaro, Querétaro, México
Bruno Hernandez Phone: 52 442 471 7732

CALIBRATION

Valid To: December 31, 2022

Certificate Number: 4872.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 8}:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Cylindrical Gages – Plain Rings Class X, Y, Z, ZZ, or Unmarked	(2 to 300) mm	(0.4 + 0.0023L) µm	Method: direct comparison Master reference(s): ULM, ring gages
Cylindrical Gages – Plain Plugs, Discs, Pins Class X, Y, Z, ZZ, or Unmarked	Up to 20 mm (>20 to 200) mm	0.5 µm (0.5 + 0.0024L) µm	Method: direct comparison Master reference(s): ULM, gage blocks

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Pitch Diameter (External) – Straight Thread, Taper Threads	(1 to 100) mm	1.4 μm	Method: direct comparison Master reference(s): ULM, gage blocks, thread wires
Pitch Diameter (Internal) – Straight Thread, Taper Threads	(2.6 to 100) mm	2.0 μm	Method: direct comparison Master reference(s): ULM, ring gages, spheres
Shims and Snap	Up to 10 mm (1 to 100) mm	0.5 μm 0.9 μm	Method: direct comparison Master reference(s): ULM, gage blocks
End Rods/Standards, Micrometer Setting Standards	(25 to 600) mm	$(0.33 + 0.002L)$ μm	Method: direct comparison Master reference(s): ULM, gage blocks
Bore Gages ³ – Three-Point Contact Two-Point Contact	 (2 to 100) mm (100 to 200) mm (2 to 500) mm	 $(0.79 + 0.017L)$ μm $(2.5 + 0.020L)$ μm $(0.96 + 0.0045L)$ μm	Method: direct comparison Master reference(s): ULM, gauge blocks, ring gages

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
Micrometers ³ – Outside, Inside, Depth	Up to 600 mm	$(1.4 + 0.005L) \mu\text{m}$	Method: direct comparison Master reference(s): gage blocks, step gage
Calipers ³	Up to 1016 mm	$(8 + 0.008L) \mu\text{m}$	Method: direct comparison Master reference(s): gage blocks, step gage, ring gage
Length Indicator (Dial, Test, LVDT, Transducer)	Up to 102 mm (Resolution of 0.001 mm)	$(1.0 + 0.03L) \mu\text{m}$	Method: direct comparison Master reference(s): indicator calibrator
Height Gages ³	Up to 600 mm	$(1.7 + 0.005L) \mu\text{m}$	Method: direct comparison Master reference(s): step gage, gage blocks
Squares	Up to 500 mm	$(5.7 + 0.0059L) \mu\text{m}$	Method: direct comparison Master reference(s): master square, LVDT
Splines – Internal External	Up to 100 mm Up to 100 mm	2.9 μm 2.3 μm	Method: direct comparison Master reference(s): ULM, spheres, ring gages

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6} (\pm)	Comments
Surface Plate Flatness ³	Up to 3658 mm of the Diagonal Length	$(2.0 + 0.003D) \mu\text{m}$	Method: differential level
Optical Comparators ³ – Length Amplification Angle	X = 250 mm Y = 250 mm 5X, 10X, 20X (0 to 360)°	$(2.3 + 0.01L) \mu\text{m}$ 0.018 % of reading 2.3"	Method: direct comparison Master reference(s): master glass scales
Vision Systems ³ – Error of Indication (axis X & Y)	Up to 300 mm	$(0.60 + 0.0053L) \mu\text{m}$	Master glass scales
Fixtures & Functional Gages (X, Y) & Sieves	Up to 200 mm	$(2.7 + 0.0011L) \mu\text{m}$	Method: direct comparison Master reference(s): vision system Tesa V-200gl
Fixtures & Functional Gages – Angle	(0 to 360)°	0.04°	Method: direct comparison Master reference(s): vision system Tesa V-200gl
Fixtures & Functional Gages	Up to 600 mm	$(3.0 + 0.0052L) \mu\text{m}$	Method: direct comparison Master reference(s): linear height gauge
Goniometers	Up to 90° 30'	4.1'	Method: direct comparison Master reference(s): angle blocks, granite plate

