



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: January 31, 2019

Certificate Number: 1995.01

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

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Gage Blocks	Up to 1 in (1 to 4) in (4 to 20) in	(3 + 4L) μin (2 + 4L) μin (6 + 3L) μin	By mechanical comparison with gage blocks standard
Length Standards ³	(1 to 20) in. flat end (21 to 80) in. flat end (1 to 20) in. spherical end (21 to 80) in. spherical end	(8.6 + 4.1L) μin (15 + 4.3L) μin (36 + 4.0L) μin (57 + 3.9L) μin	P&W 80 in LMM, Supermic TM
Bore Gages ³	Up to 5 in	0.00039 in	Master ring gages
Micrometers ³	Up to 1 in (1 to 80) in	(70 + 2L) μin (70 + 3L) μin	Gage blocks
Calipers ³	Up to 60 in	(600 + 8L) μin	Gage blocks

Parameter/Equipment	Range	CMC ^{2,7} (\pm)	Comments
Length Indicators ³	Up to 8 in	$(60 + 60L) \mu\text{in}$	Gage blocks and granite plate
Ruled Standards ³ – Steel Rules	Up to 60 in	$(400 + 200L) \mu\text{in}$	Precision rule and microscope
Steel Tape	Up to 100 ft	0.016 in	Precision rule, microscope, and standard tape
Plain Ring Gages ³	(0.06 to 1) in (1 to 4) in (4 to 12) in	38 μin 47 μin 82 μin	Internal comparator and gage blocks
Plain Plug and Pin Gages ³	Up to 12 in	$(10 + 9L) \mu\text{in}$	ULM and gage blocks
Thread Plug Gages – Major Diameter	Up to 5 in	68 μin	ULM and gage blocks
Pitch Diameter ³	(4 to 80) pitch	62 μin	Thread wires
Coating Thickness Gages ³	Up to 60 mils	$(0.071 + 0.0061L)$ mils	Coating thickness standards
Ultrasonic Thickness Gages ³	Up to 1 in	0.00059 in.	Step block standards
Height Gage ³	Up to 24 in	$(5 + 10L) \mu\text{in}$	Gage blocks and surface plate

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6}	Comments
DC Voltage – Generate ³	Up 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	14 $\mu\text{V}/\text{V}$ + 0.4 μV 6.6 $\mu\text{V}/\text{V}$ + 0.7 μV 4.4 $\mu\text{V}/\text{V}$ + 2.5 μV 4.4 $\mu\text{V}/\text{V}$ + 4 μV 6.4 $\mu\text{V}/\text{V}$ + 40 μV 9.3 $\mu\text{V}/\text{V}$ + 400 μV	Fluke 5720A calibrator
Fixed Points	0.1 V 1 V 10 V 100 V 1000 V	2.2 $\mu\text{V}/\text{V}$ 1.4 $\mu\text{V}/\text{V}$ 0.50 $\mu\text{V}/\text{V}$ 1.8 $\mu\text{V}/\text{V}$ 2.2 $\mu\text{V}/\text{V}$	Datron 4910 with divider Datron 4910 Datron 4910 with divider
DC Voltage – Measure ³	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1050) V	9.3 $\mu\text{V}/\text{V}$ + 0.1 μV 5.7 $\mu\text{V}/\text{V}$ + 0.4 μV 4.3 $\mu\text{V}/\text{V}$ + 4 μV 8.3 $\mu\text{V}/\text{V}$ + 40 μV 8.8 $\mu\text{V}/\text{V}$ + 500 μV	Fluke 8508A Opt. 01 DMM
High DC Voltage – Generate and Measure	(1 to 120) kV	0.12 %	Ross VD120 HV divider with Agilent 34401A meter and high voltage DC source
DC Current – Generate	Up to 220 μA 220 μA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2 to 20) A (20 to 120) A	53 $\mu\text{A}/\text{A}$ + 6 nA 47 $\mu\text{A}/\text{A}$ + 7 nA 47 $\mu\text{A}/\text{A}$ + 40 nA 57 $\mu\text{A}/\text{A}$ + 0.7 μA 0.010 % + 1.2 μA 0.016 % + 0.8 mA 0.014 % + 4.8 mA	Fluke 5720A calibrator Fluke 52120A amplifier

