SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: July 31, 2024 Certificate Number: 4038.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 6]:

I. Acoustical Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Sound Level –			
Measuring Devices @ 1 kHz	94 dB 114 dB	0.26 dB 0.26 dB	Comparison with: sound level calibrator
Frequency	1 kHz	0.070 Hz	Frequency source
Calibrators @ 1 kHz	60 dB (> 60 to 90) dB (> 90 to 94) dB (> 94 to 110) dB (> 110 to 114) dB	0.90 dB 1.1 dB 0.99 dB 1.7 dB 0.87 dB	Sound level meter
Calibrators @ 250 Hz	94 dB 114 dB	0.90 dB 0.90 dB	

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II. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calipers[3] –			
Exterior	(1.0 to 200) mm (> 200 to 400) mm (> 400 to 500) mm (0.0625 to 4.0) in (> 4.0 to 8.0) in (> 8.0 to 12) in	7.4 µm 7.7 µm 8.1 µm 290 µin 340 µin 350 µin	Comparison with master gauge blocks
Interior	(1.0 to 400) mm (> 400 to 500) mm (0.0625 to 12) in	8.2 µm 8.3 µm 370 µin	
Depth	(1.0 to 500) mm (0.0625 to 12) in	7.1 µm 330 µin	
Depth Gauges[3]	(1.0 to 100) mm (> 100 to 500) mm (0.0625 to 12) in	5.8 µm 5.9 µm 290 µin	Comparison with master gauge blocks
Depth Micrometers[3]	(1.0 to 25) mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm (> 100 to 125) mm (> 125 to 150) mm (> 150 to 175) mm (> 175 to 200) mm (> 200 to 225) mm (> 225 to 250) mm (> 250 to 275) mm (> 275 to 300) mm (> 300 to 325) mm (> 325 to 350) mm (> 350 to 375) mm (> 375 to 400) mm (> 400 to 425) mm (> 425 to 450) mm (> 450 to 500) mm	0.59 µm 0.61 µm 0.63 µm 0.67 µm 0.68 µm 0.70 µm 0.71 µm 0.84 µm 0.85 µm 0.86 µm 0.88 µm 0.91 µm 0.92 µm 0.93 µm 0.94 µm 0.97 µm 0.98 µm 0.99 µm 1.0 µm	Comparison with master gauge blocks

Parameter/Equipment	Range	CMC[2] (±)	Comments
Depth Micrometers[3] (cont)	(0.0625 to 0.5) in (> 0.5 to 1.5) in (> 1.5 to 2.5) in (> 2.5 to 3.25) in (> 3.25 to 3.75) in (> 3.75 to 4.25) in (> 4.25 to 5) in (> 5 to 6.5) in (> 6.5 to 7.5) in (> 7.5 to 8) in (> 8 to 9) in (> 9 to 10) in (> 10 to 11) in (> 11 to 12) in	58 µin 59 µin 60 µin 61 µin 62 µin 64 µin 65 µin 66 µin 67 µin 69 µin 70 µin 71 µin 72 µin 73 µin	Comparison with master gauge blocks
Height Gauges[3]	(1.0 to 200) mm (> 450 to 500) mm (0.0625 to 12) in	6.0 µm 6.1 µm 300 µin	Comparison with master gauge blocks
Indicators[3]	(1.0 to 25) mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm (> 100 to 125) mm (> 125 to 150) mm (> 150 to 175) mm (> 175 to 200) mm (0.0625 to 0.5) in (> 0.5 to 1.5) in (> 1.5 to 2.5) in (> 2.5 to 3.25) in (> 3.25 to 3.75) in (> 3.75 to 4.25) in (> 4.25 to 5) in (> 5 to 6.5) in (> 6.5 to 7.5) in (> 7.5 to 8) in	0.59 µm 0.61 µm 0.63 µm 0.67 µm 0.68 µm 0.70 µm 0.71 µm 0.84 µm 58 µin 59 µin 60 µin 61 µin 62 µin 64 µin 65 µin 66 µin 67 µin 64 µin	Comparison with master gauge blocks
Inside Micrometers[3]	(1.0 to 25) mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm (> 100 to 125) mm (> 125 to 150) mm	0.59 µm 0.61 µm 0.63 µm 0.67 µm 0.68 µm 0.70 µm	Comparison with master gauge blocks

Parameter/Equipment	Range	CMC[2] (±)	Comments
Inside Micrometers[3] (cont)	(> 150 to 175) mm (> 175 to 200) mm (> 200 to 225) mm (> 225 to 250) mm (> 250 to 275) mm (> 275 to 300) mm (> 300 to 325) mm (> 325 to 350) mm (> 350 to 375) mm (> 375 to 400) mm (> 400 to 425) mm (> 425 to 450) mm (> 450 to 500) mm (0.0625 to 0.5) in (> 0.5 to 1.5) in (> 1.5 to 2.5) in (> 2.5 to 3.25) in (> 3.25 to 3.75) in (> 3.75 to 4.25) in (> 4.25 to 5) in (> 5 to 6.5) in (> 6.5 to 7.5) in (> 7.5 to 8) in (> 8 to 9) in (> 9 to 10) in (> 10 to 11) in (> 11 to 12) in	0.71 µm 0.84 µm 0.85 µm 0.86 µm 0.88 µm 0.91 µm 0.92 µm 0.93 µm 0.94 µm 0.97 µm 0.98 µm 0.99 µm 1.0 µm 58 µin 59 µin 60 µin 61 µin 62 µin 64 µin 65 µin 66 µin 67 µin 69 µin 70 µin 71 µin 72 µin 73 µin	Comparison with master gauge blocks
Outside Micrometers[3]	(1.0 to 25) mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm (> 100 to 125) mm (> 125 to 150) mm (> 150 to 175) mm (> 175 to 200) mm (> 200 to 225) mm (> 225 to 250) mm (> 250 to 275) mm (> 275 to 300) mm (> 300 to 325) mm (> 325 to 350) mm (> 350 to 375) mm (> 375 to 400) mm (> 400 to 425) mm (> 425 to 450) mm (> 450 to 500) mm	0.59 µm 0.61 µm 0.63 µm 0.67 µm 0.68 µm 0.70 µm 0.71 µm 0.84 µm 0.85 µm 0.86 µm 0.88 µm 0.91 µm 0.92 µm 0.93 µm 0.94 µm 0.97 µm 0.98 µm 0.99 µm 1.0 µm	Comparison with master gauge blocks