Parameter/Equipment	Range	CMC ² (±)		Comments
Gage Blocks ³ –				
Steel	(0.5 to 10.16) mm (10.16 to 25.4) mm (25.4 to 50.8) mm (50.8 to 76.2) mm (76.2 to 101.6) mm	<i>lc</i> 0.043 μm 0.050 μm 0.068 μm 0.091 μm 0.12 μm	<i>v</i> 0.017 μm 0.018 μm 0.023 μm 0.028 μm 0.034 μm	Master reference(s): Tesa gage block comparator, gage blocks
Ceramic	(0.5 to 10.16) mm (10.16 to 25.4) mm (25.4 to 50.8) mm (50.8 to 76.2) mm (76.2 to 101.6) mm	0.045 μm 0.051 μm 0.069 μm 0.092 μm 0.12 μm	0.021 μm 0.023 μm 0.027 μm 0.034 μm 0.042 μm	<i>lc</i> = uncertainty at the reference point; <i>v</i> = uncertainty on parallelism (variation in length)
Carbide	(0.5 to 10.16) mm (10.16 to 25.4) mm (25.4 to 50.8) mm (50.8 to 76.2) mm (76.2 to 101.6) mm	0.044 μm 0.051 μm 0.068 μm 0.10 μm 0.13 μm	0.017 μm 0.018 μm 0.023 μm 0.028 μm 0.035 μm	
Long Gage Blocks – Materials	(102 to 150) mm (150 to 200) mm (200 to 250) mm (250 to 300) mm (300 to 400) mm (400 to 508) mm	0.33 μm 0.40 μm 0.47 μm 0.51 μm 0.63 μm 0.75 μm	0.11 μm 0.11 μm 0.13 μm 0.15 μm 0.20 μm 0.24 μm	Master reference(s): ULM. gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
DC Voltage ³ – Generate	0 mV to <0.33 V (0.33 to <3.3) V (3.3 to <33) V (33 to <330) V (330 to 1000) V	15 μV/V + 1 μV 9.5 μV/V + 2 μV 11 μV/V + 20 μV 15 μV/V + 150 μV 14 μV/V + 1500 μV	Multifunction calibrator
DC Voltage – Measure	(10 to <100) mV (0.1 to <1) V (1 to <10) V (10 to <100) V (100 to 1000) V	9 μV/V + 0.5 μV 8 μV/V + 1.6 μV 8 μV/V + 13 μV 10 μV/V + 150 μV 10 μV/V + 1.5 mV	Digital multimeter

Parameter/Equipment	Range	CMC ^{2,7} (\pm)	Comments
DC Current ³ – Generate	(33 to <330) μ A (0.33 to <3.3) mA (3.3 to <33) mA (33 to <330) mA (0.33 to <1.1) A (1.1 to <3) A (3 to <11) A (11 to 20) A	110 μ A/A + 0.02 μ A 85 μ A/A + 0.05 μ A 90 μ A/A + 0.25 μ A 90 μ A/A + 2.5 μ A 160 μ A/A + 40 μ A 290 μ A/A + 40 μ A 380 μ A/A + 0.50 mA 740 μ A/A + 0.75 mA	Multifunction calibrator
Clamp	(20 to <55) A (55 to <150) A (150 to <550) A (550 to <1000) A	0.20 % + 2 mA 0.20 % + 15 mA 0.20 % + 50 mA 0.20 % + 50 mA	Multifunction calibrator with 50 turn coil
DC Current – Measure	(10 to <100) nA (0.1 to <1) μ A (1 to <10) μ A (10 to <100) μ A (0.1 to <1) mA (1 to <10) mA (10 to <100) mA 0.1 mA to 1 A	30 μ A/A + 47 pA 20 μ A/A + 50 pA 20 μ A/A + 150 pA 20 μ A/A + 1.2 nA 20 μ A/A + 9 nA 20 μ A/A + 90 nA 35 μ A/A + 1.1 μ A 110 μ A/A + 25 μ A	Digital multimeter
DC Power ³ – Generate	0.010 89 mW to <336.6 W 336.6 W to <3.06 kW (3.06 to 20.4) kW	0.018 % + 2 μ W 0.017 % + 5.5 μ W 0.055 % + 0.1 mW	Multifunction calibrator
Resistance ³ – Generate	(1.1 to <11) Ω (11 to <33) Ω (33 to <110) Ω (110 to <330) Ω (0.33 to <1.1) k Ω (1.1 to <3.3) k Ω (3.3 to <11) k Ω (11 to <33) k Ω (33 to <110) k Ω (110 to <330) k Ω (0.33 to <1.1) M Ω (1.1 to <3.3) M Ω (3.3 to <11) M Ω (11 to <33) M Ω (33 to <110) M Ω (110 to <330) M Ω (0.33 to 1.1) G Ω	5 $\mu\Omega/\Omega$ + 0.001 Ω 15 $\mu\Omega/\Omega$ + 0.0015 Ω 21 $\mu\Omega/\Omega$ + 0.0014 Ω 22 $\mu\Omega/\Omega$ + 0.002 Ω 22 $\mu\Omega/\Omega$ + 0.002 Ω 22 $\mu\Omega/\Omega$ + 0.02 Ω 22 $\mu\Omega/\Omega$ + 0.02 Ω 22 $\mu\Omega/\Omega$ + 0.2 Ω 22 $\mu\Omega/\Omega$ + 0.2 Ω 26 $\mu\Omega/\Omega$ + 2 Ω 21 $\mu\Omega/\Omega$ + 2 Ω 44 $\mu\Omega/\Omega$ + 30 Ω 95 $\mu\Omega/\Omega$ + 50 Ω 180 $\mu\Omega/\Omega$ + 2.5 k Ω 380 $\mu\Omega/\Omega$ + 3 k Ω 0.23 % + 0.1 M Ω 1.1 % + 0.5 M Ω	Multifunction calibrator

