SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

TECHNOLOGY & METROLOGY TEGMETRO S.A.
Juan Domingo N65-85 y Manuel Guizado
Quito, Ecuador 170301
Henry Arizaga Phone: +593-02-6007779

CALIBRATION

Valid To: December 31, 2024 Certificate Number: 4150.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory at the location listed above as well as the satellite laboratory location listed below to perform the following calibrations[1, 5]:

I. Acoustics

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Sound Level[3] – Measuring Equipment 74 dB 84 dB 94 dB 104 dB 114 dB	(125 to 1000) Hz	 0.51 dB 0.51 dB 0.51 dB 0.51 dB 0.24 dB	Comparison using portable sound level calibrator
Sound Level[3] – Measuring Equipment 74 dB 84 dB 94 dB 104 dB 114 dB	(1 to 4) kHz	 0.59 dB 0.59 dB 0.59 dB 0.59 dB 0.35 dB	Comparison using portable sound level calibrator

II. Chemical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Conductivity Meters[3]	1 µS/cm 2 µS/cm 5 µS/cm 10 µS/cm	0.3 µS/cm 0.14 µS/cm 0.14 µS/cm 0.6 µS/cm	Conductivity standard solution
Conductivity Meters[3]	100 µS/cm 1000 µS/cm 1413 µS/cm 10 000 µS/cm 100 000 µS/cm	2 µS/cm 4.6 µS/cm 4.6 µS/cm 56 µS/cm 550 µS/cm	Conductivity standard solution
pH Meters[3]	4 pH Unit 7 pH Unit 10 pH Unit 12.47 pH Unit	0.011 pH Unit 0.011 pH Unit 0.011 pH Unit 0.046 pH Unit	pH buffer solution

III. Dimensional Testing

Parameter/Equipment	Range	CMC[2] (±)	Comments
One Dimensional[8] – Length	Up to 25 mm Up to 1 in	0.000 82 mm 32 µin	Vision system with microscope
	Up to 25 mm Up to 1 in	0.000 45 mm 18 µin	Precision micrometer
	Up to 25 mm Up to 1 in	0.0015 mm 59 µin	Indicator
	Up to 150 mm Up to 6 in	0.0019 mm 75 µin	Micrometer
	Up to 200 mm Up to 8 in	0.011 mm 0.000 43 in	Caliper
	Up to 450 mm Up to 17.7 in	0.011 mm 0.000 43 in	Height gage
	Up to 5000 mm Up to 197 in	0.61 mm 0.024 in	Tape master

IV. Dimensional

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Calipers – Outside, Inside, & Depth			
Digital	Up to 600 mm (Up to 24) in	8.2 µm 0.000 32 in	Gage blocks
Analog	Up to 600 mm (Up to 24) in	16 µm 0.000 63 in	
Outside, Inside, & Depth Micrometers – Digital & Analog	Up to 25 mm (25 to 600) mm Up to 1 in (1 to 24) in	0.35 µm (0.012*L* - 0.052) µm 14 µin (12*L* - 2.0) µin	Gage blocks
Three Contact Inside Micrometers & Bore Gages – Digital & Analog	(12.7 to 114.3) mm (0.5 to 4.5) in 127 mm 5 in (139.7 to 152.4) mm (5.5 to 6) in	0.9 µm 35 µin 2.2 µm 86 µin 1.0 µm 38 µin	Gage rings
Mechanical Thickness Gages	Up to 50 mm Up to 2 in	0.8 µm 32µin	Gage blocks
Indicators	Up to 25 mm Up to 1 in	1.2 µm 47 µin	Gage blocks
Analog & Digital Weld Gages	Up to 50 mm Up to 2.7 in	20 µm 0.000 79 in	Gage blocks Caliper
Oil Gauging Tape Measures	Up to 30 m	200 µm	Master tape measure

