



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

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CALIBRATION

Valid To: May 31, 2024

Certificate Number: 2417.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 5}:

I. Chemical Quantities

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
pH – Generate ³ , Fixed Points	(4, 7, 10) pH	0.03 pH	Certified pH solutions

II. Dimensional

Parameter/Equipment	Range	CMC ² (±)	Comments
Calipers and Micrometers ³ – (Length Only)	(0.05 to 1.0) in (1.0 to 2.0) in (2.0 to 3.0) in (3.0 to 4.0) in (4.0 to 6.0) in (6.0 to 8.0) in (8.0 to 10.0) in (10.0 to 12.0) in	9.1 x 10 ⁻⁵ in 1.1 x 10 ⁻⁴ in 1.5 x 10 ⁻⁴ in 1.8 x 10 ⁻⁴ in 3.5 x 10 ⁻⁴ in 3.3 x 10 ⁻⁴ in 5.7 x 10 ⁻⁴ in 6.8 x 10 ⁻⁴ in	Class B gage blocks



III. Dimensional Testing⁷

Parameter/Equipment	Range	CMC ² (±)	Comments
Length 1D – Measure ³	Up to 12.0 in	1.9 x 10 ⁻³ in	Digital caliper

IV. Electrical – DC Low Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Voltage – Generate ³	(0 to 220) mV (0.220 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	32 μV/V + 0.80 μV 8.9 μV/V + 1.2 μV 8.7 μV/V + 4.0 μV 9.2 μV/V + 8.0 μV 9.2 μV/V + 0.10 mV 9.7 μV/V + 0.60 mV	5700A Fluke calibrator
	(0.1 to 1.0) kV (1.0 to 4.0) kV (4.0 to 9.0) kV	0.61 V 2.5 V 4.7 V	HV Source monitored by Vitrek 4700
	(9.0 to 25) kV (25 to 50) kV (50 to 60) kV	38 V 58 V 81 V	HV Source monitored by Vitrek 4700/HVL-150 probe
DC Voltage – Measure ³	Up to 200 mV (0.200 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	11 μV/V 5.3 μV/V 53 μV/V 750 μV/V 7.8 mV/V	8508A DMM
	(0.1 to 1.0) kV (1.0 to 4.0) kV (4.0 to 9.0) kV	0.61 V 2.5 V 4.7 V	Vitrek 4700A
	(9.0 to 25) kV (25 to 50) kV (50 to 75) kV (75 to 100) kV (100 to 125) kV (125 to 140) kV	0.047 kV 0.064 kV 0.086 kV 0.19 kV 0.17 kV 0.29 kV	Vitrek 4700 w/ HVL150

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate ³			
(0.22 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 to 1000) kHz	0.53 % + 5.0 μV 0.50 % + 5.0 μV 0.51 % + 5.0 μV 0.56 % + 5.0 μV 0.83 % + 8.0 μV 1.8 % + 15 μV 4.1 % + 30 μV 14 % + 40 μV	5700A 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 to 1000) kHz	0.11 % + 6.0 μV 0.074 % + 6.0 μV 0.064 % + 6.0 μV 0.093 % + 6.0 μV 0.16 % + 8.0 μV 0.34 % + 15 μV 0.53 % + 30 μV 0.72 % + 40 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 to 1000) kHz	0.16 % + 16 μV 0.031 % + 10 μV 0.020 % + 10 μV 0.042 % + 10 μV 0.11 % + 30 μV 0.14 % + 30 μV 0.33 % + 40 μV 3.6 % + 0.10 mV	
(0.22 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 to 1000) kHz	0.059 % + 0.10 mV 0.020 % + 30 μV 0.010 % + 7.0 μV 0.015 % + 20 μV 0.034 % + 80 μV 0.059 % + 0.15 mV 0.15 % + 0.40 mV 0.32 % + 1.0 mV	
(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 to 1000) kHz	0.061 % + 1.0 mV 0.020 % + 0.30 mV 81 μV/V + 70 μV 0.015 % + 0.20 mV 0.031 % + 0.40 mV 0.069 % + 1.7 mV 0.16 % + 5.0 mV 0.39 % + 9.0 mV	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Voltage – Generate ³ (cont)			
(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	0.061 % +10 mV 0.021 % + 3.0 mV 0.011 % + 1.0 mV 0.028 % + 4.0 mV 0.064 % + 10 mV	5700A calibrator
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.042 % + 4.0 mV 0.010 % + 4.0 mV	
(300 to 1000) V	(1 to 8) kHz	1.2 V	5520A calibrator
(0.1 to 1.0) kV (1.0 to 4.0) kV (4.0 to 9.0) kV	(50 to 60) Hz (50 to 60) Hz (50 to 60) Hz	2.1 V 6.4 V 18 V	HV source monitored by Vitrek 4700
(9.0 to 10) kV	(50 to 60) Hz	0.12 kV	HV source monitored by Vitrek 4700 w/ HVL-150 probe
AC Voltage – Measure ³			
(1 to 200) mV	(1 to 40) Hz (40 to 60) Hz 60 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.022 mV 0.019 mV 0.016 mV 0.018 mV 0.045 mV 0.11 mV	Fluke 8508A
(0.201 to 2.00) V	(1 to 40) Hz (40 to 300) Hz (0.30 to 3) kHz (3 to 10) kHz (10 to 30) kHz (30 to 100) kHz (0.100 to 1.00) MHz	0.16 mV 0.14 mV 0.12 mV 0.14 mV 0.30 mV 0.83 mV 35 mV	
(2.01 to 20.00) V	(1 to 40) Hz (40 to 300) Hz (0.30 to 3) kHz (3 to 10) kHz (10 to 30) kHz (30 to 100) kHz (0.10 to 1.0) MHz	1.5 mV 1.3 mV 1.0 mV 1.3 mV 2.8 mV 8.2 mV 0.35 V	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure ³ (cont)			
(20.01 to 200.0) V	(1 to 40) Hz (40 to 300) Hz (0.30 to 3) kHz (3 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.11 V 13 mV 10 mV 13 mV 28 mV 82 mV	Fluke 8508A
(200.1 to 1000) V	40 Hz to 10 kHz	0.18 V	
(0.1 to 1.0) kV (1.0 to 4.0) kV (4.0 to 9.0) kV	(50 to 60) Hz (50 to 60) Hz (50 to 60) Hz	2.1 V 6.4 V 19 V	Vitrek 4700A
(9.0 to 20) kV (20.0 to 40) kV (40.0 to 60) kV (60.0 to 80) kV (80.0 to 100.0) kV	(50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz	0.14 kV 0.25 kV 0.30 kV 0.49 kV 0.59 kV	Vitrek 4700A w/ Vitrek HVL150