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Resistance – Measure	(1 to <10) Ω (10 to <100) Ω (0.1 to <1) kΩ (1 to <10) kΩ (10 to <100) kΩ (0.1 to <1) MΩ (1 to <10) MΩ (10 to <100) MΩ (0.1 to <1) GΩ	15 μΩ/Ω + 90 μΩ 12 μΩ/Ω + 0.80 mΩ 10 μΩ/Ω + 1.5 mΩ 10 μΩ/Ω + 15 mΩ 10 μΩ/Ω + 0.70 Ω 15 μΩ/Ω + 5 Ω 50 μΩ/Ω + 0.2 kΩ 0.05 % + 9 kΩ 0.6 % + 1 kΩ	Digital multimeter

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Voltage ³ – Generate			
(3.3 to <33) mV	45 Hz to 10 kHz	100 μV/V + 6 μV	Multifunction calibrator
(33 to <330) mV	45 Hz to <10 kHz (10 to <20) kHz (20 to <50) kHz	110 μV/V + 8 μV 120 μV/V + 8 μV 270 μV/V + 8 μV	
(0.33 to <3.3) V	45 Hz to <10 kHz (10 to <20) kHz (20 to <50) kHz (50 to <100) kHz	120 μV/V + 60 μV 150 μV/V + 60 μV 230 μV/V + 50 μV 550 μV/V + 130 μV	
(3.3 to <33) V	45 Hz to <10 kHz (10 to <20) kHz (20 to <50) kHz (50 to 100) kHz	120 μV/V + 0.60 mV 190 μV/V + 0.60 mV 280 μV/V + 0.60 mV 680 μV/V + 1.6 mV	
(33 to <330) V	45 Hz to <1 kHz (1 to <10) kHz (10 to <20) kHz	150 μV/V + 2 mV 160 μV/V + 6 mV 200 μV/V + 6 mV	
(330 to <1000) V	45 Hz to <1 kHz (1 to <5) kHz (5 to 10) kHz	240 μV/V + 10 mV 200 μV/V + 10 mV 240 μV/V + 10 mV	

