



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

TECHNOLOGY & METROLOGY TEGMETRO S.A.  
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CALIBRATION

Valid To: December 31, 2022

Certificate Number: 4150.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1, 5</sup>:

I. Chemical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Conductivity Meters <sup>3</sup>	1 µS/cm 10 µS/cm 100 µS/cm 1000 µS/cm 1413 µS/cm	0.3 µS/cm 0.6 µS/cm 2 µS/cm 4.6 µS/cm 4.6 µS/cm	Conductivity standard solution
pH Meters <sup>3</sup>	4 pH Unit 7 pH Unit 10 pH Unit	0.011 pH Unit 0.011 pH Unit 0.011 pH Unit	pH buffer solution

II. Dimensional

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Calipers – Outside, Inside, & Depth			
Digital	Up to 600 mm	8.2 µm	Gage blocks

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Calipers – Outside, Inside, & Depth (cont)  Analog	Up to 600 mm	16 µm	Gage blocks
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 (0.012L - 0.052) µm  14 µin (12L - 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  0.001 in	Gage blocks  Caliper
Oil Gauging Tape Measures	Up to 30 m	200 µm	Master tape measure
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

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
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	(2 to 25) mm	0.018 mm	Multi-step thickness gage blocks
Ultrasonic Flaw Detectors	(25.4 to 100) mm (100 to 250) mm	0.013 mm 0.015 mm	IIW Type 1 reference block
Coating Thickness Gage	(25.1, 53.4, 128.2, 260, 261.6, 538.5, 770.2, 1580.3) μm	0.38 μm	Coating thickness standard
Rulers	Up to 1 m	0.17 mm	Master tape measure
Reference Blocks for Calibration of Ultrasonic Testing Instruments	Up to 450 mm Up to 17.7 in	15 μm 610 μin	ASTM E164: calipers
Feeler/Thickness Gages <sup>3</sup>	Up to 2 mm Up to 0.08 in	0.76 μm 30 μin	Precision micrometer
Force Testing Machine Crosshead Travel <sup>3</sup>	(0.5 to 25) mm  (25 to 150) mm	2 μm  8.4 μm	Digital indicator  Digital caliper

### III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
DC Voltage – 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

Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
DC Voltage – Measure	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	10 $\mu\text{V}/\text{V} + 0.5 \mu\text{V}$ 14 $\mu\text{V}/\text{V} + 0.26 \mu\text{V}$ 14 $\mu\text{V}/\text{V} + 1.4 \mu\text{V}$ 14 $\mu\text{V}/\text{V} + 43 \mu\text{V}$ 14 $\mu\text{V}/\text{V} + 470 \mu\text{V}$	HP 3458A
DC Current – Generate	(0 to 100) $\mu\text{A}$ (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A	0.15 nA/ $\mu\text{A} + 27 \text{nA}$ 0.25 $\mu\text{A}/\text{mA} + 0.063 \mu\text{A}$ 0.25 $\mu\text{A}/\text{mA} + 0.63 \mu\text{A}$ 0.25 $\mu\text{A}/\text{mA} + 6.3 \mu\text{A}$ 0.22 mA/A + 0.11 mA 0.44 mA/A + 1.4 mA	Transmille 1000A
DC Current – Measure	(10 to 100) $\mu\text{A}$ 100 $\mu\text{A}$ 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 $\mu\text{A}/\text{A} + 0.0009 \mu\text{A}$ 21 $\mu\text{A}/\text{A} + 0.0052 \mu\text{A}$ 21 $\mu\text{A}/\text{A} + 0.05 \mu\text{A}$ 32 $\mu\text{A}/\text{A} + 1.1 \mu\text{A}$ 110 $\mu\text{A}/\text{A} + 2.5 \mu\text{A}$  0.94 mA/A + 0.24 mA 1.4 mA/A + 1.7 mA	HP 3458A  Fluke 8845A
DC Current – 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 – Generate	(0 to 10) $\Omega$ (10 to 100) $\Omega$ (0.1 to 1) k $\Omega$ (1 to 10) k $\Omega$ (10 to 100) k $\Omega$ (0.1 to 1) M $\Omega$ (1 to 10) M $\Omega$	0.11 m $\Omega/\Omega + 1.4 \text{m}\Omega$ 0.11 m $\Omega/\Omega + 14 \text{m}\Omega$ 0.11 $\Omega/\text{k}\Omega + 0.14 \Omega$ 0.11 $\Omega/\text{k}\Omega + 1.4 \Omega$ 0.11 $\Omega/\text{k}\Omega + 14 \Omega$ 0.11 k $\Omega/\text{M}\Omega + 0.14 \text{k}\Omega$ 0.42 k $\Omega/\text{M}\Omega + 1.0 \text{k}\Omega$	Transmille 1000A
Resistance – Measure	(0 to 10) $\Omega$ (10 to 100) $\Omega$ (0.1 to 1) k $\Omega$ (1 to 10) k $\Omega$	0.014 m $\Omega/\Omega + 0.09 \text{m}\Omega$ 0.014 m $\Omega/\Omega + 0.8 \text{m}\Omega$ 0.013 m $\Omega/\Omega + 2.6 \text{m}\Omega$ 0.013 m $\Omega/\Omega + 20 \text{m}\Omega$	HP 3458A

Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
Resistance – Measure	(10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ	14 mΩ/kΩ + 150 mΩ 18 Ω/MΩ + 2.9 Ω 0.07 kΩ/MΩ + 0.1 kΩ	HP 3458A
	(1 to 100) MΩ	7.8 kΩ/MΩ + 24 kΩ	Fluke 8845A

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

Parameter/Range	Frequency	CMC <sup>2,7</sup> (±)	Comments
AC Current – Measure (cont)			
1 kHz	(100 to 400) mA 400 mA to 1 A (1 to 3) A (3 to 10) A	0.45 µA/mA + 530 µA 720 µA/A + 480 µA 0.91 mA/A + 3.6 mA 0.88 mA/A + 11 mA	Fluke 8845A
AC Current – Clamp-On Meters			
56 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

Parameter/Frequency	Range	CMC <sup>2,7</sup> (±)	Comments
Insulation Resistance <sup>3</sup> –			
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	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	Decade resistance



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

#### IV. Fluid Quantities

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
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 8655-6, ISO 4787, NIST SOP 14

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
One-Mark Volumetric Flasks	1 mL 2 mL 5 mL 10 mL 20 mL 25 mL 50 mL 100 mL 200 mL 250 mL 500 mL 1000 mL 5000 mL	0.0082 mL 0.0082 mL 0.0082 mL 0.0082 mL 0.013 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 ISO 8655-6, 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 ISO 8655-6, 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 ISO 8655-6, 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 ISO 8655-6, ISO 4787, NIST SOP 14



Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Burettes	1 mL 2 mL 5 mL 10 mL 25 mL 50 mL 100 mL	0.0020 mL 0.0033 mL 0.0033 mL 0.0066 mL 0.010 mL 0.017 mL 0.033 mL	Gravimetric method using analytical balance per TM-CR-03 based ISO 8655-6, 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 8655-6, ISO 4787, NIST SOP 14
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 ISO 8655-6, 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 ISO 8655-6, 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 ISO 8655-6, ISO 4787, NIST SOP 14

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Piston Operated Volumetric Apparatus –  Piston Pipettes	(>10 to 20) µL 50 µL 100 µL 200 µL 500 µL 1000 µL 2000 µL 5000 µL 10 000 µL	0.031 µL 0.042 µL 0.094 µL 0.34 µL 1.3 µL 2.5 µL 5.7 µL 14 µL 21 µL	Gravimetric method using analytical balance per TM-CR-03 based ISO 8655-6, ISO 4787, NIST SOP 14
Piston Operated Volumetric Apparatus –  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	Gravimetric method using analytical balance per TM-CR-03 based ISO 8655-6, ISO 4787, NIST SOP 14
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	

V. Mechanical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments	
Pressure Gages, Calibrators <sup>3</sup> –	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
		(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
	Hydraulic	(15 to 87) psig (0.103 to 0.60) kPa	0.011 psig 0.077 kPa	
		(87 to 1015.26) psi (0.6 to 7.0) Mpa	0.007 % of reading	Oil operated deadweight tester, DH-budenberg CPB 5800 (low pressure piston)
		(1015.26 to 10 152.0) psig (7 to 70) Mpa	0.0063 % of reading	Oil operated dead-weight tester, DH-budenberg CPB 5800 (high pressure piston)
Pressure Transmitters <sup>3</sup> –	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
		(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