Parameter/Equipment	Range	CMC ^{2,4,9} (±)	Comments
DC Current – Generate ³	(0 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA	0.013 % + 10 nA 59 µA/A + 10 nA 60 µA/A + 0.10 µA 70 µA/A + 1.0 µA	5700A calibrator Add 200·I ² µA/A for I > 100 mA
	220 mA to 2.2 A	0.012 % + 30 µA	Add 10·I ² µA/A for I > 1 A reference calibrator
	(1.1 to 2.9999) A (3.0 to 11) A (11 to 20) A	0.051 % 0.060 % 0.11 %	Fluke 5520A calibrator
	(20 to 100) A	0.058 A	Guildline 9211A shunt
	(20 to 149) A (150 to 1000) A	0.72 % 0.83 %	Fluke 5520, 5500A coil

Parameter/Equipment	Range	CMC ^{2, 4, 9} (±)	Comments
DC Current – Measure ³	(0 to 100) nA	0.017 % + 40 pA	3458A option 002 DMM
	(0.100 to 1.0) µA	36 µA/A + 40 pA	
	(1 to 10) µA	67 µA/A + 0.1 nA	
	(10 to 100) µA	2.9 µA/A + 0.80 nA	
	(0.100 to 1.0) mA	30 µA/A + 5.0 nA	
	(1.0 to 10.0) mA	30 µA/A + 50 nA	
	(10.0 to 100.0) mA	47 µA/A + 0.50 µA	
	(0.100 to 1.0) A	0.013 % + 10 µA	
	(1 to 10) A	0.012 % + 3.0 µA	
(10 to 100) A	0.058 % + 30 µA		
(100 to 300) A	0.12 % + 30 µA		
(300 to 700) A	(700 to 1000) A	8.2 %	Fluke 80i-1010 current probe
		8.3 %	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments	
AC Current – Generate ³	(9 to 220) µA	(10 to 20) Hz	0.10 % + 30 nA	5700A calibrator
		(20 to 40) Hz	0.057 % + 25 nA	
		40 Hz to 1 kHz	0.032 % + 20 nA	
		(1 to 5) kHz	0.12 % + 50 nA	
		(5 to 10) kHz	0.25 % + 0.10 µA	
(29 to 190.0) µA (190.0 to 329.99) µA	(10 to 30) kHz (10 to 30) kHz	4 µA	5520A calibrator	
		11 µA		
(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	0.076 % + 50 nA	5700A calibrator	
		0.040 % + 40 nA		
		0.020 % + 40 nA		
		0.10 % + 0.50 µA		
		0.24 % + 1.0 µA		
(0.33 to 1.900) mA (1.900 to 3.299) mA	(10 to 30) kHz (10 to 30) kHz	0.023 mA	5520A calibrator	
		0.084 mA		
(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	0.078 % + 0.50 µA	5700A calibrator	
		0.046 % + 0.40 µA		
		0.020 % + 0.40 µA		
		0.10 % + 5.0 µA		
		0.24 % + 10 µA		