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Voltage – Measure			
(1 to <10) mV	(1 to 40) Hz 40 Hz to <1 kHz (1 to <20) kHz (20 to <100) kHz	0.035 % + 4 μV 0.030 % + 1.6 μV 0.040 % + 1.7 μV 0.12 % + 8 μV	Digital multimeter
(10 to <100) mV	(1 to 40) Hz 40 Hz to <1 kHz (1 to <20) kHz (20 to <50) kHz (50 to <100) kHz (100 to <300) kHz 300 kHz to 1 MHz	75 μV/V + 6 μV 75 μV/V + 3 μV 0.020 % + 4 μV 0.035 % + 7 μV 0.082% + 15 μV 0.3 % + 60 μV 1.0 % + 170 μV	
(0.1 to <1) V	(1 to 40) Hz 40 Hz to <1 kHz (1 to <20) kHz (20 to <50) kHz (50 to <100) kHz (100 to <300) kHz 300 kHz to 1 MHz	70 μV/V + 60 μV 70 μV/V + 30 μV 0.014 % + 40 μV 0.030 % + 70 μV 0.081 % + 150 μV 0.3 % + 0.6 mV 1.0 % + 2 mV	
(1 to <10) V	(1 to 40) Hz 40 Hz to <1 kHz (1 to <20) kHz (20 to <50) kHz (50 to <100) kHz (100 to <300) kHz 300 kHz to 1 MHz	70 μV/V + 0.60 mV 70 μV/V + 0.30 mV 0.016 % + 0.40 mV 0.030 % + 0.70 mV 0.081 % + 1.5 mV 0.3 % + 6 mV 1.0 % + 20 mV	
(10 to <100) V	(1 to 40) Hz 40 Hz to <1 kHz (1 to <20) kHz (20 to <50) kHz (50 to <100) kHz (100 to <300) kHz 300 kHz to 1 MHz	0.020 % + 8 mV 0.021 % + 5 mV 0.021 % + 5 mV 0.035 % + 8 mV 0.12 % + 20 mV 0.40 % + 70 mV 1.5 % + 150 mV	
(100 to 700) V	(1 to 40) Hz 40 Hz to <1 kHz (1 to <20) kHz (20 to <50) kHz (50 to <100) kHz	0.040 % + 0.12 V 0.040 % + 0.08 V 0.060 % + 0.11 V 0.12 % + 0.21 V 0.30 % + 0.40 V	

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Current ³ – Generate			
(33 to <330) µA	(20 to <45) Hz 45 Hz to <1 kHz (1 to <5) kHz (5 to 10) kHz	0.11 % + 0.1 µA 0.090 % + 0.1 µA 0.22 % + 0.15 µA 0.62 % + 0.2 µA	Multifunction calibrator
(0.33 to <3.3) mA	(20 to <45) Hz 45 Hz to <1 kHz (1 to <5) kHz (5 to 10) kHz	0.094 % + 0.15 µA 0.076 % + 0.15 µA 0.16 % + 0.20 µA 0.37 % + 0.30 µA	
(3.3 to <33) mA	(20 to <45) Hz 45 Hz to <1 kHz (1 to <5) kHz (5 to 10) kHz	0.069 % + 2 µA 0.030 % + 2 µA 0.060 % + 2 µA 0.15 % + 3 µA	
(33 to <330) mA	(20 to <45) Hz 45 Hz to <1 kHz (1 to <5) kHz (5 to 10) kHz	0.070 % + 20 µA 0.030 % + 20 µA 0.072 % + 50 µA 0.15 % + 0.1 mA	
(0.33 to <1.1) A	(10 to <45) Hz 45 Hz to <1 kHz (1 to <5) kHz	0.14 % + 0.1 mA 0.037 % + 0.1 mA 0.45 % + 1 mA	
(1.1 to <3) A	(10 to <45) Hz 45 Hz to <1 kHz (1 to <5) kHz	0.14 % + 0.1 mA 0.045 % + 0.1 mA 0.45 % + 1 mA	
(3 to <11) A	(45 to < 100) Hz 100 Hz to < 1 kHz (1 to 5) kHz	0.043 % + 2 mA 0.074 % + 2 mA 2.3 % + 2 mA	
(11 to 20) A	(45 to < 100) Hz 100 Hz to < 1 kHz (1 to 5) kHz	0.085 % + 5 mA 0.11 % + 5 mA 2.3 % + 5 mA	
Clamp			
(20 to <55) A	(45 to 65) Hz	0.24 % + 3 mA	Multifunction calibrator with 50 turn coil
(55 to <150) A		0.24 % + 25 mA	
(150 to <550) A		0.25 % + 90 mA	
(550 to <1000) A		0.25 % + 90 mA	