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6}	Comments
Current Clamps ³	(10 to 16.5) A (16.5 to 150) A (150 to 1025) A (0 to 5000) A	0.25 % + 0.002 A 0.26 % + 0.015 A 0.28 % + 0.05 A 0.81 %	Fluke 5522A + 50 turn coil Fluke 52120A + 25/50 turn coil
DC Current – Measure ³	Up to 200 μ A 200 μ A to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A (1 to 50) A (50 to 100) A	59 μ A/A + 0.4 nA 29 μ A/A + 4 nA 26 μ A/A + 40 nA 62 μ A/A + 0.8 μ A 0.027 % + 16 μ A 0.049 % + 0.4 mA 0.013 % 0.013 %	Fluke 8508A Opt. 01 DMM Ohm-Labs CS-50 shunt, Agilent 3458A Ohm-Labs CS-100 shunt, Agilent 3458 A
DC Current – Generate and Measure ³	(100 to 1000) A	0.25 %	Empro shunts, Agilent 3458A and current source
DC Power – Generate ³	Up to 109 μ W (0.109 to 1.09) mW (1.09 to 10.9) mW (10.9 to 109) mW (0.109 to 1.09) W (1.09 to 10.9) W (10.9 to 109) W (109 to 337) W (337 to 990) W (0.99 to 3.06) kW (3.06 to 11.2) kW (11.2 to 20.9) kW	0.023 % 0.014 % 0.013 % 0.013 % 0.013 % 0.013 % 0.013 % 0.013 % 0.013 % 0.027 % 0.045 % 0.064 % 0.12 %	Fluke 5522A calibrator

Parameter/Equipment	Range	CMC ^{2, 4, 6} (±)	Comments
Resistance – Generate ³			
Fixed Points	0.0001 Ω	0.25 %	Fluke 5720A calibrator
	0.001 Ω	0.013 %	Ohm-Labs CS-100 shunt
	0.01 Ω	0.013 %	Ohm-Labs CS-50 shunt
	0.1 Ω	11 μΩ/Ω	ESI SR1010 1 Ω/step
	1 Ω	11 μΩ/Ω	Fluke 742A-1
	10 Ω	8.1 μΩ/Ω	Fluke 742A-10
	25 Ω	8.1 μΩ/Ω	Fluke 742A-25
	100 Ω	8.1 μΩ/Ω	Fluke 742A-100
	1 kΩ	8.1 μΩ/Ω	Fluke 742A-1K
	10 kΩ	1.5 μΩ/Ω	ESI SR-104 standard resistor
	100 kΩ	11 μΩ/Ω	Fluke 742A-100K
	1 MΩ	11 μΩ/Ω	Fluke 742A-1M
	10 MΩ	12 μΩ/Ω	Fluke 742A-10M
	100 MΩ	12 μΩ/Ω	ESI SR-1050 10 MΩ/step
	1 GΩ	0.01 %	Fluke 8508A-7000K
	0 Ω	41 μΩ/Ω	Fluke 5720A Calibrator
	1.9 Ω	120 μΩ/Ω	
	19 Ω	28 μΩ/Ω	
	190 Ω	14 μΩ/Ω	
	1.9 kΩ	12 μΩ/Ω	
	19 kΩ	12 μΩ/Ω	
	190 kΩ	16 μΩ/Ω	
	1.9 MΩ	28 μΩ/Ω	
	19 MΩ	73 μΩ/Ω	
Variable Range	(0 to 11) Ω	51 μΩ/Ω + 0.001 Ω	Fluke 5522A Calibrator
	(11 to 33) Ω	35 μΩ/Ω + 0.015 Ω	
	(33 to 110) Ω	33 μΩ/Ω + 0.0014 Ω	
	(110 to 330) Ω	33 μΩ/Ω + 0.002 Ω	
	330 Ω to 1.1 kΩ	33 μΩ/Ω + 0.002 Ω	
	(1.1 to 3.3) kΩ	33 μΩ/Ω + 0.02 Ω	
	(3.3 to 11) kΩ	33 μΩ/Ω + 0.02 Ω	
	(11 to 33) kΩ	33 μΩ/Ω + 0.2 Ω	
	(33 to 110) kΩ	33 μΩ/Ω + 0.2 Ω	
	(110 to 330) kΩ	37 μΩ/Ω + 2 Ω	
	330 kΩ to 1.1 MΩ	38 μΩ/Ω + 2 Ω	
	(1.1 to 3.3) MΩ	70 μΩ/Ω + 30 Ω	
	(3.3 to 11) MΩ	0.015 % + 50 Ω	
	(11 to 33) MΩ	0.029 % + 2.5 kΩ	
	(33 to 110) MΩ	0.06 % + 3 kΩ	
	(110 to 330) MΩ	0.35 % + 0.1 MΩ	
	(330 to 1100) MΩ	1.7 % + 0.5 MΩ	