Parameter/Range	Frequency	CMC ^{2, 4, 9} (±)	Comments
AC Current – Generate ³ (cont)			
(3.3 to 19.00) mA	(10 to 30) kHz	0.093 mA	5520A calibrator
(19.00 to 32.999) mA	(10 to 30) kHz	0.53 mA	
(22 to 220) mA	(10 to 20) Hz	0.074 % + 5.0 µA	5700A calibrator
	(20 to 40) Hz	0.039 % + 4.0 µA	
	40 Hz to 1 kHz	0.021 % + 4.0 µA	
	(1 to 5) kHz	0.018 % + 50 µA	
	(5 to 10) kHz	0.24 % + 0.10 mA	
(33 to 190.0) mA	(10 to 30) kHz	1.1 mA	5520A calibrator
(190.0 to 329.99) mA	(10 to 30) kHz	3.8 mA	
(0.22 to 2.2) A	(0.020 to 1) kHz	0.070 % + 40 µA	5700A calibrator
	(1 to 5) kHz	0.086 % + 0.10 mA	
	(5 to 10) kHz	22 mA	
(1.1 to 2.9) A	(10 to 45) Hz	6.1 mA	5520A calibrator
	(0.45 to 1) kHz	2.2 mA	
	(1 to 5) kHz	20 mA	
	(5 to 10) kHz	20 mA	
(3 to 10.9) A	(45 to 100) Hz	8.0 mA	
	(0.1 to 1) kHz	13 mA	
	(1 to 5) kHz	0.38 A	
(10.9 to 20.5) A	(45 to 100) Hz	0.17 %	
	(0.1 to 1) kHz	0.20 %	
	(1 to 5) kHz	3.5 %	
(16.5 to 149) A	(45 to 65) Hz	0.97 %	Fluke 5500A coil w/ 5520A calibrator
	(65 to 440) Hz	1.4 %	
(150 to 1000) A	(45 to 65) Hz	1.3 %	
	(65 to 440) Hz	1.9 %	

Parameter/Range	Frequency	CMC ^{2, 4, 9} (±)	Comments
AC Current – Measure ³			
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.100 to 5) kHz	0.47 % + 30 nA 0.19 % + 30 nA 0.11 % + 30 nA 0.12 % + 30 nA	3458A option 002 DMM
(0.100 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.100 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 0.20 µA 0.18 % + 0.20 µA 0.091 % + 0.20 µA 0.061 % + 0.20 µA 0.11 % + 0.20 µA 0.47 % + 0.40 µA 0.63 % + 1.5 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.100 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 2.0 µA 0.18 % + 2.0 µA 0.091 % + 2.0 µA 0.061 % + 2.0 µA 0.085 % + 2.0 µA 0.47 % + 4.0 µA 0.63 % + 15 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.100 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 20 µA 0.18 % + 20 µA 0.091 % + 20 µA 0.061 % + 20 µA 0.090 % + 20 µA 0.68 % + 40 µA 0.63 % + 0.15 mA	
(0.100 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.100 to 5) kHz (5 to 20) kHz (20 to 50) kHz	0.48 % + 0.20 mA 0.22 % + 0.20 mA 0.15 % + 0.20 mA 0.17 % + 0.20 mA 0.37 % + 0.20 mA 1.2 % + 0.40 mA	3458A option 002 DMM
(1 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.10 % 0.30 %	Fluke 8508A
(20 to 100) A	(0.045 to 1) kHz	0.012 %	Valhalla 2575
(100 to 700) A	(48 to 62) Hz (62 to 440) Hz	3.5 % 5.8 %	Fluke 80i-1010 current probe

Parameter/Equipment	Range	CMC ^{2, 4, 9} (±)	Comments
DC Watts – Generate ³	(0.010 89 to 10.89) mW (10.890 to 99) mW (99 to 336.6) W (336.6 to 3060) W (3060 to 20 910) W	0.033 % 0.14 % 0.14 % 0.12 % 0.07 %	Fluke 5520A
AC Watts – Generate ³ , (45 to 65) Hz/PF=1	(0.1089 to 0.297) mW (0.297 to 2.97) mW (2.97 to 10.89) mW (10.89 to 72.60) mW (72.60 to 1485) mW (1.485 to 6.765) W (6.765 to 33.66) W (33.66 to 336.6) W (336.6 to 917.9) W (917.9 to 2244) W (2244 to 20 910) W	0.17 % 0.13 % 0.12 % 0.24 % 0.23 % 0.21 % 0.19 % 0.22 % 0.21 % 0.23 % 0.13 %	Fluke 5520A
Resistance – Generate ³	(1 to 10.99) Ω (11 to 32.99) Ω (33 to 109.99) Ω (110 to 329.99) Ω (0.33 to 1.099) kΩ (1.10 to 3.299) kΩ (3.3 to 10.99) kΩ (11.0 to 32.99) kΩ (33 to 109.99) kΩ (110 to 329.99) kΩ (0.33 to 1.099) MΩ (1.10 to 3.299) MΩ (3.30 to 10.99) MΩ (11.0 to 32.99) MΩ (33 to 109.99) MΩ (110 to 329.99) MΩ (0.330 to 1.0) GΩ	0.0012 Ω 0.0018 Ω 0.0049 Ω 0.0064 Ω 0.037 Ω 0.065 Ω 0.36 Ω 0.61 Ω 4.6 Ω 6.3 Ω 0.044 kΩ 0.27 kΩ 1.9 kΩ 0.013 MΩ 0.072 MΩ 1.2 MΩ 1.9 % + 0.50 MΩ	5520A calibrator