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Current – Measure			
(10 to <100) µA	(20 to <45) Hz (45 to <100) Hz 100 Hz to 1 kHz	0.15 % + 60 nA 0.07 % + 40 nA 0.07 % + 40 nA	Digital multimeter
(0.1 to <1) mA	(20 to <45) Hz (45 to <100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.15 % + 0.50 µA 0.061 % + 0.32 µA 0.031 % + 0.28 µA 0.061 % + 0.32 µA 0.40 % + 1.1 µA 0.55 % + 2.6 µA	
(1 to <10) mA	(20 to <45) Hz (45 to <100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.15 % + 4.5 µA 0.061 % + 3.2 µA 0.031 % + 2.8 µA 0.061 % + 3.2 µA 0.40 % + 11 µA 0.55 % + 26 µA	
(10 to <100) mA	(20 to <45) Hz (45 to <100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.15 % + 45 µA 0.061 % + 32 µA 0.031 % + 28 µA 0.061 % + 32 µA 0.40 % + 0.11 mA 0.55 % + 0.26 mA	
(0.1 to <1) A	(20 to <45) Hz (45 to <100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.16 % + 0.45 mA 0.080 % + 0.35 mA 0.10 % + 0.35 mA 0.30 % + 0.65 mA 1.0 % + 1.5 mA	
AC Power ³ – Generate			
(PF = 1)			
(0.1089 to <2.97) mW (2.97 to <10.89) mW (10.89 to <29.7) mW (29.7 to <108.9) mW 108.9 mW to <0.297 W (0.297 to <0.726) W (0.726 to <1.485) W	(45 to 65) Hz	0.37 % + 2.6 µW 0.30 % + 5.0 µW 0.11 % + 2.5 µW 0.093 % + 1.0 µW 19 mW 19 mW 1.6 % + 0.18 W	Multifunction calibrator

Parameter/Range	Frequency	CMC ^{2,6,7} (±)	Comments
AC Power ³ – Generate (cont) (PF = 1) (1.485 to <6.6) W (6.6 to <9.18) W (9.18 to <33.66) W (33.66 to <91.18) W (91.18 to <336.6) W (336.6 to <918) W 9.18 W to <2.244 kW (2.244 to <4.59) kW (4.59 to 20.4) kW (PF = 0.5) (0.108 9 to <2.97) mW (2.97 to < 10.89) mW (10.89 to <29.7) mW (29.7 to <108.9) mW 108.9 mW to <0.297 W (0.297 to <0.726) W (0.726 to <1.485) W (1.485 to <6.6) W (6.6 to <9.18) W (9.18 to <33.66) W (33.66 to <91.18) W (91.18 to <336.6) W (336.6 to <918) W (0.918 to <2.244) kW (2.244 to <4.59) kW (4.59 to 20.4) kW	(45 to 65) Hz (45 to 65) Hz	0.90 % + 0.17 W 0.69 % + 6.5 μW 0.45 % + 0.021 W 0.13 % + 0.019 W 0.0035 % + 0.086 W 0.020 % 0.019 % 0.045 % - 0.52 W 0.035 % 0.66 % + 3 μW 0.55 % + 7.5 μW 0.60 % + 6.0 μW 0.60 % + 5.0 μW 19 mW 19 mW 1.6 % + 0.18 W 0.30 % + 0.18W 0.95 % + 4.7 μW 0.60 % + 0.03 W 0.59 % + 0.017 W 0.60 % + 0.010 W 0.61 % 0.61 % 0.61 % 0.61 %	Multifunction calibrator
AC Current ³ – Measure (>1 to 3) A (>3 to 10) A	(10 to 900) Hz >900 Hz to 5 kHz (10 to 900) Hz >900 Hz to 5 kHz	0.35 % + 2.2 mA 1.7 % + 6.0 mA 0.55 % + 17 mA 2.7 % + 35 mA	Multimeter
AC High Voltage ³ – Measure (0.1 to 1.4) kV (>1.4 a 9) kV	(30 to 400) Hz	0.12 % + 0.4 V 0.13 % + 0.8 V	High voltage voltmeter