Parameter/Equipment	Range	CMC[2] (±)	Comments
Outside Micrometers[3] (cont)	(0.0625 to 0.5) in (> 0.5 to 1.5) in (> 1.5 to 2.5) in (> 2.5 to 3.25) in (> 3.25 to 3.75) in (> 3.75 to 4.25) in (> 4.25 to 5) in (> 5 to 6.5) in (> 6.5 to 7.5) in (> 7.5 to 8) in (> 8 to 9) in (> 9 to 10) in (> 10 to 11) in (> 11 to 12) in	58 µin 59 µin 60 µin 61 µin 62 µin 64 µin 65 µin 66 µin 67 µin 69 µin 70 µin 71 µin 72 µin 73 µin	Comparison with master gauge blocks
Thickness Gauges[3]	23.3 µm (> 23.3 to 51.6) µm (> 51.6 to 124.6) µm (> 124.6 to 250.3) µm (> 250.3 to 486) µm (> 486 to 963) µm (1 to 25) mm (> 25 to 50) mm 0.92 mil (> 0.92 to 2.03) mil (> 2.03 to 4.91) mil (> 4.91 to 9.85) mil (> 9.85 to 19.13) mil (> 19.13 to 37.91) mil (0.0625 to 0.5) in (> 0.5 to 1.5) in (> 1.5 to 2.5) in (> 2.5 to 3.25) in (> 3.25 to 3.75) in (> 3.75 to 4.0) in	1.0 µm 0.95 µm 3.0 µm 1.2 µm 0.96 µm 5.0 µm 0.59 µm 0.61 µm 67 µin 65 µin 130 µin 70 µin 65 µin 200 µin 58 µin 59 µin 60 µin 61 µin 62 µin 64 µin	Comparison with master gauge blocks
Clinometers, Inclinometers & Electronic Levels	0.25° (0.25 to 0.5)° (0.5 to 1)° (1 to 2)° (2 to 3)° (3 to 4)° (4 to 5)° (5 to 10)°	0.0061° 0.0066° 0.0061° 0.0059° 0.0084° 0.0058° 0.0062° 0.0068°	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Clinometers, Inclinometers, & Electronic Levels (cont)	(10 to 15)º (15 to 20)º (20 to 25)º (25 to 30)º (30 to 40)º (40 to 50)º (50 to 60)º (60 to 70)º (70 to 80)º (80 to 90)º (90 to 100)º (100 to 110)º (110 to 116)º	0.0065º 0.0058º 0.0060º 0.0061º 0.0062º 0.0060º 0.0064º 0.0059º 0.0069º 0.0060º 0.0073º 0.0075º 0.014º	Comparison with angle blocks
Protractor – Digital & Mechanical	0.25° (0.25 to 0.5)º (0.5 to 1)º (1 to 2)º (2 to 3)º (3 to 4)º (4 to 5)º (5 to 10)º (10 to 15)º (15 to 20)º (20 to 25)º (25 to 30)º (30 to 40)º (40 to 50)º (50 to 60)º (60 to 70)º (70 to 80)º (80 to 90)º (90 to 100)º (100 to 110)º (110 to 116)º	0.0061° 0.0066º 0.0061º 0.0059º 0.0084º 0.0058º 0.0062º 0.0068º 0.0065º 0.0058º 0.0060º 0.0061º 0.0062º 0.0060º 0.0064º 0.0059º 0.0069º 0.0060º 0.0073º 0.0075º 0.014º	Comparison with angle blocks
Tape Measures, Rulers	(0 to 0.7) m (0.7 to 0.8) m (0.8 to 0.9) m (0.9 to 1) m (1 to 3) m (3 to 4) m (4 to 5) m (5 to 20) m (20 to 60) m (60 to 80) m (80 to 100) m	0.66 mm 0.67 mm 0.68 mm 0.69 mm 1.0 mm 1.3 mm 1.1 mm 1.3 mm 2.4 mm 2.5 mm 3.5 mm	Comparison with reference rulers, tape measures

Parameter/Equipment	Range	CMC[2] (±)	Comments
Tape Measures, Rulers (cont)	(0 to 60) ft (60 to 120) ft (120 to 180) ft (180 to 240) ft (240 to 360) ft	0.018 in 0.042 in 0.045 in 0.080 in 0.12 in	Comparison with reference tape measure