Parameter/Equipment	Range	CMC[2] (±)	Comments
Tape Measures	Up to 30 m (30 to 40) m (40 to 50) m (50 to 60) m (60 to 70) m (70 to 80) m (80 to 90) m (90 to 100) m	210 µm 300 µm 420 µm 520 µm 600 µm 670 µm 730 µm 790 µm	Master tape measure
Pi Tape	(10 to 150) mm (0.39 to 5.9) in (150 to 3600) mm (5.9 to 141.7) in	0.019 mm 0.000 75 in 0.12 mm 0.0047 in	Ring gages Tape master
Multi-Step Thickness Gage Blocks	Up to 25 mm Up to 1 in	1.1 µm 40 µin	ASTM E797/E797M: gage blocks & micrometer as comparator
Ultrasonic Thickness Gages[3]	(2 to 25) mm (0.0079 to 1) in	0.018 mm 0.000 71 in	Multi-step thickness gage blocks
Ultrasonic Flaw Detectors[3]	(25.4 to 100) mm (1 to 4) in (100 to 250) mm (4 to 9.8) in	0.013 mm 0.000 51 in 0.015 mm 0.000 59 in	I IW Type 1 reference block
Coating Thickness Gage[3]	24 µm (0.94 mil) 53 µm (2.09 mil) 130 µm (5.12 mil) 260 µm (10.2 mil) 261.6 µm (10.3 mil) 530 µm (20.9 mil) 538.5 µm (21.2 mil) 770.2 µm (30.3 mil) 1580.3 µm (62.2 mil)	0.82 µm / 0.032 mil 0.82 µm / 0.032 mil 0.82 µm / 0.032 mil 0.82 µm / 0.032 mil 0.94 µm / 0.037 mil 0.82 µm / 0.032 mil 0.82 µm / 0.032 mil 0.82 µm / 0.032 mil 0.82 µm / 0.032 mil	Coating thickness standard

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Rulers	Up to 1 m	0.17 mm	Master tape measure
Reference Blocks for Calibration of Ultrasonic Testing Instruments	Up to 200 mm Up to 8 in (>200 to 450) mm Up to 17.7 in	19 µm 750 µin 16 µm 630 µin	ASTM E164 using: Calipers Height gauge
Feeler/Thickness Gages[3]	Up to 2 mm Up to 0.08 in	0.76 µm 30 µin	Precision micrometer
Displacement Measuring Systems and Devices used in Material Testing Machines – Displacement/ Crosshead Travel[3]	(0.5 to 25) mm (25 to 150) mm	2 µm 8.4 µm	ASTM E2309 using: Digital indicator Digital caliper

V. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Voltage[3] – Generate	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	33 µV/V + 10 µV 62 µV/V + 26 µV 0.062 mV/V + 0.24 mV 0.062 mV/V + 2.4 mV 0.062 mV/V + 24 mV	Transmille 1000A
DC Voltage[3] – Measure	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	10 µV/V + 0.5 µV 14 µV/V + 0.26 µV 14 µV/V + 1.4 µV 14 µV/V + 43 µV 14 µV/V + 470 µV	HP 3458A
DC Current[3] – Generate	(0 to 100) µA (0.1 to 1) mA (1 to 10) mA	0.15 nA/µA + 27 nA 0.25 µA/mA + 0.063 µA 0.25 µA/mA + 0.63 µA	Transmille 1000A