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Capacitance ³ – Generate	(0.19 to <0.40) nF (0.40 to <1.1) nF (1.1 to <3.3) nF (3.3 to <11) nF (11 to <33) nF (33 to <110) nF (110 to <330) nF (0.33 to <1.1) μF (1.1 to <3.3) μF (3.3 to <11) μF (11 to <33) μF (33 to <110) μF (110 to <330) μF (0.33 to <1.1) mF (1.1 to <3.3) mF (3.3 to <11) mF (11 to <33) mF (33 to 110) mF	0.69 % + 6.5 pF 0.70 % + 6 pF 0.70 % + 4 pF 0.30 % + 4 pF 0.35 % + 60 pF 0.31 % + 40 pF 0.31 % + 0.10 nF 0.25 % + 0.40 nF 0.25 % + 1 nF 0.25 % + 4 nF 0.40 % + 5 nF 0.45 % + 20 nF 0.45 % + 30 nF 0.45 % + 0.20 μF 0.45 % + 0.30 μF 0.45 % + 2 μF 0.48 % + 30 μF 0.84 % + 0.1 mF	Multifunction calibrator
Electrical Calibration of Thermocouple Indicators ³ –			
Type B	(600 to 1820) °C	0.28 °C	Multifunction calibrator
Type C	(0 to 650) °C	0.23 °C	
	(650 to 1800) °C	0.39 °C	
	(1800 to 2316) °C	0.65 °C	
Type E	(-250 to 650) °C	0.12 °C	
	(650 to 1000) °C	0.16 °C	
Type J	(-210 to -100) °C	0.21 °C	
	(-100 to 760) °C	0.13 °C	
	(760 to 1200) °C	0.18 °C	
Type K	(-200 to -100) °C	0.26 °C	
	(-100 to 120) °C	0.14 °C	
	(120 to 1000) °C	0.20 °C	
	(1000 to 1372) °C	0.31 °C	
Type L	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.20 °C	
	(800 to 900) °C	0.13 °C	

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Electrical Calibration of Thermocouple Indicators ³ – (cont)			
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1300) °C	0.31 °C 0.19 °C 0.15 °C 0.21 °C	Multifunction calibrator
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.44 °C 0.27 °C 0.31 °C	
Type S	(0 to 1400) °C (1400 to 1767) °C	0.30 °C 0.36 °C	
Type T	(-250 to 0) °C (0 to 400) °C	0.19 °C 0.12 °C	
Type U	(-200 to 600) °C	0.21 °C	
Electrical Calibration of RTDs ³ –			
Pt 385, 100 Ω	(-200 to 800) °C	0.034 °C	Multifunction calibrator
Pt 3926, 100 Ω	(-200 to 630) °C	0.034 °C	
Pt 3916, 100 Ω	(-200 to 630) °C	0.027 °C	
Pt 385, 200 Ω	(-200 to 630) °C	0.027 °C	
Pt 385, 500 Ω	(-200 to 630) °C	0.027 °C	
Pt 385, 1 000 Ω	(-200 to 630) °C	0.021 °C	
PtNi 385, 120 Ω	(-80 to 260) °C	0.054 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.20 °C	
Rectifiers and DC Current Supplies ³	(4 to 40) A (40 to 400) A (400 to 1000) A	1.1 % + 0.62 A 1.9 % + 0.33 A 2.6 % - 2.7 A	Clamp meter

