



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

MTS METROLOGY AND CALIBRATION LABORATORY
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CALIBRATION

Valid To: May 31, 2020

Certificate Number: 1044.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

(Calibration of digital linear gages, calipers, dial indicators, extensometers, extensometer calibrators, rotary encoders, protractors, micrometers, length standards, and other general purpose dimensional M&TE.)

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Extensometer	(0.0002 to 2) in	0.2 % + 0.000 013 in	MTS extensometer calibration system
Laser Extensometer	Up to 5 in Up to 15 in	(400 + 2L) µin (1300 + 2L) µin	Laser interferometer system per ASTM E83
Extensometer Calibrator	(0.001 to 2) in	(5 + 2L) µin	Laser interferometer system per ISO 9513 Annex B
Vee Length Standard	0.1 in (0.5, 1, and 2) in 6 mm 12 mm (15, 25, and 50) mm	300 µin 200 µin 5 µm 6 µm 7 µm	Gage blocks, optical comparator

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Angle – Rotary Measuring Equipment	0° to 10° 11° to 30° 31° to 360°	0.0005° 0.001° 0.002°	Rotary table system
Digital Protractor	0° to 360°	0.035°	Gage blocks, sine bar
Digital Indicator	Up to 2.4 in Up to 4 in Up to 18 in	12 μin 150 μin 200 μin or 0.003 % (whichever is greater)	Gage blocks
Digital Caliper	Up to 6 in	500 μin	Gage blocks, ring gages
MTS Temposonics for Linear Displacement	Up to 48 in	400 μin	Laser interferometer system
Laser Based System for Linear Displacement	Up to 60 in	25 μin	Laser interferometer system

II. Electrical – DC/Low Frequency

(Calibration of multimeters, signal sources, generators, process calibrators, signal conditioners, strain gage instrumentation, recorders, bridge simulators, thermocouple and RTD instruments and other general purpose electrical M&TE.)

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Voltage – Generate	(10 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	6 μV/V + 0.4 μV 3.5 μV/V + 0.8 μV 2.5 μV/V + 3 μV 2.5 μV/V + 4 μV 3.5 μV/V + 41 μV 4.6 μV/V + 400 μV	Fluke 5720A
Fixed Points	10 V	5 μV	Fluke 732B