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Current[3] – Generate (cont)	(10 to 100) mA (0.1 to 1) A (1 to 10) A	0.25 µA/mA + 6.3 µA 0.22 mA/A + 0.11 mA 0.44 mA/A + 1.4 mA	Transmille 1000A
DC Current[3] – Measure	(10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 3) A (3 to 10) A	19 µA/A + 0.0009 µA 21 µA/A + 0.0052 µA 21 µA/A + 0.05 µA 32 µA/A + 1.1 µA 110 µA/A + 2.5 µA 0.94 mA/A + 0.24 mA 1.4 mA/A + 1.7 mA	HP 3458A Fluke 8845A
DC Current[3] – Clamp-On Meters	Up to 50 A (>50 to 100) A (>100 to 200) A (>200 to 300) A (>300 to 400) A (>400 to 500) A	0.8 A 1.1 A 1.8 A 2.4 A 3.1 A 3.7 A	Transmille 1000A & EA002 turn coil adapter
Resistance[3] – Generate	(0 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	0.11 mΩ/Ω + 1.4 mΩ 0.11 mΩ/Ω + 14 mΩ 0.11 Ω/kΩ + 0.14 Ω 0.11 Ω/kΩ + 1.4 Ω 0.11 Ω/kΩ + 14 Ω 0.11 kΩ/MΩ + 0.14 kΩ 0.42 kΩ/MΩ + 1.0 kΩ	Transmille 1000A
Resistance[3] – Measure	(0 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 (1 to 100) MΩ	0.014 mΩ/Ω + 0.09 mΩ 0.014 mΩ/Ω + 0.8 mΩ 0.013 mΩ/Ω + 2.6 mΩ 0.013 mΩ/Ω + 20 mΩ 14 mΩ/kΩ + 150 mΩ 18 Ω/MΩ + 2.9 Ω 0.07 kΩ/MΩ + 0.1 kΩ 7.8 kΩ/MΩ + 24 kΩ	HP 3458A Fluke 8845A

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Generate			
(0.1 to 1) V	60 Hz & 1 kHz	0.64 mV/V + 0.21 mV	Transmille 1000A
(1 to 10) V		0.60 mV/V + 2.6 mV	
(10 to 100) V		0.69 mV/V + 21 mV	
(0.1 to 1) kV		0.60 V/kV + 0.42 V	
AC Voltage[3] – Measure			
(0.1 to 1) V	1 kHz	58 µV/V + 18 µV	HP 3458A
(1 to 10) V	20 Hz to 1 kHz	0.03 mV/V + 1 mV	
	(1 to 20) kHz	0.1 mV/V + 0.6 mV	
	(20 to 100) kHz	0.8 mV/V + 0.2 mV	
	100 kHz to 1 MHz	9.4 mV/V + 6.4 mV	
(10 to 100) V	20 Hz to 1 kHz	0.18 mV/V + 3 mV	
(100 to 700) V		0.21 mV/V + 250 mV	
AC Current[3] – Generate			
(0 to 0.1) mA	60 Hz & 1 kHz	0.17 µA/mA + 0.40 µA	Transmille 1000A
(0.1 to 1) mA		0.081 µA/mA+ 0.79 µA	
(1 to 10) mA		0.040 µA/mA+ 8.0 µA	
(10 to 100) mA		0.57 µA/mA+ 73 µA	
(0.1 to 1) A		0.57 mA/A+ 0.73 mA	
(1 to 10) A		0.39 mA/A+ 15 mA	
AC Current[3] – Measure			
Up to 10 mA	1 kHz	1.1 µA/mA + 5.6 µA	Fluke 8845A
(10 to 100) mA		0.7 µA/mA + 47 µA	
(100 to 400) mA		0.45 µA/mA + 530 µA	
400 mA to 1 A		720 µA/A + 480 µA	
(1 to 3) A		0.91 mA/A + 3.6 mA	
(3 to 10) A		0.88 mA/A + 11 mA	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Current[3] – Clamp-On Meters			
(50 Hz, 60 Hz)	Up to 50 A (>50 to 100) A (>100 to 200) A (>200 to 300) A (>300 to 400) A (>400 to 500) A	0.8 A 1.1 A 1.8 A 2.4 A 3.1 A 3.7 A	Transmille 1000A & EA002 turn coil adapter
Insulation Resistance[3] –			
Fixed Points	100 kΩ 200 kΩ 300 kΩ 400 kΩ 500 kΩ 600 kΩ 700 kΩ 800 kΩ 900 kΩ 1 MΩ 5 MΩ 10 MΩ 20 MΩ 30 MΩ 40 MΩ 50 MΩ 60 MΩ 70 MΩ 80 MΩ 90 MΩ 100 MΩ 200 MΩ 300 MΩ 400 MΩ 500 MΩ 600 MΩ 700 MΩ 800 MΩ 900 MΩ 1 GΩ 5 GΩ 10 GΩ 20 GΩ 30 GΩ	0.12 kΩ 0.35 kΩ 0.35 kΩ 0.58 kΩ 0.81 kΩ 0.81 kΩ 1 kΩ 1 kΩ 1 kΩ 0.0024 MΩ 0.0058 MΩ 0.13 MΩ 0.04 MΩ 0.04 MΩ 0.072 MΩ 0.072 MΩ 0.092 MΩ 0.092 MΩ 0.13 MΩ 0.13 MΩ 0.25 MΩ 0.48 MΩ 0.72 MΩ 0.96 MΩ 1.2 MΩ 1.7 MΩ 1.7 MΩ 2.1 MΩ 2.1 MΩ 0.0091 GΩ 0.062 GΩ 0.12 GΩ 0.26 GΩ 0.38 GΩ	