Parameter/Equipment	Range	CMC ^{2, 6, 7} (\pm)	Comments
AC Current Supplies ³ (≤ 60 Hz)	(4 to 40) A (40 to 400) A (400 to 1000) A	1.1 % + 0.628 A 2.0 % + 0.30 A 2.6 % - 2.3 A	Clamp meter
DC Current ³ – Measure	(>1 to 3) A (>3 to 10) A	0.24 % + 1.2 mA 0.28 % + 6.5 mA	Multimeter
DC High Voltage ³ – Measure	(0.1 to 1.4) kV (>1.4 to 9) kV	0.03 % + 0.12 V 0.03 % + 1.0 V	High voltage voltmeter
Resistance ³ – Generate	6.0 m Ω 16.0 m Ω 25.9 m Ω 35.9 m Ω 45.8 m Ω 55.8 m Ω 65.7 m Ω 75.7 m Ω 85.7 m Ω 95.6 m Ω 105.6 m Ω >105.6 m Ω to 1 Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω	50 $\mu\Omega$ 51 $\mu\Omega$ 52 $\mu\Omega$ 50 $\mu\Omega$ 50 $\mu\Omega$ 51 $\mu\Omega$ 52 $\mu\Omega$ 52 $\mu\Omega$ 52 $\mu\Omega$ 53 $\mu\Omega$ 53 $\mu\Omega$ 43 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 34 $\mu\Omega/\Omega$ + 55 $\mu\Omega$ 30 $\mu\Omega/\Omega$ + 0.55 m Ω 24 $\mu\Omega/\Omega$ + 3.6 m Ω 25 $\mu\Omega/\Omega$ + 31 m Ω 25 $\mu\Omega/\Omega$ + 0.30 Ω	Resistance decade
	1.0000 M Ω 1.9999 M Ω 2.9998 M Ω 3.9998 M Ω 4.9997 M Ω 5.9995 M Ω 6.9995 M Ω 7.9996 M Ω 8.9995 M Ω 9.9994 M Ω (>9.9994 to 100) M Ω (>100 to 1000) M Ω (>1 to 10) G Ω (>10 to 100) G Ω	0.058 % 0.029 % 0.020 % 0.015 % 0.012 % 0.010 % 0.0093 % 0.0083 % 0.0077 % 0.0071 % 0.0080 % + 5.1 k Ω 0.010 % + 56 k Ω 0.064 % + 0.23 M Ω 0.36 % + 5 M Ω	Resistance decade

III. Mechanical

Parameter/Equipment	Range	CMC ^{2,6,9} (±)	Comments
Pressure ³ – Measuring Equipment	(>6.90 to 103.43) kPa (>103.43 to 2068.43) kPa (>2060.07 to 20 684.09) kPa (>20 623.24 to 68 947.76) kPa	49.67 Pa - 0.193 Pa/kPa 0.0104 Pa/kPa + 72.93 Pa 0.097 Pa/kPa + 0.081 kPa 0.025 Pa/kPa + 4.78 kPa	Method: direct comparison
Negative Pressure ³ (Relative Vacuum)	(-68.949 to -6.897) kPa	0.075 Pa/kPa + 6.45 kPa	Crystal nVision indicator and pressure modules
Differential Pressure ³	(-249.089 to 249.089) Pa	0.62 Pa	Additel ADT681-05-DP1-INH2O
Scales and Balances ³	Up to 200 g (0.2 to 2) kg (2 to 15) kg (15 to 100) kg	0.85 µg/g + 0.027 mg 1.0 mg/kg - 0.001 mg 4.3 mg/kg - 6.6 mg 0.04 g/kg - 0.2 g	Class E ₂ weights Class E ₂ weights Class F ₁ weights Class F ₁ and M ₁ weights
Force ³ – Universal Machine, Load Cells, Instruments, Gages, Dynamometers (Compression)	(0.5 to 200) N (>200 to 500) N (>500 to 5000) N	(0.000 73 + 0.0049 %) N 0.35 N (1.2 + 0.091 %) N	Mass Load cells
Force ³ – Universal Machine, Load Cells, Instruments, Gages, Dynamometers (Tension)	(0.5 to 200) N (>200 to 500) N (>500 to 5000) N	(0.000 73 + 0.0049 %) N 0.37 N (1.6 + 0.038 %) N	Mass Load cells
Torque Wrenches ³	(0.6 to 10) N·m (10 to 100) N·m (100 to 1100) N·m	0.016 N·m 0.081 N·m 0.22 N·m	Method: direct comparison Torque calibrator with transducers

Parameter/Equipment	Range	CMC ^{2, 6, 9} (\pm)	Comments
Rotary Tools ³	(1.3 to 28.2) N·m (28.2 to 203.4) N·m	0.60 % L 0.34 % L	Torque transducer
Indirect Verification of Rockwell Hardness Testers ³	HRB Low Medium High HRC Low Medium High	0.53 HRB 0.66 HRB 0.51 HRB 0.33 HRC 0.33 HRC 0.33 HRC	Indirect verification per ASTM E18
Indirect Verification of Brinell Hardness Testers ³ HBW 2.5/62.5	HBW Low High	1.7 HBW 2.4 HBW	Indirect verification per ASTM E10