Parameter/Equipment	Range	CMC ^{2, 4, 9} (±)	Comments
Resistance – Generate ³ (cont)			
Fixed Points	0.000 3333 Ω 0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 M 10 MΩ 19 MΩ 100 MΩ	0.3 μΩ 0.5 μΩ 1.0 μΩ 10 μΩ 59 μΩ/Ω 59 μΩ/Ω 34 μΩ/Ω 35 μΩ/Ω 22 μΩ/Ω 22 μΩ/Ω 13 μΩ/Ω 14 μΩ/Ω 12 μΩ/Ω 13 μΩ/Ω 14 μΩ/Ω 15 μΩ/Ω 21 μΩ/Ω 22 μΩ/Ω 46 μΩ/Ω 52 μΩ/Ω 0.014 %	9211A Guildline 5700A calibrator
Resistance – Measure ³	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ (2 to 20) GΩ	28 μΩ/Ω 25 μΩ/Ω 17 μΩ/Ω 14 μΩ/Ω 14 μΩ/Ω 14 μΩ/Ω 19 μΩ/Ω 28 μΩ/Ω 0.014 % 0.12 % 0.23 %	8508A DMM

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Capacitance – Generate ³ (0.19 to 0.4) nF (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 330 nF 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 330 μF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	0.81 % + 0.01 nF 0.64 % + 0.01 nF 0.61 % + 0.01 nF 0.31 % + 0.01 nF 0.29 % + 0.1 nF 0.36 % + 0.1 nF 0.30 % + 0.3 nF 0.32 % + 1 nF 0.30 % + 3 nF 0.30 % + 10 nF 0.47 % + 30 nF 0.53 % + 0.1 μF 0.53 % + 0.3 μF 0.78 % + 1 μF 0.55 % + 3 μF 0.53 % + 10 μF 0.87 % + 30 μF 1.3 % + 0.1 mF	5520A calibrator
Capacitance – Measure ³ (0 to 1) pF (> 1 to 10) pF (> 10 to 100) pF	40 kHz 100 kHz 4 kHz 10 kHz 20 kHz 40 kHz 100 kHz 400 Hz 1 kHz 2 kHz 4 kHz 10 kHz 20 kHz 40 kHz 100 kHz	0.51 % + 1 fF + 6 <i>cts</i> 0.51 % + 1 fF + 3 <i>cts</i> 0.40 % + 6 <i>cts</i> 0.13 % + 3 <i>cts</i> 0.13 % + 2 <i>cts</i> 0.35 % + 1 fF + 6 <i>cts</i> 0.35 % + 1 fF + 3 <i>cts</i> 0.12 % + 6 <i>cts</i> 0.12 % + 3 <i>cts</i> 0.12 % + 2 <i>cts</i> 0.12 % + 6 <i>cts</i> 0.12 % + 3 <i>cts</i> 0.12 % + 2 <i>cts</i> 0.12 % + 6 <i>cts</i> 0.12 % + 3 <i>cts</i>	Agilent 4274A LCR Meter <i>cts</i> : Counts of LSD