Parameter/Frequency	Range	CMC[2, 7] (±)	Comments
Insulation Resistance[3] – (cont) Fixed Points	 40 GΩ 50 GΩ 60 GΩ 70 GΩ 80 GΩ 90 GΩ 100 GΩ	 0.63 GΩ 0.63 GΩ 0.88 GΩ 0.88 GΩ 1.3 GΩ 1.3 GΩ 1.3 GΩ	Decade resistance

VI. Fluid Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Hydrometry – Hydrometers API Hydrometers and Thermo-hydrometers (API Scale for Petroleum Products)	 (600 to 1000) kg/m³ (1000 to 1500) kg/m³ (1500 to 2000) kg/m³ (-1 to 101) API	 0.12 kg/m³ 0.011 API	Cuckow method
Volume – Laboratory Glassware Single Volume Pipettes	0.5 mL 1 mL 2 mL 5 mL 10 mL 20 mL 25 mL 50 mL 100 mL	0.0017 mL 0.0027 mL 0.0033 mL 0.005 mL 0.0066 mL 0.01 mL 0.01 mL 0.017 mL 0.027 mL	Gravimetric method using analytical balance per TM-CR-03 based ISO 4787, NIST SOP 14
One-Mark Volumetric Flasks	1 mL 2 mL 5 mL 10 mL 20 mL	0.0082 mL 0.0082 mL 0.0082 mL 0.0082 mL 0.013 mL	

Parameter/Equipment	Range	CMC[2] (±)	Comments
One-Mark Volumetric Flasks (cont)	25 mL 50 mL 100 mL 200 mL 250 mL 500 mL 1000 mL 5000 mL	0.013 mL 0.02 mL 0.033 mL 0.05 mL 0.05 mL 0.082 mL 0.13 mL 0.4 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Graduated Pipettes	0.1 mL 0.2 mL 0.5 mL 1 mL 2 mL 5 mL 10 mL 20 mL 25 mL	0.002 mL 0.002 mL 0.002 mL 0.0023 mL 0.0033 mL 0.0058 mL 0.0091 mL 0.033 mL 0.033 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Graduated Measuring Cylinders	5 mL 10 mL 25 mL 50 mL 100 mL 250 mL 500 mL 1000 mL 2000 mL	0.011 mL 0.013 mL 0.082 mL 0.14 mL 0.2 mL 0.36 mL 0.57 mL 0.96 mL 1.5 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Plastic Graduated Measuring Cylinders	10 mL 25 mL 50 mL 100 mL 250 mL 500 mL 1000 mL 2000 mL 4000 mL	0.033 mL 0.11 mL 0.19 mL 0.26 mL 0.47 mL 0.7 mL 1.1 mL 1.9 mL 7.3 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Burettes	1 mL 2 mL 5 mL 10 mL	0.0020 mL 0.0033 mL 0.0033 mL 0.0066 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14