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
Resistance – Measure	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 k Ω (2 to 20) k Ω (20 to 200) k Ω 200 k Ω to 2 M Ω (2 to 20) M Ω (20 to 200) M Ω 200 M Ω to 2 G Ω (2 to 20) G Ω	26 $\mu\Omega/\Omega$ + 4 $\mu\Omega$ 17 $\mu\Omega/\Omega$ + 14 $\mu\Omega$ 10 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 11 $\mu\Omega/\Omega$ + 0.5 m Ω 11 $\mu\Omega/\Omega$ + 5 m Ω 11 $\mu\Omega/\Omega$ + 50 m Ω 14 $\mu\Omega/\Omega$ + 1 Ω 24 $\mu\Omega/\Omega$ + 10 Ω 84 $\mu\Omega/\Omega$ + 1 k Ω 0.03 % + 0.1 M Ω 0.18 % + 10 M Ω	Fluke 8508A Opt. 01 DMM
Capacitance – Generate ³	(200 to 400) pF (0.4 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) μ F (1.1 to 3.3) μ F (3.3 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F (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	0.58 % + 0.01 nF 0.58 % + 0.01 nF 0.58 % + 0.01 nF 0.29 % + 0.01 nF 0.29 % + 0.1 nF 0.29 % + 0.1 nF 0.29 % + 0.3 nF 0.29 % + 1 nF 0.29 % + 3 nF 0.29 % + 10 nF 0.46 % + 30 nF 0.52 % + 0.1 μ F 0.52 % + 0.3 μ F 0.52 % + 1 μ F 0.52 % + 3 μ F 0.52 % + 10 μ F 0.87 % + 30 μ F 1.2 % + 100 μ F	Fluke 5522A calibrator
Capacitance – Measure	300 pF to 1000 nF (1 to 300) μ F (300 to 1100) μ F	0.05 % 0.12 % 0.15 %	GenRad 1689M RLC Digibridge

Parameter/Equipment	Range	CMC ^{2, 4, 6} (±)	Comments
Electrical Calibration of Thermocouple Indicators ³ — Generate and Measure			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.59 °C 0.23 °C 0.21 °C 0.23 °C 0.28 °C	Fluke 5522A calibrator
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.34 °C 0.23 °C 0.21 °C 0.24 °C 0.30 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.4 °C 0.25 °C 0.23 °C 0.33 °C 0.48 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.67 °C 0.43 °C 0.40 °C 0.48 °C	
Type S	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.56 °C 0.44 °C 0.45 °C 0.55 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.74 °C 0.31 °C 0.23 °C 0.21 °C	