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Voltage[3] – Measure	Up to 50 mV (50 to 100) mV (100 to 500) mV (0.5 to 1) V (1 to 5) V (5 to 10) V (10 to 50) V (50 to 100) V (100 to 500) V (0.5 to 1) kV (1 to 2) kV (2 to 3) kV (3 to 4) kV (4 to 6) kV (6 to 8) kV (8 to 10) kV (10 to 12) kV Up to 6 kV (6 to 15) kV (15 to 30) kV (30 to 42) kV (42 to 60) kV	1.8 µV 1.6 µV 6.4 µV 7.5 µV 65 µV 75 µV 0.80 mV 1.4 mV 14 mV 15 mV 50 V 56 V 62 V 77 V 90 V 0.10 kV 0.12 kV 5.8 V 6.1 V 6.8 V 7.7 V 9.4 V	Precision multimeter & divider
DC Voltage[3] – Generate	Up to 10 mV (10 to 100) mV (100 to 220) mV (0.22 to 1) V (1 to 2.2) V (2.2 to 10) V	9.2 µV 9.3 µV 16 µV 51 µV 0.14 mV 0.42 mV	Multifunction calibrator

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Voltage[3] – Generate (cont)	(10 to 20) V (20 to 100) V (100 to 200) V (200 to 220) V (0.22 to 1) kV	0.80 mV 5.1 mV 10 mV 17 mV 51 mV	Multifunction calibrator
Resistance[3] – Generate			
Simulated	Up to 30 Ω (30 to 100) Ω (100 to 300) Ω (0.3 to 1) kΩ (1 to 2) kΩ (2 to 3) kΩ (3 to 4) kΩ (4 to 6) kΩ (6 to 8) kΩ (8 to 10) kΩ (10 to 30) kΩ (30 to 100) kΩ (100 to 300) kΩ (0.3 to 1) MΩ (1 to 3) MΩ (3 to 10) MΩ (10 to 20) MΩ (20 to 30) MΩ (30 to 40) MΩ (40 to 50) MΩ (50 to 60) MΩ (60 to 70) MΩ (70 to 80) MΩ (80 to 90) MΩ (90 to 100) MΩ (100 to 200) MΩ (200 to 400) MΩ (400 to 600) MΩ (600 to 800) MΩ (0.8 to 1) GΩ (1 to 2) GΩ (2 to 4) GΩ (4 to 6) GΩ (6 to 8) GΩ (8 to 10) GΩ (10 to 20) GΩ (20 to 40) GΩ (40 to 60) GΩ (60 to 80) GΩ	68 mΩ 93 mΩ 0.16 Ω 0.41 Ω 0.76 Ω 1.1 Ω 1.4 Ω 2.2 Ω 2.9 Ω 3.6 Ω 12 Ω 35 Ω 0.12 kΩ 0.35 kΩ 1.2 kΩ 3.6 kΩ 0.23 MΩ 0.35 MΩ 0.46 MΩ 0.58 MΩ 0.69 MΩ 0.81 MΩ 0.92 MΩ 1.0 MΩ 1.2 MΩ 2.9 MΩ 5.8 MΩ 8.7 MΩ 12 MΩ 15 MΩ 25 MΩ 0.24 GΩ 0.35 GΩ 0.47 GΩ 0.58 GΩ 0.61 GΩ 0.68 GΩ 0.78 GΩ 0.90 GΩ	Multifunction calibrator EXTHV multiplier

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Resistance[3] – Generate (cont)			
Simulated	(80 to 100) GΩ (100 to 200) GΩ (200 to 400) GΩ (400 to 600) GΩ (600 to 800) GΩ (0.8 to 1) TΩ	1.0 GΩ 1.8 GΩ 3.5 GΩ 5.2 GΩ 7.0 GΩ 8.7 GΩ	Multifunction calibrator EXTHV multiplier
Resistance[3] – Generate			
Passive 2 Wire	0.16 Ω 0.252 Ω 1.227 Ω 10.167 Ω 100.225 Ω 1.002 kΩ 9.999 92 kΩ 99.9956 kΩ 0.999 964 MΩ 10.004 07 MΩ 100 MΩ 0.99202 GΩ 0.0515 Ω 0.0587 Ω 0.1091 Ω 0.1260 Ω 0.1766 Ω 0.2322 Ω 0.2839 Ω 0.3547 Ω 0.4071 Ω 0.4940 Ω 0.5467 Ω 0.9750 Ω 1.0265 Ω 4.9961 Ω 5.0428 Ω 9.0307 Ω 9.0819 Ω 90.403 Ω 90.470 Ω 905.644 Ω 905.650 Ω	5.9 mΩ 5.9 mΩ 6 mΩ 7.3 mΩ 13 mΩ 0.10 Ω 1 Ω 9.6 Ω 0.19 kΩ 5.3 kΩ 0.65 MΩ 14 MΩ 5.0 mΩ 5.1 mΩ 5.4 mΩ 5.5 mΩ 5.8 mΩ 6.1 mΩ 6.4 mΩ 6.8 mΩ 7.1 mΩ 7.6 mΩ 7.8 mΩ 10 mΩ 11 mΩ 34 mΩ 34 mΩ 57 mΩ 57 mΩ 0.53 Ω 0.53 Ω 5.2 Ω 5.5 Ω	Multifunction calibrator