Parameter/Equipment	Range	CMC[2] (±)	Comments
Burettes (cont)	25 mL 50 mL 100 mL	0.010 mL 0.017 mL 0.033 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Pyknometers	1 mL 2 mL 5 mL 10 mL 25 mL 50 mL 100 mL	0.0023 mL 0.0023 mL 0.0023 mL 0.0023 mL 0.005 mL 0.010 mL 0.010 mL	Gravimetric method using analytical balance per TM-CR-03 based ISO 3507
Centrifuge Tube	0.1 mL 0.3 mL 0.5 mL 1 mL 2 mL 3 mL 5 mL 10 mL 25 mL 100 mL	0.0066 mL 0.010 mL 0.017 mL 0.017 mL 0.033 mL 0.033 mL 0.066 mL 0.17 mL 0.34 mL 0.57 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Imhoff Cone	(0 to 2) mL (>2 to 10) mL (>10 to 40) mL (> 40 to 100) mL (>100 to 1000) mL	0.033 mL 0.17 mL 0.34 mL 0.66 mL 3.3 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Water Trap	2 mL 5 mL 10 mL 25 mL	0.0082 mL 0.017 mL 0.033 mL 0.033 mL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 4787, NIST SOP 14
Piston Operated Volumetric Apparatus (POVA) –			
Piston Pipettes	(>10 to 20) µL 50 µL 100 µL 200 µL	0.031 µL 0.042 µL 0.094 µL 0.34 µL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 8655-6:2002

Parameter/Equipment	Range	CMC[2] (±)	Comments
Piston Operated Volumetric Apparatus (POVA) – (cont)			
Piston Pipettes	500 µL 1000 µL 2000 µL 5000 µL 10 000 µL	1.3 µL 2.5 µL 5.7 µL 14 µL 21 µL	Gravimetric method using analytical balance per TM-CR-03 based on ISO 8655-6:2002
Piston Burettes	1 mL 2 mL 5 mL 10 mL 20 mL 25 mL 50 mL 100 mL	0.0010 mL 0.0020 mL 0.0050 mL 0.0070 mL 0.014 mL 0.018 mL 0.025 mL 0.030 mL	
Dispensers	(>0.01 to 0.02) mL 0.02 mL 0.05 mL 0.1 mL 0.2 mL 0.5 mL 1 mL 2 mL 5 mL 10 mL 25 mL 50 mL 100 mL 200 mL	0.000 034 mL 0.000 034 mL 0.000 042 mL 0.000 095 mL 0.000 60 mL 0.0012 mL 0.0029 mL 0.0058 mL 0.012 mL 0.029 mL 0.058 mL 0.12 mL 0.29 mL 0.29 mL	

VII. Magnetic Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Magnetometers[3] Gaussmeters (Positive and Negative Polarity)	Up to 80 Gauss	0.85 Gauss	FW BELL 5170 Gauss meter

VIII. Mechanical

Parameter/Equipment	Range	CMC[2, 4, 9] (±)	Comments
Vibration[3] – Measuring Equipment			
Peak Acceleration	0.4 g pk (3.92 m/s^2) @ 7 Hz	0.030 g pk (0.29 m/s^2)	Back-to-back comparison using portable reference calibrator (shaker and transducer)
	0.8 g pk (7.84 m/s^2) @ 10 Hz	0.038 g pk (0.37 m/s^2)	
	1 g pk (9.81 m/s^2) @ 30 Hz to 2 kHz	0.039 g pk (0.38 m/s^2)	
	1 g pk (9.81 m/s^2) (>2 to 10) kHz	0.054 g pk (0.53 m/s^2)	
Pressure Gages, Calibrators[3] –			
Pneumatic	(-9 to 0) psig (-62.1 to 0) kPa	0.0035 psig 0.024 kPa	Precision pressure indicator Mensor CPG 2500 & vacuum transducer Mensor CPT 6020, Fluke 754
	(-5 to 5) mbar	0.0059 mbar 0.59 Pa	Digital Pressure Gauge Additel ADT681-05-DP2 BAR
	(0 to 15) psig (0 to 0.103) kPa	0.0018 psig 0.013 kPa	Precision pressure indicator Mensor CPG 2500 & pressure transducer Mensor CPR 2550, Fluke 754
	(15 to 87) psig (0.103 to 0.60) kPa	0.011 psig 0.077 kPa	
Hydraulic	(87 to 1015.26) psi (0.6 to 7.0) MPa	0.007 %	Oil operated deadweight tester, DH-Budenberg CPB 5800 (low pressure piston)
	(1015.26 to 10 152.0) psig (7 to 70) MPa	0.0063 %	Oil operated dead-weight tester, DH-Budenberg CPB 5800 (high pressure piston)