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
Electrical Calibration of RTD Indicator ³ – Source Only			
Pt 385,100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.06 °C 0.06 °C 0.08 °C 0.11 °C 0.12 °C 0.14 °C 0.27 °C	Fluke 5522A calibrator
AC Voltage – Generate			
Up 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	0.23 % + 4 μ V 0.16 % + 4 μ V 0.13 % + 4 μ V 0.18 % + 4 μ V 0.23 % + 5 μ V 0.37 % + 10 μ V 0.46 % + 20 μ V 0.62 % + 20 μ V	Fluke 5720A calibrator
(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	0.040 % + 4 μ V 0.019 % + 4 μ V 0.017 % + 4 μ V 0.031 % + 4 μ V 0.069 % + 5 μ V 0.14 % + 10 μ V 0.18 % + 20 μ V 0.34 % + 20 μ V	
(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	0.033 % + 12 μ V 0.013 % + 7 μ V 0.010 % + 7 μ V 0.025 % + 7 μ V 0.056 % + 17 μ V 0.11 % + 20 μ V 0.17 % + 25 μ V 0.36 % + 45 μ V	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (\pm)	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	0.035 % + 40 μ V 0.013 % + 15 μ V 55 μ V/V + 8 μ V 0.011 % + 10 μ V 0.015 % + 30 μ V 0.059 % + 80 μ V 0.13 % + 200 μ V 0.27 % + 300 μ V	Fluke 5720A calibrator
(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	0.035 % + 400 μ V 0.013 % + 150 μ V 59 μ V/V + 50 μ V 100 μ V/V + 100 μ V 0.014 % + 200 μ V 0.046 % + 0.6 mV 0.13 % + 2 mV 0.26 % + 3.2 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	0.035 % + 4 mV 0.013 % + 1.5 mV 68 μ V/V + 0.6 mV 0.011 % + 1 mV 0.019 % + 2.5 mV	
(220 to 1100) V	(10 to 50) Hz 50 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.038 % + 16 mV 87 μ V/V + 3.5 mV 0.020 % + 6 mV 0.070 % + 11 mV	Fluke 5720A calibrator Fluke 5725A amplifier
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.070 % + 11 mV 0.27 % + 45 mV	Fluke 5725A amplifier

Parameter/Range	Frequency	CMC ^{2, 4, 6} (\pm)	Comments
AC Current- Generate			
Up to 220 μ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.042 % + 16 nA 0.024 % + 10 nA 0.014 % + 8 nA 0.034 % + 12 nA 0.20 % + 65 nA	Fluke 5720A calibrator
(0.22 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	0.039 % + 40 nA 0.024 % + 35 nA 0.020 % + 35 nA 0.032 % + 0.11 μ A 0.15 % + 0.65 μ A	
(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	0.048 % + 0.4 μ A 0.028 % + 0.35 μ A 0.022 % + 0.35 μ A 0.037 % + 0.55 μ A 0.20 % + 5 μ A	
(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	0.047 % + 4 μ A 0.028 % + 3.5 μ A 0.022 % + 2.5 μ A 0.034 % + 3.5 μ A 0.17 % + 10 μ A	
(0.22 to 2.2) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.044 % + 35 μ A 0.071 % + 80 μ A 1.0 % + 0.16 mA	
(2 to 20) A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz (6 to 10) kHz	0.022 % + 9.4 mA 0.032 % + 9.4 mA 0.09 % + 9.4 mA 0.27 % + 31 mA 0.90 % + 62 mA 2.7 % + 94 mA	Fluke 52120A amplifier
(20 to 120) A	(10 to 650) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz	0.031 % + 19 mA 0.038 % + 28 mA 0.092 % + 94 mA 0.27 % + 0.23 A 0.92 % + 0.42 A	Fluke 52120A amplifier