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
DC Voltage – Measure	(1 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	4.6 μ V/V + 0.1 μ V 3.1 μ V/V + 0.4 μ V 3 μ V/V + 4 μ V 4.5 μ V/V + 40 μ V 4.9 μ V/V + 450 μ V	Fluke 8508A
Fixed Points	10 V	5 μ V	10 V (ratiometric)
DC Current – Generate	(10 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (3 to < 11) A (11 to 20) A	35 μ A/A + 6 nA 31 μ A/A + 8 nA 31 μ A/A + 41 nA 40 μ A/A + 0.8 μ A 61 μ A/A + 12 μ A 0.04 % + 600 μ A 0.08 % + 1 mA	Fluke 5720A Fluke 5522A
DC Current – Measure	120 nA to 1.2 μ A (1.2 to 12) μ A (12 to 120) μ A 120 μ A to 1.2 mA (1.2 to 12) mA (12 to 120) mA 120 mA to 1.0 A	20 μ A/A + 0.05 nA 21 μ A/A + 0.1 nA 20 μ A/A + 0.8 nA 20 μ A/A + 5 nA 20 μ A/A + 51 nA 35 μ A/A + 510 nA 0.011 % + 10 μ A	HP 3458A
Resistance – Generate, Fixed Points	1 Ω 10 k Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 k Ω 1.9 k Ω 10 k Ω 19 k Ω 100 k Ω 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	6 $\mu\Omega$ 0.03 Ω 84 $\mu\Omega$ 0.16 m Ω 0.21 m Ω 0.42 m Ω 1.0 m Ω 1.7 m Ω 8.0 m Ω 15 m Ω 80 m Ω 0.15 Ω 0.9 Ω 1.7 Ω 16 Ω 32 Ω 320 Ω 780 Ω 9.8 k Ω	Fluke 742A Fluke 5720A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Resistance – Measure	(1 to 12) Ω (12 to 120) Ω 120 Ω to 1.2 kΩ (1.2 to 12) kΩ (12 to 120) kΩ 120 kΩ to 1.2 MΩ (1.2 to 12) MΩ (12 to 120) MΩ 120 MΩ to 1 GΩ	15 μΩ/Ω + 0.06 mΩ 12 μΩ/Ω + 0.6 mΩ 10 μΩ/Ω + 0.6 mΩ 10 μΩ/Ω + 6.5 mΩ 10 μΩ/Ω + 63 mΩ 15 μΩ/Ω + 2 Ω 51 μΩ/Ω + 110 Ω 0.050 % + 1 kΩ 0.50 % + 12 kΩ	HP 3458A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate			
(1 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 4 μV 88 μV/V + 4 μV 79 μV/V + 4 μV 0.018 % + 4 μV 0.048 % + 5 μV 0.092 % + 10 μV 0.12 % + 20 μV 0.25 % + 20 μV	Fluke 5720A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 4 μV 88 μV/V + 4 μV 79 μV/V + 4 μV 0.018 % + 4 μV 0.048 % + 5 μV 0.092 % + 10 μV 0.12 % + 20 μV 0.25 % + 20 μV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 12 μV 88 μV/V + 7 μV 79 μV/V + 7 μV 0.018 % + 7 μV 0.044 % + 17 μV 0.076 % + 20 μV 0.12 % + 25 μV 0.25 % + 45 μV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate (cont)			
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 44 μV 83 μV/V + 16 μV 43 μV/V + 9 μV 72 μV/V + 12 μV 0.011 % + 31 μV 0.034 % + 81 μV 0.090 % + 210 μV 0.15 % + 310 μV	Fluke 5720A
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 0.44 mV 83 μV/V + 0.16 mV 43 μV/V + 0.06 mV 72 μV/V + 0.12 mV 96 μV/V + 0.20 mV 0.026 % + 0.61 mV 0.090 % + 2.0 mV 0.13 % + 3.3 mV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 4.0 mV 86 μV/V + 1.5 mV 49 μV/V + 0.60 mV 76 μV/V + 1.0 mV 0.013 % + 3.0 mV 0.080 % + 17 mV 0.42 % + 40 mV 0.70 % + 80 mV	
(220 to 1100) V	50 Hz to 1 kHz	60 μV/V + 4 mV	
AC Voltage – Measure			
(1 to 10) 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	0.03 % + 3.2 μV 0.02 % + 1.1 μV 0.03 % + 1.1 μV 0.10 % + 1.1 μV 0.5 % + 1.1 μV 4 % + 2.1 μV	HP 3458A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure (cont)			
(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 (1 to 2) MHz	75 µV/V + 4.3 µV 71 µV/V + 2.2 µV 0.014 % + 2.2 µV 0.03 % + 2.1 µV 0.08 % + 2.1 µV 0.3 % + 11 µV 1 % + 11 µV 1.5 % + 10 µV	HP 3458A
100 mV 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 (1 to 2) MHz	75 µV/V + 43 µV 71 µV/V + 22 µV 0.014 % + 22 µV 0.03 % + 21 µV 0.08 % + 21 µV 0.3 % + 110 µV 1 % + 110 µV 1.5 % + 100 µV	
(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 (1 to 2) MHz	75 µV/V + 0.43 mV 71 µV/V + 0.22 mV 0.014 % + 0.22 mV 0.03 % + 0.21 mV 0.08 % + 0.21 mV 0.3 % + 1 mV 1 % + 1 mV 1.5 % + 1 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	0.021 % + 4 mV 0.02 % + 22 mV 0.02 % + 22 mV 0.035 % + 21 mV 0.12 % + 21 mV 0.4 % + 110 mV 1.5 % + 110 mV	
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.04 % + 43 mV 0.04 % + 21 mV 0.06 % + 22 mV 0.12 % + 21 mV 0.3 % + 21 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Generate			
(22 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 17 nA 0.015 % + 10 nA 0.011 % + 9 nA 0.026 % + 12 nA 0.091 % + 65 nA	Fluke 5720A
220 µA to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 41 nA 0.015 % + 36 nA 0.011 % + 38 nA 0.019 % + 120 nA 0.091 % + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 0.42 µA 0.014 % + 0.36 µA 0.011 % + 0.36 µA 0.019 % + 0.55 µA 0.094 % + 5 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 4.2 µA 0.014 % + 3.6 µA 0.011 % + 2.5 µA 0.019 % + 3.5 µA 0.094 % + 10 µA	
(3 to < 11) A	(45 to 100) Hz 100 Hz to 1 kHz	0.05 % + 2 mA 0.08 % + 2 mA	
(11 to 20) A	(45 to 100) Hz 100 Hz to 1 kHz	0.09 % + 5 mA 0.12 % + 5 mA	Fluke 5522A
AC Current – Measure			
(12 to 120) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.41 % + 21 nA 0.16 % + 21 nA 0.06 % + 21 nA 0.06 % + 21 nA	HP 3458A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Measure (cont)			
120 µA to 1.2 mA	(10 to 20) Hz (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	0.41 % + 0.21 µA 0.16 % + 0.21 µA 0.06 % + 0.21 µA 0.03 % + 0.21 µA 0.06 % + 0.21 µA 0.41 % + 0.41 µA 0.57 % + 1.6 µA	HP 3458A
(1.2 to 12) mA	(10 to 20) Hz (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	0.41 % + 2.1 µA 0.16 % + 2.1 µA 0.06 % + 2.1 µA 0.03 % + 2.1 µA 0.06 % + 2.1 µA 0.41 % + 4.1 µA 0.57 % + 16 µA	
(12 to 120) mA	(10 to 20) Hz (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	0.41 % + 21 µA 0.16 % + 21 µA 0.06 % + 21 µA 0.03 % + 21 µA 0.06 % + 21 µA 0.41 % + 41 µA 0.57 % + 160 µA	
120 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.41 % + 0.21 mA 0.16 % + 0.21 mA 0.08 % + 0.21 mA 0.10 % + 0.21 mA 0.31 % + 0.21 mA 1 % + 0.41 mA	