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Pressure Transmiters[3] –			
Pneumatic	(-9 to 0) psig (-62.1 to 0) kPa	0.0053 psig 0.036 kPa	Precision pressure indicator Mensor CPG 2500; vacuum transducer Mensor CPT 6020 & amperemeter 6 ½ digits Fluke 8845A
	(-5 to 5) mbar	0.0059 mbar 0.59 Pa	Digital Pressure Gauge Additel ADT681-05-DP2 BAR amperemeter 6 ½ digits Fluke 8845A
	(0 to 15) psig (0 to 103.4) kPa	0.0062 psig 0.043 kPa	Precision pressure indicator Mensor CPG 2500; pressure transducer Mensor CPR 2550 & amperemeter 6½ digits Fluke 8845A
	(15 to 87) psig (103.4 to 599.8) kPa	0.037 psig 0.26 kPa	Oil operated dead-weight tester DH-Budenberg CPB 5800 (low pressure piston) & amperemeter 6½ digits Fluke 8845A
Hydraulic	(87 to 1015.26) psig (599.8 to 7000) kPa	0.041 %	Oil operated dead-weight tester DH-Budenberg CPB 5800 (low pressure piston) & amperemeter 6½ digits Fluke 8845A
	(1015.26 to 10 152) psig (7 to 70) MPa	0.041 %	
Pressure Safety Valve (PSV´s) & Pressure Switch[3]	(-9 to -1) psi (-62.1 to -1) kPa	0.4 %	Vacuum & pressure indicator
	(1 to 10 000) psi (1 to 68.95) MPa	0.1 %	
Scales & Balances[3]	(10 to 100) mg 100 mg to 100 g 100 mg to 200 g	0.013 mg 0.02 mg 0.082 mg	Comparison with OIML Class E2 weights
	100 mg to 2100 g (1 to 10 000) g	0.91 mg 9.1 mg	Comparison with OIML Class F1 weights

Parameter/Equipment	Range	CMC[2] (±)	Comments
Scales & Balances[3] (cont)	(10 to 32 000) g (50 to 61 000) g (0.5 to 160) kg (2 to 200) kg (2 to 500) kg (2 to 1000) kg (2 to 2000) kg	91 mg 0.9 g 9.1 g 18 g 45 g 83 g 0.17 kg	Comparison with OIML Class M1 weights
Mass –			
OIML Classes F2, M1, M2 & M3	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg	0.0091 mg 0.0091 mg 0.0091 mg 0.0091 mg 0.0091 mg 0.0091 mg	Mass comparator & inter-comparison with OIML Class F1 weights
OIML Classes F1, F2, M1, M2 & M3	0.1 g 0.2 g 0.5 g 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1000 g	0.0093 mg 0.0093 mg 0.0094 mg 0.011 mg 0.012 mg 0.013 mg 0.018 mg 0.028 mg 0.063 mg 0.15 mg 0.25 mg 0.6 mg 1.2 mg	Mass comparator & inter-comparison with OIML Class E2 weights
OIML Classes F2, M1, M2 & M3	2 kg	9.6 mg	Mass comparator & inter-comparison with OIML Class F1 and Class F2 weights
OIML Classes M1, M2 & M3	5 kg 10 kg 20 kg	91 mg 110 mg 310 mg	
Torque Tools & Torque Wrenches	(1 to 10) N·m	(0.0005·reading + 0.0038) N·m	AWS TT-QC-100I-1/4 torque transducer and display