IV. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 9} (\pm)	Comments
Temperature – Measuring Equipment ³	(0 to <25) °C (25 to 300) °C (>300 to 630) °C	0.18 °C 0.092 °C 0.17 °C	PT 100 RTD and indicator, dry well & environmental chamber
Liquid-in-Glass	(25 to 300) °C (>300 to 500) °C	0.43 °C 0.83 °C	PT 100 RTD and indicator, dry well
Environmental Thermometer	(10 to 20) °C (20 to 60) °C	0.29 °C 0.20 °C	PT 100 RTD and indicator, environmental chamber

Parameter/Equipment	Range	CMC ^{2,9} (±)	Comments
IR Thermometers ³ – (Infrared)	(30 to <38) °C (38 to <50) °C (50 to <150) °C (150 to <250) °C (250 to <350) °C (350 to <500) °C 500 °C	0.19 °C 0.24 °C 0.34 °C 1.2 °C 2.0 °C 2.8 °C 4.1 °C	Black body calibrator ε = 0.95, λ = (8 to 14) μm
Environmental Chambers ³ – System Accuracy Test (SAT)	(-100 to 0) °C (>0 to 300) °C (>300 to 600) °C (>600 to 800) °C (>800 to 1200) °C	1.1 °C 1.0 °C 1.0 °C 1.0 °C 1.5 °C	AMS2750, CQI- 9, requirements of the customer; process calibrator & standard thermocouples
Environmental Chambers ³ – Uniformity Surveys (TUS)	(-100 to 0) °C (>0 to 500) °C (>500 to 1200) °C	1.1 °C 1.0 °C 1.5 °C	AMS2750, CQI- 9, requirements of the customer; data logger calibrator & standard thermocouples
Relative Humidity – Measuring Equipment	(11 to 75) % RH (75 to 98) % RH	1.1 % RH 1.7 % RH	Method: direct comparison Reference: humidity probe (Vaisala HMP76 with MI70 probe)
Humidity Uniformity Test ³ – Environmental Chambers, Clean Rooms	(11.31 to 75.47) % RH (75.47 to 97.7) % RH	2.3 % RH 2.6 % RH	Humidity probe (Vaisala HMP76, MI70) Humidity probe (Vaisala HMP76, MI70) + datalogger

Parameter/Equipment	Range	CMC ^{2, 9} (±)	Comments
Humidity Measure/Sensors ³	(11.31 to 75.47) % RH	1.0 % RH	Humidity probe (Vaisala HMP76, MI70)
	(75.47 to 97.7) % RH	1.6 % RH	Humidity probe (Vaisala HMP76, MI70) + datalogger

V. Time & Frequency

Parameter/Range	Frequency	CMC ^{2, 7} (±)	Comments
Frequency – Generate (1 to 5) V _(peak-peak)	(0.01 to 119.99) Hz (120.0 to 1199.9) Hz (1.200 to 11.999) kHz (12.00 to 49.99) kHz	5.8 mHz 58 mHz 0.58 Hz 5.8 Hz	Fluke 5520A/SC1100
5 mV _(peak-peak) to 5.5 V _(peak-peak)	50 kHz to <100 MHz (100 to <300) MHz (300 to 500) MHz	5.8 kHz 5.8 kHz 5.8 kHz	
Stopwatches	(10 to 7200) s (7200 to 86 400) s	0.051 s 1.3 μs/s + 0.038 s	Reference stopwatch

¹ This laboratory offers commercial calibration and field calibration services, where noted.

² Calibration and Measurement Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at 95.45 % level of confidence, with a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

- ³ Field calibration service is available for this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.
- ⁴ In the statement of CMC, L is the numerical value of the nominal length of the device measured in the indicated unit.
- ⁵ In the statement of CMC, D is the numerical value of the diagonal length of the device measured in millimeters.
- ⁶ In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.
- ⁷ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.
- ⁸ This scope meets A2LA's *P112 Flexible Scope Policy*.
- ⁹ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.



Accredited Laboratory

A2LA has accredited

TRESCAL CALIBRACIÓN MÉXICO S.A. DE C.V.

Santiago de Querétaro, MEXICO

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).



Presented this 27th day of January 2021.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4872.01
Valid to December 31, 2022
Revised March 4, 2022

For the Calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.