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Pressure Transmitters <sup>3</sup> – (cont)			
Hydraulic	(87 to 1015.26) psig (599.8 to 7000) kPa	0.041 % of reading	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 % of reading	
Pressure Safety Valve (PSV's) & Pressure Switch <sup>3</sup>	(-9 to -1) psi (-62.1 to -1) kPa	0.4 % of reading	Vacuum & pressure indicator
	(1 to 10 000) psi (1 to 68.95) MPa	0.1 % of reading	
Scales & Balances <sup>3</sup>	(10 to 100) mg 100 mg to 100 g 100 mg to 200 g	0.013 mg 0.02 mg 0.082 mg	OIML Class E2 weights
	100 mg to 2100 g (1 to 10 000) g	0.91 mg 9.1 mg	OIML Class F1 weights
	(10 to 32 000) g (50 to 61 000) g (0.5 to 160) kg (2 to 200) kg (2 to 500) kg	91 mg 0.9 g 9.1 g 18 g 45 g	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 & ASTM 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	0.0093 mg 0.0093 mg 0.0094 mg 0.011 mg 0.012 mg 0.013 mg	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Mass – (cont)			
OIML Classes F1, F2, M1, M2 & M3	10 g 20 g 50 g 100 g 200 g 500 g 1000 g	0.018 mg 0.028 mg 0.063 mg 0.15 mg 0.25 mg 0.6 mg 1.2 mg	Mass comparator & ASTM Class E2 weights
OIML Classes F2, M1, M2 & M3	2 kg	9.6 mg	Mass comparator & ASTM Class F1 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  (10 to 100) N·m  (100 to 1000) N·m	(0.0005·reading + 0.0038) N·m  (0.0028·reading + 0.12) N·m  (0.0039·reading + 0.37) N·m	AWS TT-QC-100I-1/4 torque transducer and display  AWS ITI-1000 torque transducer & display  AWS ITS-750 torque transducer & display
Force – Tension & Compression Testing Machines <sup>3</sup>	(44 to 1000) N (>1 to 5) kN (>5 to 50) kN (>50 to 500) kN	0.12 % of reading 0.14 % of reading 0.13 % of reading 0.12 % of reading	Precision load cells
Force Testing Machine Crosshead Speed <sup>3</sup>	(10 to 840) mm/min	0.12 % of reading	Stopwatches, indicator & caliper

## VI. Optical Quantities

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Spectrophotometers <sup>3</sup> –  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
Spectrophotometers <sup>3</sup> – (cont)			
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	Neutral density glass filters
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

## VII. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Digital Thermometers <sup>3</sup>	(-30 to -20) °C (-20 to 0) °C (0 to 140) °C (140 to 231) °C (231 to 420) °C	0.038 °C 0.035 °C 0.042 °C 0.059 °C 0.037 °C	Digital thermometer & temperature bath

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Mechanical Thermometers <sup>3</sup>	(-30 to 420) °C	0.15 °C	Digital thermometer & temperature bath
Liquid-In-Glass Thermometers <sup>3</sup>	(-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 Transmitters <sup>3</sup>	(-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 <sup>3</sup>	(-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	Fluke 4180 black body  Fluke 4181 black body
Temperature <sup>3</sup> – Measure  Ovens, Liquid Baths, Dry Wells, Weather Cameras, Freezers, Stoves, Incubators, Muffles, Refrigerators, Autoclaves	(-80 to 420) °C (420 to 700) °C (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
Humidity <sup>3</sup> – Measure, Humidity Chambers	(20 to 90) % RH	2.3 % RH	Thermo-hygrometer Vaisala HM40

VIII. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Non-Contact Tachometers	(100 to 3000) RPM (4000 to 60 000) RPM	0.14 RPM 1.8 RPM	Transmille 1000 <sup>a</sup> , multicabrator & Transmille EA003 optical tachometer adapter
Frequency – Measuring Equipment	(0 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 multicalibrador

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.

<sup>2</sup> 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.

<sup>3</sup> 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 Calibration and Measurement Capability Uncertainty (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 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.

<sup>4</sup> 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.

<sup>5</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.

<sup>6</sup> In the statement of CMC,  $L$  is the numerical value of the nominal length in the units indicated.

<sup>7</sup> 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





# 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 the 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 9<sup>th</sup> day of April 2021.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 4150.01  
Valid to December 31, 2022

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