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Resistance[3] – Generate Passive 4 Wire	100 mΩ 1.0032 Ω 10.008 494 Ω 99.998 26 Ω 1.000 008 kΩ 9.999 656 kΩ 99.9956 kΩ	5.8 mΩ 5.9 mΩ 7.2 mΩ 13 mΩ 0.10 Ω 1.0 Ω 9.6 Ω	Multifunction calibrator
Resistance[3] – Measure 2 Wire	Up to 1 Ω (1 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 (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ	32 µΩ 0.20 mΩ 1.6 mΩ 14 mΩ 0.16 Ω 0.36 Ω 20 Ω 0.35 kΩ 72 kΩ 3.0 MΩ 0.38 GΩ 5.2 GΩ	Precision multimeter
Resistance[3] – Measure 4 Wire	Up to 1 Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ	32 µΩ 0.20 mΩ 1.6 mΩ 14 mΩ 0.16 Ω 0.36 Ω	Precision multimeter, comparison with Transmille 8081
Capacitance[3] – Generate, @ 1 kHz	1.0813 nF 10.089 nF 20.007 nF 50.43 nF 100.32 nF 0.9946 µF 9.907 µF	4.6 pF 18 pF 88 pF 0.22 nF 0.41 nF 4.1 nF 21 nF	Multifunction calibrator
Capacitance[3] – Generate, (Simulated)	105.68 µF 1.052 mF 10.383 mF	1.0 µF 17 µF 0.17 mF	Multifunction calibrator

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Current[3] – Measure	Up to 10 nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 50) µA (50 to 100) µA (100 to 500) µA (0.5 to 1) mA (1 to 5) mA (5 to 10) mA (10 to 50) mA (50 to 100) mA (100 to 500) mA (0.5 to 1) A (1 to 5) A (5 to 10) A (10 to 20) A (20 to 30) A	0.33 nA 0.44 nA 0.48 nA 0.71 nA 1.4 pA 1.5 pA 17 pA 18 pA 0.19 µA 0.22 µA 3.8 µA 5.8 µA 0.14 mA 0.26 mA 3.5 mA 6.3 mA 21 mA 29 mA	Precision multimeter comparison
DC Current[3] – Generate	Up to 100 µA (100 to 210) µA (0.21 to 1) mA (1 to 2.1) mA (2.1 to 5) mA (5 to 10) mA (10 to 21) mA (21 to 100) mA (100 to 210) mA (0.21 to 1) A (1 to 2.1) A (2.1 to 10) A (10 to 20) A (20 to 30) A	61 nA 75 nA 0.11 µA 0.63 µA 0.82 µA 1.2 µA 1.8 µA 13 µA 23 µA 0.19 mA 0.32 mA 5.5 mA 10 mA 15 mA	Multifunction calibrator
DC Current[3] – Clamp-On Meters	(1 to 19) A (> 19 to 100) A (> 100 to 500) A (> 500 to 1500) A	0.63 A 1.1 A 3.6 A 8.9 A	Multifunction calibrator & coil