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments	
Capacitance – Measure ³ (cont)				
(> 100 to 1000) nF	100 Hz	0.12 % + 3 <i>cts</i>	Agilent 4274A LCR Meter <i>cts</i> : Counts of LSD	
	120 Hz	0.12 % + 3 <i>cts</i>		
	200 Hz	0.12 % + 2 <i>cts</i>		
	400 Hz	0.12 % + 6 <i>cts</i>		
	1 kHz	0.12 % + 3 <i>cts</i>		
	2 kHz	0.12 % + 2 <i>cts</i>		
	4 kHz	0.23 % + 1 <i>cts</i>		
	10 kHz	0.35 % + 1 <i>cts</i>		
	20 kHz	0.58 % + 1 <i>cts</i>		
	40 kHz	0.23 % + 1 <i>cts</i>		
	100 kHz	0.35 % + 1 <i>cts</i>		
	(1 to 10) μF	100 Hz		0.12 % + 3 <i>cts</i>
		120 Hz		0.12 % + 3 <i>cts</i>
200 Hz		0.12 % + 2 <i>cts</i>		
400 Hz		0.23 % + 1 <i>cts</i>		
1 kHz		0.35 % + 1 <i>cts</i>		
2 kHz		0.58 % + 1 <i>cts</i>		
4 kHz		0.23 % + 1 <i>cts</i>		
10 kHz		0.35 % + 1 <i>cts</i>		
20 kHz		0.58 % + 1 <i>cts</i>		
40 kHz		0.35 % + 1 <i>cts</i>		
100 kHz	0.35 % + 1 <i>cts</i>			
(> 10 to 100) μF	100 Hz	0.35 % + 1 <i>cts</i>		
	120 Hz	0.46 % + 1 <i>cts</i>		
	200 Hz	0.58 % + 1 <i>cts</i>		
	400 Hz	0.23 % + 1 <i>cts</i>		
	1 kHz	0.35 % + 1 <i>cts</i>		
	2 kHz	0.58 % + 1 <i>cts</i>		
	4 kHz	1.2 % + 1 <i>cts</i>		
	10 kHz	1.2 % + 1 <i>cts</i>		
	20 kHz	0.35 % + 1 <i>cts</i>		

Parameter/Range	Frequency	CMC ^{2, 4, 9} (±)	Comments
Capacitance – Measure ³ (cont)			
(> 100 to 1000) µF	100 Hz	0.35 % + 1 <i>cts</i>	Agilent 4274A LCR Meter <i>cts</i> : Counts of LSD
	120 Hz	0.46 % + 1 <i>cts</i>	
	200 Hz	0.58 % + 1 <i>cts</i>	
	400 Hz	1.2 % + 1 <i>cts</i>	
	1 kHz	1.2 % + 1 <i>cts</i>	
	2 kHz	1.2 % + 1 <i>cts</i>	
	4 kHz	3.5 % + 1 <i>cts</i>	
	10 kHz	3.5 % + 1 <i>cts</i>	
	20 kHz	3.5 % + 1 <i>cts</i>	
	(1 to 10) mF	100 Hz	
120 Hz		1.2 % + 1 <i>cts</i>	
200 Hz		1.2 % + 1 <i>cts</i>	
400 Hz		3.5 % + 1 <i>cts</i>	
1 kHz		3.5 % + 1 <i>cts</i>	
2 kHz		3.5 % + 1 <i>cts</i>	
(> 10 to 100) mF	100 Hz	3.5 % + 1 <i>cts</i>	
	120 Hz	3.5 % + 1 <i>cts</i>	
	200 Hz	3.5 % + 1 <i>cts</i>	
	400 Hz	5.8 % + 1 <i>cts</i>	
	1 kHz	12 % + 1 <i>cts</i>	
	2 kHz	12 % + 1 <i>cts</i>	
(> 100 to 1000) mF	100 Hz	12 % + 1 <i>cts</i>	
	120 Hz	12 % + 1 <i>cts</i>	
	200 Hz	12 % + 1 <i>cts</i>	
Inductance – Generate ³			
1 H	(0.1 to 1) kHz	0.17 %	Standard inductors
10 mH	(0.1 to 1) kHz	0.16 %	
200 µH	10 Hz to 1 kHz	0.29 %	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments	
Inductance – Measure ³	Up to 100 nH	(100 or 120) Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	Multi-frequency LCR meter <i>cts</i> : Counts of LSD
		200 Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		400 Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		1 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		2 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		4 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		10 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		20 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		40 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		100 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
	(100 to 1000) nH	(100 or 120) Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		200 Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		400 Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		1 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		2 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		4 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		10 kHz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		20 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		40 kHz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		100 kHz	0.35 % + 0.1 nH + 3 <i>cts</i>	
	(1 to 10) μH	(100 or 120) Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		200 Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		400 Hz	1.2 % + 0.1 nH + 5 <i>cts</i>	
		1 kHz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		2 kHz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		4 kHz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		10 kHz	0.35 % + 3 <i>cts</i>	
		20 kHz	0.35 % + 3 <i>cts</i>	
		40 kHz	0.35 % + 3 <i>cts</i>	
		100 kHz	0.12 % + 3 <i>cts</i>	
	(10 to 100) μH	(100 or 120) Hz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		200 Hz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		400 Hz	0.58 % + 0.1 nH + 5 <i>cts</i>	
		1 kHz	0.35 % + 3 <i>cts</i>	
		2 kHz	0.35 % + 3 <i>cts</i>	
		4 kHz	0.35 % + 3 <i>cts</i>	
		10 kHz	0.12 % + 3 <i>cts</i>	
		20 kHz	0.12 % + 3 <i>cts</i>	
		40 kHz	0.12 % + 3 <i>cts</i>	
		100 kHz	0.23 % + 3 <i>cts</i>	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Inductance – Measure ³ (cont)			
(0.1 to 1) mH	(100 or 120) Hz	0.35 % + 3 <i>cts</i>	Multi-frequency LCR meter <i>cts</i> : counts of LSD
	200 Hz	0.35 % + 3 <i>cts</i>	
	400 Hz	0.35 % + 3 <i>cts</i>	
	1 kHz	0.12 % + 3 <i>cts</i>	
	2 kHz	0.12 % + 3 <i>cts</i>	
	4 kHz	0.12 % + 3 <i>cts</i>	
	10 kHz	0.23 % + 3 <i>cts</i>	
	20 kHz	0.23 % + 3 <i>cts</i>	
	40 kHz	0.23 % + 3 <i>cts</i>	
	100 kHz	0.12 % + 1 <i>cts</i>	
(1 to 10) mH	(100 or 120) Hz	0.12 % + 3 <i>cts</i>	
	200 Hz	0.12 % + 3 <i>cts</i>	
	400 Hz	0.12 % + 3 <i>cts</i>	
	1 kHz	0.23 % + 3 <i>cts</i>	
	2 kHz	0.23 % + 3 <i>cts</i>	
	4 kHz	0.23 % + 3 <i>cts</i>	
	10 kHz	0.12 % + 1 <i>cts</i>	
	20 kHz	0.12 % + 1 <i>cts</i>	
	40 kHz	0.12 % + 1 <i>cts</i>	
	100 kHz	0.12 % + 1 <i>cts</i>	
(10 to 100) mH	(100 or 120) Hz	0.23 % + 1 <i>cts</i>	
	200 Hz	0.23 % + 1 <i>cts</i>	
	400 Hz	0.23 % + 1 <i>cts</i>	
	1 kHz	0.12 % + 1 <i>cts</i>	
	2 kHz	0.12 % + 1 <i>cts</i>	
	4 kHz	0.12 % + 1 <i>cts</i>	
	10 kHz	0.12 % + 1 <i>cts</i>	
	20 kHz	0.12 % + 1 <i>cts</i>	
	40 kHz	0.12 % + 1 <i>cts</i>	
	100 kHz	0.12 % + 1 <i>cts</i>	