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Torque Tools & Torque Wrenches (cont)	(10 to 100) N·m (100 to 1000) N·m	(0.0028·reading + 0.12) N·m (0.0039·reading + 0.37) N·m	AWS ITI-1000 torque transducer & display AWS ITS-750 torque transducer & display
Torque Transducers with Indicators[3]	(0.113 to 1.13) N·m (1.13 to 11.3) N·m (11.3 to 113) N·m (113 to 1016) N·m	$(9.0 \times 10^{-5}X + 5.0 \times 10^{-5})$ N·m $(5.3 \times 10^{-4}X - 1.7 \times 10^{-4})$ N·m $(6.7 \times 10^{-4}X - 1.2 \times 10^{-2})$ N·m $(1.8 \times 10^{-3}X - 2.3 \times 10^{-1})$ N·m	Comparison with torque arm and OIML class F1, F2 & M1 weights X = reading value in N·m
Force Transducers with Indicators[3] – Tension & Compression	(0.044 to 1) kN (1 to 50) kN (50 to 500) kN	$(6.0 \times 10^{-4}X + 5.4 \times 10^{-6})$ kN $(1.0 \times 10^{-3}X + 3.3 \times 10^{-3})$ kN $(9.0 \times 10^{-4}X + 1.8 \times 10^{-3})$ kN	ISO 376 by comparison with reference Precision load cells X = reading value in kN
Force Gauges[3] – Tension & Compression	(44 to 1000) N (>1 to 5) kN (>5 to 50) kN (>50 to 500) kN	0.13 % 0.19 % 0.19 % 0.12 %	ISO 7500-1 by comparison with reference Precision load cells
Force – Tension & Compression Testing Machines[3]	(44 to 1000) N (>1 to 5) kN (>5 to 50) kN (>50 to 500) kN (>500 to 3000) kN	0.12 % 0.14 % 0.13 % 0.12 % 0.13 %	ISO 7500-1 using Precision load cells
Force Testing Machines – Crosshead Speed[3]	(10 to 840) mm/min	0.12 %	Stopwatches, indicator & caliper

IX. Optical Quantities

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Light Meters – Visible Light (Luxmeter)	(20 to 3000) lux	$(8.6 \times 10^{-5} X + 1.0)$ lux	Reference lamp X = reading value in lux
Irradiance – UV-A meters (Radiometers)	(>200 to 600) µW/cm² (>600 to 1000) µW/cm² (>1000 to 2000) µW/cm² (>2000 to 3000) µW/cm² (>3000 to 4000) µW/cm²	3.4 % 3.4 % 3.2 % 3.2 % 3.2 %	Master radiometer
Spectrophotometers[3] –			
Absorbance:			
λ: (235 to 350) nm	(0.09 to 0.28) A (0.19 to 0.57) A (0.29 to 0.87) A (0.39 to 1.15) A (0.48 to 1.45) A	0.0037 A 0.0045 A 0.0049 A 0.0057 A 0.0067 A	Potassium Dichromate quartz cells
λ: (440 to 635) nm	(0.52 to 0.56) A (0.66 to 0.77) A (0.95 to 1.11) A	0.0027 A 0.0027 A 0.0027 A	Neutral density glass filters
Transmittance:			
λ: (440 to 635) nm	(7.71 to 11.22) % (16.81 to 21.71) % (27.44 to 30.34) %	0.047 % of transmittance 0.10 % of transmittance 0.17 % of transmittance	
Wavelength:			
SBW: (0.1, 0.25, 0.5, 1, 1.5, 2, 3, 4, 5) nm	(241 to 638) nm	0.12 nm	Holmium glass filter
SBW: (0.1, 0.25, 0.5, 1, 1.5, 2, 3, 4, 5) nm	(440 to 880) nm	0.12 nm	Didymium glass filter