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
Current Clamps ³			
(10 to 16.5) A	(45 to 65) Hz (65 to 440) Hz	0.29 % + 0.003 A 0.83 % + 0.003 A	Fluke 5522A + 50 turn coil
(16.5 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.32 % + 0.025 A 0.87 % + 0.027 A	
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	0.32 % + 0.09 A 1.5 % + 0.1 A	
(0 to 6000) A	(10 to 65) Hz (65 to 300) Hz	0.82 % + 0.47 A 0.82 % + 0.84 A	Fluke 52120 A + 25/50 turn coil
AC Voltage – Measure ³			
Up 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	0.27 % + 1.3 μV 0.11 % + 1.3 μV 0.067 % + 1.3 μV 0.13 % + 2 μV 0.19 % + 2.5 μV 0.36 % + 4 μV 0.39 % + 8 μV 0.64 % + 8 μV	Fluke 5790A
(2.2 to 7) 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	0.14 % + 1.3 μV 0.063 % + 1.3 μV 0.041 % + 1.3 μV 0.065 % + 2 μV 0.094 % + 2.5 μV 0.19 % + 4 μV 0.20 % + 8 μV 0.31 % + 8 μV	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (\pm)	Comments
AC Voltage – Measure ³ (cont)			
(7 to 22) mV	(10 to 20) Hz	0.045 % + 1.3 μ V	Fluke 5790A
	(20 to 40) Hz	0.029 % + 1.3 μ V	
	40 Hz to 20 kHz	0.017 % + 1.3 μ V	
	(20 to 50) kHz	0.032 % + 2 μ V	
	(50 to 100) kHz	0.047 % + 2.5 μ V	
	(100 to 300) kHz	0.12 % + 4 μ V	
	(300 to 500) kHz	0.13 % + 8 μ V	
	500 kHz to 1 MHz	0.22 % + 8 μ V	
(22 to 70) mV	(10 to 20) Hz	0.037 % + 1.3 μ V	
	(20 to 40) Hz	0.019 % + 1.3 μ V	
	40 Hz to 20 kHz	98 μ V/V + 1.3 μ V	
	(20 to 50) kHz	0.021 % + 2 μ V	
	(50 to 100) kHz	0.041 % + 2.5 μ V	
	(100 to 300) kHz	0.078 % + 4 μ V	
	(300 to 500) kHz	0.099 % + 8 μ V	
	500 kHz to 1 MHz	0.15 % + 8 μ V	
(70 to 220) mV	(10 to 20) Hz	0.032 % + 1.3 μ V	
	(20 to 40) Hz	0.013 % + 1.3 μ V	
	40 Hz to 20 kHz	54 μ V/V + 1.3 μ V	
	(20 to 50) kHz	0.011 % + 2 μ V	
	(50 to 100) kHz	0.025 % + 2.5 μ V	
	(100 to 300) kHz	0.037 % + 4 μ V	
	(300 to 500) kHz	0.056 % + 8 μ V	
	500 kHz to 1 MHz	0.13 % + 8 μ V	
(220 to 700) mV	(10 to 20) Hz	0.032 % + 1.3 μ V	
	(20 to 40) Hz	0.011 % + 1.3 μ V	
	40 Hz to 20 kHz	46 μ V/V + 1.3 μ V	
	(20 to 50) kHz	77 μ V/V + 2 μ V	
	(50 to 100) kHz	0.011 % + 2.5 μ V	
	(100 to 300) kHz	0.025 % + 4 μ V	
	(300 to 500) kHz	0.038 % + 8 μ V	