Parameter/Equipment	Range	CMC ² (±)	Comments
Thermocouple Simulation – Measure			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.38 °C 0.12 °C 0.11 °C 0.12 °C 0.16 °C	Fluke 5522A

Parameter/Equipment	Range	CMC ² (±)	Comments
Thermocouple Simulation – Measure (cont)			
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.21 °C 0.12 °C 0.11 °C 0.13 °C 0.18 °C	Fluke 5522A
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.25 °C 0.14 °C 0.12 °C 0.20 °C 0.31 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.44 °C 0.27 °C 0.25 °C 0.31 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1760) °C	0.36 °C 0.28 °C 0.35 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.48 °C 0.19 °C 0.12 °C 0.11 °C	
RTD Simulation –			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C (630 to 800) °C	0.04 °C 0.06 °C 0.08 °C 0.09 °C 0.18 °C	Fluke 5522A
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C	0.04 °C 0.06 °C 0.08 °C 0.09 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
RTD Simulation – (cont)			
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 600) °C (600 to 630) °C	0.19 °C 0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.18 °C	Fluke 5522A

III. Mechanical

(Calibration of force transducers, force gages, torque transducers, pressure transducers, pressure gages, vacuum transducers, vacuum gages, weight sets, and other general purpose mechanical M&TE.)