X. Thermodynamics

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Digital Thermometers[3]	(-30 to -20) °C (-20 to 0) °C (0 to 140) °C (140 to 231) °C (231 to 420) °C (420 to 450) °C (450 to 700) °C (700 to 950) °C (950 to 1200) °C	0.038 °C 0.035 °C 0.042 °C 0.059 °C 0.037 °C 1.3 °C 1.4 °C 1.4 °C 1.8 °C	Digital indicator whit thermocouple type "R/S" and temperature bath
Mechanical Thermometers[3]	(-30 to 420) °C	0.15 °C	Digital thermometer & temperature bath
Liquid-In-Glass Thermometers[3]	(-30 to 100) °C (100 to 150) °C (150 to 200) °C (200 to 300) °C (300 to 420) °C	0.07 °C 0.30 °C 0.40 °C 0.80 °C 1.0 °C	Digital thermometer & temperature bath
Temperature Transmiters[3]	(-30 to -20) °C (-20 to 0) °C (0 to 50) °C (50 to 100) °C (100 to 150) °C (150 to 200) °C (200 to 300) °C (300 to 420) °C	0.05 °C 0.048 °C 0.056 °C 0.067 °C 0.08 °C 0.10 °C 0.14 °C 0.18 °C	Digital thermometer & amperemeter, & temperature bath
IR Thermometers	(-15 to 0) °C (>0 to 35) °C (>35 to 75) °C (>75 to 100) °C (>100 to 150) °C (>150 to 200) °C (>200 to 300) °C (>300 to 400) °C (>400 to 500) °C	0.49 °C 0.43 °C 0.44 °C 0.47 °C 0.56 °C 0.65 °C 0.90 °C 1.2 °C 1.5 °C	Comparison with Fluke 4180 black body, or Fluke 4181 black body Emissivity = 0.950 Spectral band: (8 to 14) µm

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Temperature[3] – Temperature Sources and Temperature Controlled Enclosures Autoclaves, Cold Rooms, Dry Wells, Environment Chambers, Freezers, Furnace, Incubators, Liquid Baths, Ovens, Refrigerators, Sterile Rooms, Stability Rooms, Trucks, Warehouses.	(-80 to 420) ºC (420 to 700) ºC (700 to 1000) °C	0.039 °C 1.9 °C 2.9 °C	Digital thermometer
Relative Humidity – Thermo Hygrometer	(20 to 90) % RH	2.1 % RH	Thermo-hygrometer Vaisala HM40 & humidity chamber
Relative Humidity[3] – Humidity Chambers	(20 to 90) % RH	2.3 % RH	Thermo-hygrometer Vaisala HM40

XI. Time & Frequency

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Non-Contact Tachometers	(100 to 3000) RPM (4000 to 60 000) RPM	0.20 RPM 1.5 RPM	Transmille 1000A, multicalibrator & Transmille EA003 optical tachometer adapter
Frequency – Measuring Equipment	(20 to 100) Hz (100 to 1) kHz (1 to 10) kHz (10 to 100) kHz	0.01 Hz 0.1 Hz 0.6 Hz 3 Hz	Transmille 1000A multicalibrator

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Stopwatches, Hours meters & Timers[3]	Up to 7200 s Up to 32 768 s	0.0026 s 0.0055 s	Direct comparison with reference stopwatches

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[1] This laboratory offers commercial calibration service and field calibration service.

[2] Calibration and Measurement Capability 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 approximately the 95 % level of confidence, usually using 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] The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that generate the values in the ranges indicated for the listed measurement parameter.

[5] This scope meets A2LA's *P112 Flexible Scope Policy*.

[6] In the statement of CMC, *L* is the numerical value of the nominal length in the units 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. CMCs are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

[8] Dimensional testing is not equivalent to calibration and does not serve to transfer metrological traceability.

[9] In the statement of CMC, percentages are percentages of reading, unless otherwise indicated.

Accredited Laboratory

A2LA has accredited

TECHNOLOGY & METROLOGY TEGMETRO S.A.

Quito, ECUADOR

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 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 28th day of April 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4150.01
Valid to December 31, 2024

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