Parameter/Range	Frequency	CMC ^{2,4} (\pm)	Comments
Inductance – Measure ³ (cont)			
(0.100 to 1) H	(100 or 120) Hz	0.12 % + 1 <i>cts</i>	Multi-frequency LCR meter <i>cts</i> : Counts of LSD
	200 Hz	0.12 % + 1 <i>cts</i>	
	400 Hz	0.12 % + 1 <i>cts</i>	
	1 kHz	0.12 % + 1 <i>cts</i>	
	2 kHz	0.12 % + 1 <i>cts</i>	
	4 kHz	0.12 % + 1 <i>cts</i>	
	10 kHz	0.12 % + 1 <i>cts</i>	
	20 kHz	0.12 % + 1 <i>cts</i>	
	40 kHz	0.12 % + 1 <i>cts</i>	
	100 kHz	3.5 % + 1 <i>cts</i>	
(1 to 10) H	(100 or 120) Hz	0.12 % + 1 <i>cts</i>	
	200 Hz	0.12 % + 1 <i>cts</i>	
	400 Hz	0.12 % + 1 <i>cts</i>	
	1 kHz	0.12 % + 1 <i>cts</i>	
	2 kHz	0.12 % + 1 <i>cts</i>	
	4 kHz	0.12 % + 1 <i>cts</i>	
	10 kHz	0.35 % + 1 <i>cts</i>	
	20 kHz	0.35 % + 1 <i>cts</i>	
	40 kHz	0.35 % + 1 <i>cts</i>	
	(10 to 100) H	(100 or 120) Hz	
200 Hz		0.12 % + 1 <i>cts</i>	
400 Hz		0.12 % + 1 <i>cts</i>	
1 kHz		3.5 % + 1 <i>cts</i>	
2 kHz		3.5 % + 1 <i>cts</i>	
4 kHz		3.5 % + 1 <i>cts</i>	
(100 to 1000) H	(100 or 120) Hz	3.5 % + 1 <i>cts</i>	
	200 Hz	3.5 % + 1 <i>cts</i>	
	400 Hz	3.5 % + 1 <i>cts</i>	
	1 kHz	5.8 % + 1 <i>cts</i>	
	2 kHz	5.8 % + 1 <i>cts</i>	
	4 kHz	5.8 % + 1 <i>cts</i>	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Dissipation Factor – Measure (Df) ³ 1 pF to 100 μF	(0.0001 to 10) Df	3.5 % + 1 <i>cts</i>	Multi-frequency LCR meter <i>cts</i> : Counts of LSD
Electrical Calibration of Thermocouple Indicating Systems ³ – Simulation			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.30 °C 0.33 °C	5520A calibrator
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.30 °C 0.26 °C 0.31 °C 0.50 °C 0.84 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.50 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.40 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.40 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicating Systems ³ – Simulation (cont)			
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	5520A calibrator
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.20 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C	
Electrical Calibration of RTD Indicators ³ – Simulation			
Pt 385, 100 Ω	(-200 to 100) °C (100 to 630) °C (630 to 800) °C	0.09 °C 0.15 °C 0.27 °C	5520A calibrator
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 300) °C (300 to 630) °C	0.08 °C 0.12 °C 0.15 °C	
Pt 3916, 100 Ω	(-190 to 0.0) °C (0.0 to 260) °C (260 to 600) °C (600 to 630) °C	0.07 °C 0.09 °C 0.12 °C 0.26 °C	
Pt 385, 200 Ω	(-200 to 260) °C (260 to 400) °C (400 to 630) °C	0.07 °C 0.15 °C 0.19 °C	