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
DC Power[3] – Generate			
Voltage Out = 20 V	Up to 1 mA (> 1 to 10) mA (> 10 to 100) mA (> 100 to 300) mA (> 0.3 to 2) A (> 2 to 3) A (> 3 to 20) A	0.021 % 0.018 % 0.017 % 0.035 % 0.040 % 0.047 % 0.034 %	Multifunction calibrator
Current Out = 3 A	Up to 20 V (> 20 to 200) V (> 200 to 1000) V	0.034 % 0.036 % 0.050 %	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Measure			
(0 to 20) mV	40 Hz	38 µV	Precision multimeter
(0 to 20) mV	(40 to 206) Hz	24 µV	
(0 to 20) mV	206 Hz to 1 kHz	20 µV	
(20 to 50) mV	40 Hz	63 µV	
(20 to 50) mV	(40 to 206) Hz	34 µV	
(20 to 50) mV	206 Hz to 1 kHz	29 µV	
(0 to 100) mV	45 Hz	49 µV	
(50 to 100) mV	(40 to 106) Hz	51 µV	
(50 to 100) mV	106 Hz to 1 kHz	45 µV	
(0 to 100) mV	(1 to 20) kHz	59 µV	
(0 to 100) mV	(20 to 50) kHz	0.17 mV	
(0 to 100) mV	(50 to 100) kHz	0.19 mV	
(0.1 to 0.2) V	40 Hz	0.31 mV	
(0.1 to 0.2) V	40 Hz to 1 kHz	0.12 mV	
(0.2 to 0.5) V	40 Hz	0.54 mV	
(0.2 to 0.5) V	40 Hz to 1 kHz	0.23 mV	
(0 to 1) V	10 Hz	0.96 mV	
(0.1 to 1) V	(45 to 106) Hz	0.40 mV	
(0.1 to 1) V	106 Hz to 1 kHz	0.34 mV	
(0.1 to 1) V	(1 to 10) kHz	0.54 mV	
(0.1 to 1) V	(10 to 20) kHz	1.1 mV	
(0.1 to 1) V	(20 to 100) kHz	1.7 mV	
(0 to 1) V	100 kHz to 1 MHz	47 mV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Measure (cont)			
(1 to 2) V	40 Hz	3.1 mV	Precision multimeter
(1 to 2) V	40 Hz to 1 kHz	1.2 mV	
(2 to 5) V	40 Hz	5.3 mV	
(2 to 5) V	40 Hz to 1 kHz	2.3 mV	
(1 to 10) V	10 Hz	9.6 mV	
(5 to 10) V	(45 to 106) Hz	4.0 mV	
(5 to 10) V	106 Hz to 1 kHz	3.3 mV	
(1 to 10) V	(1 to 10) kHz	5.5 mV	
(1 to 10) V	(10 to 20) kHz	11 mV	
(1 to 10) V	(20 to 100) kHz	17 mV	
(10 to 20) V	45 Hz	17 mV	
(10 to 20) V	45 to 1 kHz	15 mV	
(10 to 20) V	(1 to 10) kHz	22 mV	
(10 to 20) V	(10 to 20) kHz	84 mV	
(5 to 50) V	40 Hz	59 mV	
(10 to 50) V	40 Hz to 1 kHz	27 mV	
(10 to 100) V	(10 to 23) Hz	0.10 V	
(50 to 100) V	(45 to 106) Hz	47 mV	
(50 to 100) V	106 Hz to 1 kHz	42 mV	
(20 to 100) V	(1 to 10) kHz	63 mV	
(20 to 100) V	(10 to 20) kHz	0.20 V	
(10 to 100) V	(20 to 50) kHz	0.20 V	
(0.1 to 0.2) kV	1 kHz	0.14 V	
(0.1 to 0.7) kV	45 Hz	0.36 V	
(0.1 to 0.7) kV	(45 to 106) Hz	0.46 V	
(0.1 to 0.7) kV	(106 to 206) Hz	0.42 V	
(0.2 to 0.7) kV	206 Hz to 1 kHz	0.58 V	
(0.1 to 0.7) kV	(1 to 10) kHz	0.65 V	
(0.7 to 1) kV	56 Hz	0.62 V	
(0.7 to 1) kV	56 Hz to 1 kHz	0.58 V	
(0.7 to 1) kV	(1 to 10) kHz	0.90 V	
(1 to 2) kV	50 Hz	44 V	
(2 to 3) kV	50 Hz	52 V	
(3 to 4) kV	50 Hz	59 V	
(4 to 6) kV	50 Hz	0.10 kV	
(6 to 8) kV	50 Hz	0.13 kV	
(8 to 10) kV	50 Hz	0.16 kV	
(10 to 12) kV	50 Hz	0.18 kV	
(0 to 10) kV	(50 to 75) Hz	0.33 kV	Digital voltage check meter
(10 to 20) kV	(50 to 75) Hz	0.40 kV	
(20 to 30) kV	(50 to 75) Hz	0.63 kV	
(30 to 40) kV	(50 to 75) Hz	0.99 kV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Measure (cont)			
(40 to 50) kV	(50 to 75) Hz	1.2 kV	Digital voltage check meter
(50 to 60) kV	(50 to 75) Hz	1.4 kV	
(60 to 70) kV	(50 to 75) Hz	1.6 kV	
(70 to 80) kV	(50 to 75) Hz	1.7 kV	
Up to 1 kV rms	60 Hz	6.1 V	Precision multimeter & voltage divider
(1 to 4) kV rms	60 Hz	11 V	
(4 to 11) kV rms	60 Hz	21 V	
(11 to 21) kV rms	60 Hz	39 V	
(21 to 32) kV rms	60 Hz	59 V	
(32 to 42) kV rms	60 Hz	77 V	
AC Voltage[3] – Generate			
(0 to 20) mV	(40 to 206) Hz	46 µV	Multifunction calibrator
(20 to 200) mV	10 Hz	0.66 mV	
(20 to 200) mV	40 Hz to 1 kHz	0.29 mV	
(20 to 200) mV	100 kHz	2.7 mV	
(20 to 200) mV	500 kHz	2.6 mV	
(0.2 to 0.21) V	(40 to 206) Hz	0.26 mV	
(0.2 to 0.21) V	100 kHz	0.33 mV	
(0.21 to 1) V	206 Hz	0.64 mV	
(1 to 1.5) V	206 Hz	0.89 mV	
(0.2 to 2) V	10 Hz	1.3 mV	
(0.21 to 2) V	40 Hz	1.1 mV	
(0.21 to 2) V	(56 to 206) Hz	1.1 mV	