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Force – (Tension and Compression)	(1 to 25 000) lbf	0.01 %	Calibration per ISO 376, ASTM E74 and EN10002-3 Primary deadweight systems
	(1000 to 240 000) lbf	0.05 %	Secondary force systems
Torque	(5 to 2000) in·lbf	0.06 %	Calibration per ASTM E2428 Deadweight and torque arm system
	(200 to 12 000) in·lbf	0.06 %	Deadweight and torque arm system
	(400 to 100 000) in·lbf	0.05 %	Torque transducer system

Parameter/Equipment	Range	CMC ^{2, 3} (±)	Comments
Pressure – Measuring Equipment			
Pneumatic	(4 to 400) psi	0.015 %	Dead weight pressure calibrator
Hydraulic	(10 to 10 000) psi	0.02 %	Dead weight pressure calibrator
Vacuum – Measuring Equipment			
Pneumatic	(3 to 29) inHg	0.02 %	Dead weight vacuum calibrator
Mass – Fixed Points	(1, 2, 5, 10, 20) g (50, 100) g (200, 500, 1000) g (2, 5) kg (10, 20) kg (0.1, 0.2) lb (0.25, 0.5, 1, 2) lb (5, 10) lb (20, 50) lb	0.3 mg 0.3 mg 3 mg 0.02 g 0.2 g 0.000 000 6 lb 0.000 01 lb 0.0001 lb 0.001 lb	Comparison to ASTM E617 Class 1 weights

IV. Thermodynamic

(Calibration of temperature probes, thermometers, temperature meters, humidity meters, thermocouple and RTD instruments, recorders, and other general purpose temperature M&TE.)

Parameter/Equipment	Range	CMC ² (±)	Comments
Relative Humidity – Measure	(10 to 75) % RH	2 % RH	Humidity meter
Measuring Equipment	(10 to 90) % RH 11 % RH 33 % RH 75 % RH	0.6 % RH 1.4 % RH 1.3 % RH 1.6 % RH	Humidity generator (two-pressure) Humidity calibrator (saturated salts)
Temperature – Measure	(-100 to 400) °C	0.04 °C	Thermometer w/ PRT
Measuring Equipment	0 °C (-5 to 200) °C (50 to 400) °C	0.01 °C 0.1 °C 0.25 °C	Ice bath reference Oil bath w/PRT Dry well w/PRT

V. Time & Frequency

(Calibration of counters, generators, oscillators, process calibrators, optical tachometers, and general purpose time and frequency M&TE.)

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measuring Equipment	(5, 10) MHz 1 Hz to 20 MHz	1 x 10 ⁻¹¹ Hz 1 x 10 ⁻⁸ Hz	Fluke 910 GPS Agilent 33220A
Frequency – Measure	1 Hz to 225 MHz	1 x 10 ⁻¹⁰ Hz	Agilent 53131A

VI. Vibration

(Calibration of accelerometers, vibration transducers, velocity transducers, vibration instrumentation, portable shakers, vibration tables, vibration controllers and related systems, and other general purpose vibration M&TE.)

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Vibration – Measuring Equipment and Measure (Sensitivity or acceleration)	(3 to < 100) Hz	1.3 %	Accelerometer (LF) calibration system
	≥ 100 Hz to 1 kHz	1.2 %	
	(5 to < 100) Hz	1.3 %	Accelerometer (HF) calibration system
	≥ 100 Hz to 1 kHz	1.2 %	
(> 1 to 5) kHz	1.4 %		
	(> 5 to 10) kHz	1.9 %	

¹ This laboratory offers commercial 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 In the statement of CMC, the value is defined as the percentage of reading unless otherwise noted.

⁴ The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

⁵ L is the numerical value of the nominal length of the device measured in inches.



Accredited Laboratory

A2LA has accredited

MTS METROLOGY AND CALIBRATION LABORATORY

Eden Prairie, MN

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 ANSI/NCSLI Z540-1-1994 and 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 3rd day of May 2018.

A handwritten signature in black ink, written over a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 1044.01
Valid to May 31, 2020

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