Parameter/Equipment	Range	CMC ^{2, 4, 9} (±)	Comments
Electrical Calibration of RTD Indicators ³ – Simulation (cont)			
Pt 385, 500 Ω	(-200 to 260) °C (260 to 600) °C (600 to 630) °C	0.08 °C 0.11 °C 0.13 °C	5520A calibrator
Pt 385, 1000 Ω	(-200 to 100) °C (100 to 600) °C (600 to 630) °C	0.06 °C 0.08 °C 0.27 °C	
PtNi 385, 120 Ω	(-80 to 100) °C (100 to 260) °C	0.10 °C 0.16 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.35 °C	
Oscilloscopes ³ –			
Edge Rise Time			
50 Ω load @ 0.25 V _{p-p}	(1 to 999) kHz (1 to 10) MHz	0.03 % 0.03 %	5520A SC1100 calibrator
50 Ω load @ 0.5 V _{p-p}	(1 to 999) kHz (1 to 10) MHz	0.03 % 0.03 %	
50 Ω load @ 1 V _{p-p}	(1 to 999) kHz (1 to 10) MHz	0.03 % 0.03 %	
50 Ω load @ 2.5 V _{p-p}	(1 to 999) kHz (1 to 10) MHz	0.03 % 0.03 %	
DC Voltage			
1 M Ω Load	(0 to 130) V	0.058 % + 40 μV	
50 Ω Load	(0 to 6.6) V	0.29 % + 40 μV	
Square Wave			
1 M Ω Load Up to 1 kHz	1 mV to 130 V _{p-p} 1 mV to 130 V _{p-p}	0.12 % + 40 μV 0.29 % + 40 μV	
50 Ω Load ≥ 1 kHz	1 mV to 6.6 V _{p-p}	0.29 % + 40 μV	

Parameter/Equipment	Range	CMC ^{2, 4, 9} (±)	Comments
Oscilloscopes ³ – (cont)			
Flatness @ 50 Ω Reference & Relative to 50 kHz	50 kHz to 10 MHz (100 to 300) MHz (300 to 600) MHz (0.6 to 1.1) GHz	0.12 % + 0.10 mV 0.012 % + 0.10 mV 0.012 % + 0.10 mV 0.012 % + 0.10 mV	5520A SC1100 calibrator
Timing @ 1 Vp	(1 to 100) nSec (0.1 to 50) mSec (0.05 to 5) Sec	0.11 % 0.11 % 0.11 %	

V. Mechanical

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Torque ³ – Measure	(5 to 10) lbf·in (10 to 50) lbf·in (50 to 100) lbf·in (100 to 500) lbf·in (25 to 50) lbf·ft (50 to 250) lbf·ft (100 to 200) lbf·ft (200 to 1000) lbf·ft	0.30 lbf·in 0.42 lbf·in 1.2 lbf·in 3.2 lbf·in 0.69 lbf·ft 1.8 lbf·ft 2.8 lbf·ft 7.1 lbf·ft	Torque transducers w/ torque analyzer