(0.21 to 2) V	(1 to 10) kHz	10 mV	
(0.21 to 2) V	(10 to 100) kHz	19 mV	
(0.21 to 2) V	(100 to 500) kHz	20 mV	
(2 to 2.1) V	(40 to 206) Hz	2.4 mV	
(2 to 2.1) V	100 kHz	60 mV	
(2.1 to 10) V	200 Hz	6.1 mV	
(10 to 15) V	200 Hz	8.4 mV	
(2 to 20) V	10 Hz	63 mV	
(2.0 to 20) V	40 Hz to 1 kHz	11 mV	
(2.0 to 20) V	(5 to 20) kHz	19 mV	
(2.0 to 20) V	(20 to 100) kHz	0.12 V	
(20 to 21) V	(40 to 206) Hz	23 mV	
(20 to 21) V	20 kHz	88 mV	
(21 to 100) V	206 Hz	63 mV	
(20 to 200) V	30 Hz	0.17 V	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Generate (cont)			
(20 to 200) V	40 Hz to 1 kHz	0.11 V	Multifunction calibrator
(20 to 200) V	(1 to 10) kHz	0.30 V	
(20 to 200) V	(10 to 20) kHz	0.44 V	
(200 to 210) V	(40 to 206) Hz	0.045 V	
(200 to 210) V	206 Hz to 10 kHz	0.10 V	
(0.21 to 0.7) kV	30 Hz to 1 kHz	0.80 V	
(0.21 to 0.7) kV	(1 to 10) kHz	2.0 V	
(0.7 to 1) kV	56 Hz	0.63 V	
AC Current[3] – Measure			
(0 to 25) µA	1 kHz	0.21 µA	Precision multimeter
(0 to 100) µA	10 Hz	0.50 µA	
(0 to 100) µA	(10 to 45) Hz	0.22 µA	
(0 to 100) µA	45 Hz to 1 kHz	0.21 µA	
(0.1 to 0.2) mA	(40 to 206) Hz	0.34 µA	
(0.1 to 0.2) mA	206 Hz to 1 kHz	0.30 µA	
(0.2 to 0.5) mA	40 Hz to 1 kHz	0.50 µA	
(0.1 to 1) mA	10 Hz	1.3 µA	
(0.5 to 1) mA	(10 to 45) Hz	0.76 µA	
(0.5 to 1) mA	45 Hz to 1 kHz	0.69 µA	
(0 to 1) mA	(1 to 10) kHz	2.7 µA	
(1 to 2) mA	(40 to 206) Hz	2.5 µA	
(1 to 2) mA	206 Hz to 1 kHz	2.4 µA	
(2 to 5) mA	40 Hz to 1 kHz	4.5 µA	
(1 to 10) mA	10 Hz	13 µA	
(5 to 10) mA	(10 to 45) Hz	7.2 µA	
(5 to 10) mA	45 Hz to 1 kHz	6.7 µA	
(1 to 10) mA	(1 to 10) kHz	18 µA	
(10 to 20) mA	40 Hz to 1 kHz	24 µA	
(20 to 50) mA	40 Hz to 1 kHz	39 µA	
(10 to 100) mA	10 Hz	0.11 mA	
(20 to 100) mA	(10 to 45) Hz	66 µA	
(20 to 100) mA	45 Hz to 1 kHz	64 µA	
(10 to 100) mA	(1 to 10) kHz	0.15 mA	
(0.1 to 0.2) A	40 Hz to 1 kHz	0.31 mA	
(0.2 to 0.5) A	40 Hz to 1 kHz	0.53 mA	
(0.1 to 1) A	10 Hz	1.3 mA	
(0.5 to 1) A	(10 to 45) Hz	0.85 mA	
(0.5 to 1) A	45 Hz to 1 kHz	0.83 mA	
(0.1 to 1) A	(1 to 10) kHz	1.8 mA	
(1 to 2) A	(40 to 206) Hz	5.7 mA	
(1 to 2) A	206 Hz to 1 kHz	6.0 mA	
(2 to 5) A	40 Hz to 1 kHz	9.2 mA	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Current[3] – Measure (cont)			
(1 to 10) A	10 Hz	19 mA	Precision multimeter
(5 to 10) A	10 Hz to 1 kHz	15 mA	
(10 to 20) A	45 Hz to 1 kHz	33 mA	
(20 to 30) A	45 Hz to 1 kHz	46 mA	
(0 to 3) A	50 Hz	0.96 A	Precision multimeter & clamp meter
(3 to 9) A	50 Hz	0.97A	
(9 to 15) A	50 Hz	0.98 A	
(15 to 21) A	50 Hz	1.7 A	
(21 to 27) A	50 Hz	1.7 A	
(27 to 90) A	50 Hz	1.7 A	
(90 to 150) A	50 Hz	5.5 A	
(150 to 250) A	50 Hz	5.6 A	
(250 to 750) A	50 Hz	14 A	
(750 to 1000) A	50 Hz	14 A	
(1000 to 1300) A	50 Hz	14 A	
(1300 to 1450) A	50 Hz	14 A	
AC Current[3] – Generate			
(0 to 25) µA	(40 to 206) Hz	0.51 µA	Multifunction calibrator
(0 to 25) µA	206 Hz to 1 kHz	0.53 µA	
(25 to 200) µA	10 Hz	0.99 µA	
(25 to 200) µA	(40 to 56) Hz	0.60 µA	
(25 to 200) µA	56 Hz to 10 kHz	4.1 µA	
(0.2 to 0.21) mA	(40 to 206) Hz	0.81 µA	
(0.2 to 0.21) mA	206 Hz to 10 kHz	3.2 µA	
(0.20 to 2) mA	10 Hz	6.8 µA	
(0.21 to 2) mA	40 Hz to 1 kHz	2.0 µA	
(0.21 to 2) mA	(1 to 10) kHz	21 µA	
(2 to 2.1) mA	(40 to 206) Hz	7.8 µA	
(2 to 2.1) mA	206 Hz to 10 kHz	25 µA	
(2.1 to 10) mA	56 Hz	13 µA	
(2 to 20) mA	10 Hz	66 µA	
(2 to 20) mA	(10 to 40) Hz	20 µA	
(2 to 20) mA	40 Hz to 10 kHz	0.14 mA	
(20 to 21) mA	(40 to 206) Hz	78 µA	
(20 to 21) mA	206 Hz to 10 kHz	0.25 mA	
(20 to 200) mA	10 Hz	0.66 mA	
(21 to 200) mA	40 Hz to 1 kHz	0.20 mA	
(21 to 200) mA	(1 to 10) kHz	1.4 mA	
(0.2 to 0.21) A	(40 to 206) Hz	0.82 mA	
(0.2 to 0.21) A	206 Hz to 5 kHz	2.8 mA	
(0.2 to 2) A	10 Hz	6.6 mA	
(0.21 to 2) A	40 Hz to 1 kHz	2.3 mA	