	500 kHz to 1 MHz	0.12 % + 8 μ V	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage– Measure ³ (cont)			
(0.7 to 2.2) V	(10 to 20) Hz	0.03 %	Fluke 5790A
	(20 to 40) Hz	98 μV/V	
	40 Hz to 20 kHz	31 μV/V	
	(20 to 50) kHz	68 μV/V	
	(50 to 100) kHz	100 μV/V	
	(100 to 300) kHz	0.023 %	
	(300 to 500) kHz	0.034 %	
	500 kHz to 1 MHz	0.11 %	
(2.2 to 7) V	(10 to 20) Hz	0.03 %	Fluke 5790A
	(20 to 40) Hz	99 μV/V	
	40 Hz to 20 kHz	31 μV/V	
	(20 to 50) kHz	69 μV/V	
	(50 to 100) kHz	0.011 %	
	(100 to 300) kHz	0.026 %	
	(300 to 500) kHz	0.049 %	
	500 kHz to 1 MHz	0.14 %	
(7 to 22) V	(10 to 20) Hz	0.03 %	Fluke 5790A
	(20 to 40) Hz	99 μV/V	
	40 Hz to 20 kHz	36 μV/V	
	(20 to 50) kHz	69 μV/V	
	(50 to 100) kHz	0.011 %	
	(100 to 300) kHz	0.026 %	
	(300 to 500) kHz	0.05 %	
	500 kHz to 1 MHz	0.15 %	
(22 to 70) V	(10 to 20) Hz	0.03 %	Fluke 5790A
	(20 to 40) Hz	100 μV/V	
	40 Hz to 20 kHz	44 μV/V	
	(20 to 50) kHz	84 μV/V	
	(50 to 100) kHz	0.013 %	
	(100 to 300) kHz	0.027 %	
(70 to 220) V	(10 to 20) Hz	0.03 %	Fluke 5790A
	(20 to 40) Hz	100 μV/V	
	40 Hz to 20 kHz	42 μV/V	
	(20 to 50) kHz	0.011 %	
	(50 to 100) kHz	0.014 %	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (\pm)	Comments
AC Voltage – Measure ³ (cont)			
(220 to 700) V	40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	56 μ V/V 0.018 % 0.06 %	Fluke 5790A
(700 to 1000) V	40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	55 μ V/V 0.020 % 0.061 %	
AC Voltage – Generate and Measure			
(1 to 84) kV	60 Hz	0.68 %	Ross VD120 HV divider w/ Agilent 34401A meter and high voltage AC source
AC Current – Measure			
10 μ A to 20A (20 to 50) A (50 to 100) A	10 Hz to 10 kHz 10 Hz to 6 kHz 10 Hz to 6 kHz	0.015 % 0.028 % 0.028 %	Fluke 5790A with Holt HCS-1 Ohm-Labs CS-50 shunt Ohm-Labs CS-100 shunt
AC Current – Generate and Measure ³			
(100 to 6000) A	60 Hz	1.0 %	PEM LFR 30/300, Agilent 3458A, and current shunt
AC Power – Generate ³			
(45 to 65) Hz, PF = 1	Up to 10.9 μ W (10.9 to 109) μ W (0.109 to 1.09) mW (1.09 to 10.9) mW (10.9 to 109) mW (0.109 to 1.09) W (1.09 to 10.9) W (10.9 to 37) W (37 to 337) W (0.337 to 1.12) kW	0.17 % 0.13 % 0.06 % 0.056 % 0.055 % 0.055 % 0.055 % 0.058 % 0.063 % 0.076 %	Fluke 5522A calibrator