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments	
Vacuum & Pressure – Measure ³	Compressed Air ³			
		(-12 to 0) psi	0.039 psi	Fluke 700G05 gauge
		(0 to 1) psi	0.0013 psi	Fluke 700G02 gauge
		(0 to 30) psi	0.017 psi	Fluke 2700G-BG200K
		(30 to 300) psi	0.13 psi	Fluke 3130 pressure system
		(0 to 30) in H ₂ O	0.036 in H ₂ O	Fluke 700G02 gauge
	Manometer Pressure ³	(0 to 800) in H ₂ O	0.19 in H ₂ O	Fluke 2700G-BG200K
	Absolute ³	(0 to 900) mmHg	0.5 mmHg	Miriam 350 absolute manometer
	Hydraulic – Water ³	(300 to 3000) psi	0.72 psi	Fluke 2700G-G20M ⁸
		(700 to 1000) psi (1001 to 7000) psi	4.0 psi 5.0 psi	Ashcroft 700
Force – Generate ³	(1.0 to 2.0) gf (2.0 to 10.0) gf (10.0 to 20.0) gf (20.0 to 50.0) gf (50.0 to 100.0) gf (100.0 to 200.0) gf (200.0 to 300.0) gf (300.0 to 500.0) gf (500.0 to 1000.0) gf (1000.0 to 5000.0) gf (0.25 to 1.0) lbf (1.0 to 2.0) lbf (2.0 to 5.0) lbf (5.0 to 10.0) lbf (10.0 to 20.0) lbf (20.0 to 100.0) lbf (100.0 to 200.0) lbf	2.3 x 10 ⁻⁴ gf 9.3 x 10 ⁻⁴ gf 1.9 x 10 ⁻³ gf 4.6 x 10 ⁻³ gf 9.3 x 10 ⁻³ gf 1.9 x 10 ⁻² gf 2.8 x 10 ⁻² gf 4.6 x 10 ⁻² gf 9.2 x 10 ⁻² gf 4.6 x 10 ⁻¹ gf 7.3 x 10 ⁻⁴ lbf 1.1 x 10 ⁻³ lbf 2.0 x 10 ⁻³ lbf 3.5 x 10 ⁻³ lbf 2.6 x 10 ⁻³ lbf 9.2 x 10 ⁻³ lbf 1.6 x 10 ⁻² lbf	Reference weights	

VI. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Infrared – Measuring Equipment ³	(30 to 100) °C (100 to 500) °C (500 to 1000) °C (1000 to 1100) °C (1100 to 1400) °C (1400 to 1500) °C	3.4 °C 6.5 °C 7 °C 9 °C 10 °C 11 °C	Black body sources Mikron 305, 310, 335
Infrared – Measure ³	(30 to 100) °C (100 to 150) °C (150 to 200) °C (200 to 250) °C (160 to 500) °C (500 to 900) °C (900 to 1300) °C (1300 to 1650) °C	2.4 °C 3.5 °C 4.7 °C 6 °C 3 °C 4 °C 5 °C 5 °C	Infrared camera Fluke VT04 Infrared camera Williamson SW-22- 45C-FOV
Relative Humidity – Measure ³	(15 to 30) % RH (30 to 80) % RH (80 to 95) % RH	1.4 % RH 1.5 % RH 2.5 % RH	Vaisala HMP77B
Temperature – Measuring Equipment ³	(-25 to 0.0) °C (0 to 25) °C (25 to 150) °C (150 to 200) °C (200 to 300) °C (300 to 350) °C (350 to 400) °C (400 to 550) °C (550 to 660) °C	0.056 °C 0.062 °C 0.078 °C 0.078 °C 0.091 °C 0.092 °C 0.092 °C 0.12 °C 0.13 °C	Fluke 9142 w/ Fluke 5609 SPRT Fluke 9144 w/ Fluke 5609 SPRT

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Temperature – Measure ³	(-196 to -39) °C	0.052 °C	Fluke 5609 SPRT
	(-39 to 0.0) °C	0.073 °C	
	(0.0 to 232) °C	0.050 °C	
	(232 to 420) °C	0.061 °C	
	(420 to 550) °C	0.064 °C	
	(550 to 660) °C	0.096 °C	Pyromation S-type probe
	(660 to 700) °C	3.8 °C	
	(700 to 800) °C	4.0 °C	
	(800 to 900) °C	4.0 °C	
	(900 to 1000) °C	4.0 °C	

VII. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Frequency – Measuring Equipment	10 MHz 5 MHz 1 Hz	5.8 x 10 ⁻⁹ MHz 6.5 x 10 ⁻¹⁰ MHz 6.5 x 10 ⁻¹⁰ MHz	Fluke 910 GPS receiver
Frequency – Measure ³	20 Hz to 200 MHz (> 200 to 550) MHz (> 550 to 1300) MHz	2.5 x 10 ⁻⁴ MHz 9.2 x 10 ⁻⁴ MHz 1.3 x 10 ⁻³ MHz	Frequency counter & differential meter w/ GPS 8901

¹ This laboratory offers commercial 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 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.

⁴The 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 percent or fraction of the reading plus a fixed floor specification.

⁵This scope meets A2LA's *PI12 Flexible Scope Policy*.

⁶The 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.

⁷This laboratory meets *R205 – Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

⁸Uncertainty includes linearity, hysteresis, repeatability, resolution, reference uncertainty, 1 year long term stability, and temperature effects from 18 to 28 °C.

⁹In the statement of CMC a % denotes a percent of reading unless otherwise noted.



Accredited Laboratory

A2LA has accredited

CENTURY CALIBRATION LAB, LLC

Fort Wayne, IN

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/NCCL 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 15th day of September 2022.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2417.01
Valid to May 31, 2024

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