Parameter/Range	Frequency	CMC[2, 4, 7] (±)	Comments
AC Current[3] – Generate (cont)			
(0.21 to 2) A	5 kHz	17 mA	Multifunction calibrator
(2 to 2.1) A	(40 to 206) Hz	15 mA	
(2 to 20) A	10 Hz	60 mA	
(2.1 to 20) A	40 Hz to 1 kHz	87 mA	
(21 to 30) A	56 Hz	12 mA	
AC Current[3] – Clamp-On Meters			
(1 to 19) A	50 Hz	0.63 A	Multifunction calibrator and coil
(> 19 to 100) A		1.1 A	
(> 100 to 500) A		3.6 A	
(> 500 to 1500) A		8.9 A	
AC Power[3] – Generate, PF = 1			
Voltage Out = 20 V:			Multifunction calibrator
Up to 10 A	45 Hz	0.091 %	
Up to 0.3 mA	56 Hz	0.18 %	
(> 0.3 to 1) mA	56 Hz	0.10 %	
(> 1 to 2) mA	56 Hz	0.25 %	
(> 2 to 10) mA	56 Hz	0.099 %	
(> 10 to 20) mA	56 Hz	0.24 %	
(> 20 to 100) mA	56 Hz	0.10 %	
(> 0.1 to 0.3) A	56 Hz	0.24 %	
(> 0.3 to 2) A	56 Hz	0.11 %	
(> 2 to 2.5) A	56 Hz	0.16 %	
(> 2.5 to 5) A	56 Hz	0.11 %	
(> 5 to 10) A	56 Hz	0.089 %	
(> 10 to 15) A	56 Hz	0.083 %	
(> 15 to 30) A	56 HZ	0.076 %	
Up to 10 A	206 Hz	0.26 %	
Up to 100 mA	400 Hz	0.10 %	
(> 0.1 to 2) A	400 Hz	0.088 %	
Current Out = 3 A:			
Up to 200 V	45 Hz	0.14 %	
Up to 20 V	56 Hz	0.13 %	
Up to 50 V	60 Hz	0.15 %	
(> 50 to 200) V	60 Hz	0.14 %	
(> 200 to 500) V	60 Hz	0.15 %	
Up to 200 V	400 Hz	0.34 %	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
Phase Angle[3] – Measuring Devices			
0º	(120 V, 10 A, 60 Hz)	0.31°	Multifunction calibrator
(> 0 to 60)º	(120 V, 10 A, 60 Hz)	0.34°	
(> 60 to 90)º	(120 V, 10 A, 60 Hz)	0.35°	
(> 90 to 180)º	(120 V, 10 A, 60 Hz)	0.35°	
(> 180 to 270)°	(120 V, 10 A, 60 Hz)	0.30°	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of RTD Temperature Indicators[3]	-100.04 ºC	0.081 °C	Multifunction calibrator
	(> -100.04 to 0.084) °C	0.034 ºC	
	(> 0.084 to 30.009) °C	0.054 °C	
	(> 30.009 to 59.967) °C	0.069 °C	
	(> 59.967 to 99.944) °C	0.084 °C	
	(> 99.944 to 199.89) °C	0.10 °C	
	(> 199.89 to 399.79) °C	0.12 °C	
	(> 399.79 to 799.27) °C	0.13 °C	
Electrical Simulation of Thermocouple Temperature Indicators[3] –			
Type B	(600 to 1000) °C	1.6°C	Multifunction calibrator
	(> 1000 to 1820) °C	1.0 °C	
Type C	(0 to 650) °C	0.55 °C	
	(> 650 to 1000) °C	0.60 °C	
	(> 1000 to 2316) °C	0.96 °C	
Type E	(-250 to -100) °C	0.82 °C	
	(> -100 to -25) °C	0.21 °C	
	(> -25 to 350) ºC	0.21 ºC	
	(> 350 to 1000) °C	42 °C	
Type J	(-210 to -100) °C	0.39 ºC	
	(> -100 to 0) ºC	0.20 ºC	
	(> 0 to 400) °C	0.27 °C	
	(> 400 to 760) °C	0.37 °C	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Electrical Simulation of Thermocouple Temperature Indicators[3] – (cont)			
Type K	(-200 to -140) °C (> -140 to -100) °C (> -100 to -50) °C (> -50 to -25) °C (> -25 to 120) °C (> 120 to 500) °C (> 500 to 700) °C (> 700 to 1000) °C (> 1000 to 1370) °C	0.48 °C 0.46 °C 0.28 °C 0.29 °C 0.21 °C 0.35 °C 0.36 °C 0.47 °C 0.53 °C	Multifunction calibrator
Type L	(-200 to 0) °C (> 0 to 900) °C	0.60 °C 0.58 °C	
Type N	(-200 to -10) °C (> -10 to -25) ºC (> -25 to 120) °C (> 120 to 1300) °C	0.70 °C 0.36 ºC 0.29 °C 0.49 °C	
Type R	(0 to 250) °C (250 to 400) ºC (> 400 to 1760) °C	1.4 °C 0.78 ºC 89 °C	
Type S	(0 to 250) °C (250 to 4000) ºC (> 400 to 1760) °C	1.4 °C 0.78 ºC 0.89 °C	
Type T	(-250 to -150) °C (-150 to 0) ºC (> 0 to 400) °C	0.98 °C 0.21 ºC 0.22 °C	
Type U	(-200 to 0) °C (> 0 to 600) °C	0.73 °C 0.51 °C	
Energy – Defibrillator (Monophasic, Biphasic)	1 J (> 1 to 2) J (> 2 to 3) J (> 3 to 5) J (> 5 to 6) J (> 6 to 7) J (> 7 to 8) J (> 8 to 9) J (> 9 to 10) J	2.6 % 2.5 % 2.4 % 2.7 % 3.0 % 2.5 % 3.4 % 2.5 % 3.1 %	Defibrillator analyzer with pacer