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Power – Generate ³ (cont) (45 to 65) Hz, PF = 1	(1.12 to 3.06) kW (3.06 to 11.2) kW (11.2 to 20.9) kW	0.081 % 0.09 % 0.17 %	Fluke 5522A calibrator
Phase Angle ³ – Measure	5 Hz to 2 kHz (2 to 5) kHz (5 to 20) kHz (20 to 50) kHz	0.024° 0.038° 0.065° 0.073°	Clarke-Hess 6000A phase meter
Phase Angle ³ – Generate	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.12° 0.29° 0.58° 2.9° 5.8° 12°	Fluke 5522A calibrator

III. Mechanical

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Torque Wrenches ³	(5 to 20) in·lbf (50 to 250) in·lbf (25 to 2000) ft·lbf	2.2 % 1.4 % 1.3 %	CDI torque tester
Absolute Pressure ³	(0 to 30) psia	0.0054 psia	Mensor 2101 DPG

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Pressure ³ (Pneumatic) – Effective Area Determination of Piston- Cylinder Unit (PCU) or Ball Nozzle Unit (BNU)	(4 to 854) inH ₂ O (1 to 30) psi	0.011 %	Ametek PKII deadweight tester
	(4 to 1100) inH ₂ O (1 to 300) psi	0.011 %	Ametek RK deadweight tester
	(0.2 to 25) psi (1.7 to 100) psi (2 to 1000) psi	0.0013 % 0.0013 % 0.0028 %	Ruska 2465
	(100 to 2500) psi (6 to 12 000) psi	0.0031 % 0.0037 %	Ruska 2470 Oil to gas (2400/2413)
	(0.14 to 30) psi (10 to 300) psi (100 to 2500) psi	0.0082 % 0.0063 % 0.0059 %	Deadweight tester effective area by cross float method
Pressure ³ (Hydraulic) – Effective Area Determination of Piston- Cylinder Unit (PCU) Calibration of High Accuracy Transfer Standards and Pressure Devices	(100 to 1500) psi (1000 to 15 000) psi	0.0066 % 0.0071 %	Deadweight tester effective area by cross float method.
	(6 to 2400) psi (30 to 12 000) psi	0.0025 % 0.0035 %	Ruska 2400HL
	Up to 15 000 psi	0.018%	Ametek T-Type
Mass ³	(1 to 3) lb (4 to 5) lb (10 to 25) lb (30 to 50) lb	0.003 g (6.7 μlb) 0.03 g (67 μlb) 0.5 g (1200 μlb) 0.33 g (730 μlb)	Mass standard s and analytical balances. (By single substitution)
	(0.0005 to 0.3) oz (0.5 to 1) oz (2 to 4) oz (4 to 8) oz	0.06 mg (0.13 μlb) 0.08 mg (0.18 μlb) 0.3 mg (0.67 μlb) 3.4 mg (7.5 μlb)	

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Mass ³	1 mg to 20 g (20 to 100) g (100 to 200) g (200 to 400) g (0.4 to 1.2) kg (1.2 to 2) kg (2 to 4) kg (4 to 12) kg (12 to 30) kg (6.1 to 12) kg 1 mg to 6.1 kg	0.006 mg 0.06 mg 0.3 mg 0.01 g 0.03 g 0.05 g 0.1 g 0.6 g 0.8 g 0.01 % 0.005 %	Mass standards and analytical balances. (By single substitution) Mass determination for piston type deadweight tester
Balances and Scales ³	Up to 80 g Up to 300 g Up to 6000 g	0.044 mg 0.21 mg 21 mg	Mass standards

IV. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Generate and Measure ³	0.01 °C (-200 to 660) °C (660 to 1000) °C (1000 to 1100) °C (1100 to 1200) °C (1200 to 1300) °C (1300 to 1450) °C	0.001 °C 0.015 °C 0.37 °C 0.9 °C 1.5 °C 2.1 °C 2.9 °C	Hart 5901A TPW Cell Hart 5628 PRT, 1595A Superthermometer Hart 5650 with type S thermocouple

V. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measure ³	0.1 Hz to 2.7 GHz	1.8 parts in 10 ⁸	Fluke PM 6681

Parameter/Equipment	Range	CMC ² (±)	Comments
Time Interval – Timers Stop Watches ³			NIST SP 960-12
Time Base ⁸	(0 to 24) hour	0.0016 s/day	Fluke PM6681
Totalize method	(0 to 24) hour	0.039 s	Fluke PM 6681, function generator

¹ This laboratory offers commercial calibration service and field calibration services.

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 Generate. 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 and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. 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. Field environmental conditions are limited to 15 °C to 30 °C and <80% relative humidity to 30 °C.

⁴ Fluke 5700A series and 5500A series CMCs are based upon the temperature the standard was calibrated ($t_{cal} \pm 5$ °C) and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than 5 °C. For Resistance, a zero calibration is performed at least every 12 hours within ± 1 °C of use. For AC Current, best uncertainties are determined with the LCOMP off. CMCs are also based upon 1-year floor specifications. 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.

⁵ HP 3458A CMCs are based upon the temperature the standard was calibrated ($t_{cal} \pm 5$ °C) and an auto calibration (ACAL) was performed within the previous 24 hours (± 1 °C of ambient temperature.) CMCs are also based upon 1-year floor specifications. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction/percentage of the reading/output plus a range specification.

⁶ In the statement of CMC, percentages are percentages of reading, unless otherwise indicated.

⁷ In the statement of CMC, L is the numerical value of the nominal length in inches.



Accredited Laboratory

A2LA has accredited

JM TEST SYSTEMS, INC.

Baton Rouge, LA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *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 8 January 2009).



Presented this 15th day of March 2017.

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

President and CEO
For the Accreditation Council
Certificate Number 1995.01
Valid to January 31, 2019
Revised November 15, 2018

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