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Energy – Defibrillator (cont) (Monophasic, Biphasic)	(> 10 to 13) J (> 13 to 20) J (> 20 to 37) J (> 37 to 61) J (> 61 to 93) J (> 93 to 360) J	4.0 % 2.0 % 2.5 % 2.6 % 2.4 % 4.4 %	Defibrillator analyzer with Pacer
Power/Electrosurgical – Measuring Equipment	At 200 Ω: 10 W (> 10 to 50) W (> 50 to 150) W (> 150 to 300) W At 500 Ω: 10 W (> 10 to 50) W (> 50 to 150) W (> 150 to 300) W At 1000 Ω 10 W (> 10 to 50) W (> 50 to 150) W (> 150 to 300) W At 2000 Ω 10 W (> 10 to 50) W (> 50 to 150) W (> 150 to 300) W At 5000 Ω 10 W (> 10 to 50) W (> 50 to 150) W (> 150 to 300) W	 1.7 % 1.8 % 1.7 % 1.8 % 0.81 % 0.89 % 1.3 % 1.4 % 1.3 % 0.73 % 0.58 % 0.61 % 1.5 % 0.90 % 0.75 % 0.75 % 1.2 % 1.1 % 1.2 % 1.1 %	Electrosurgery analyzer

IV. Fluid Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume[3] – Single Volume Pipettes	Up to 0.5 mL (> 0.5 to 1) mL (> 1 to 2) mL (> 2 to 5) mL	0.075 µL 0.083 µL 0.14 µL 0.28 µL	Gravimetric method

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume[3] – (cont)			
Single Volume Pipettes	(> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL	0.33 µL 0.64 µL 0.86 µL 1.5 µL 3.0 µL	Gravimetric method
One-mark Volumetric Flasks	Up to 1 mL (> 1 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL (> 100 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL (> 1000 to 2000) mL (> 2000 to 5000) mL	0.083 µL 0.14 µL 0.28 µL 0.33 µL 0.64 µL 0.86 µL 1.5 µL 3.0 µL 6.1 µL 7.7 µL 15 µL 30 µL 0.14 mL 0.20 mL	
Graduated Pipettes	Up to 0.1 mL (0.1 to 0.2) mL (> 0.2 to 0.5) mL (> 0.5 to 1) mL (> 1 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL	0.056 µL 0.057 µL 0.075 µL 0.083 µL 0.14 µL 0.28 µL 0.33 µL 0.64 µL 0.86 µL	
Graduated Measuring Cylinders	Up to 5 mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL (> 100 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL (> 1000 to 2000) mL	0.28 µL 0.33 µL 0.64 µL 0.86 µL 1.5 µL 3.0 µL 6.1 µL 7.7 µL 15 µL 30 µL 0.14 mL	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume – (cont)			
Plastic Graduated Measuring Cylinders	Up to 5 mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL (> 100 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL (> 1000 to 2000) mL	0.28 µL 0.33 µL 0.64 µL 0.86 µL 1.5 µL 3.0 µL 6.1 µL 12 µL 15 µL 30 µL 0.14 mL	Gravimetric method
Burettes	Up to 5 mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL	0.28 µL 0.33 µL 0.64 µL 0.86 µL 1.5 µL 3.0 µL	
Pyknometer Type 3 (Gay-Lussac), Type 4 (Reischauer), Type 5 (Hubbard), Type 6 (With Thermometer Coupled)	Up to 1 mL (> 1 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL	0.083 µL 0.14 µL 0.28 µL 0.33 µL 0.64 µL 0.86 µL 1.5 µL 3.0 µL	
Centrifuge Tube (6 in, 8 in)	Up to 0.1 mL (0.1 to 0.2) mL (> 0.2 to 0.5) mL (> 0.5 to 1) mL (> 1 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL	0.056 µL 0.057 µL 0.075 µL 0.083 µL 0.14 µL 0.28 µL 0.33 µL 0.64 µL 0.86 µl 1.5 µL 3.0 µL	
Imhoff Cone	(0 to 2) mL (> 2 to 10) mL (> 10 to 40) mL (> 40 to 100) mL (> 100 to 1000) mL	0.14 µL 0.33 µL 1.5 µL 3.0 µL 30 µL	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume – (cont)			
Beaker	Up to 10 mL (> 10 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL	0.33 µL 1.5 µL 3.0 µL 4.6 µL 6.1 µL 7.6 µL 15 µL 30 µL	Gravimetric method
Water Trap (Dean-Stark Trap)			
Style A (Conical)	Up to 10 mL	0.33 µL	
Style B, C, D (Conical)	Up to 1 mL (> 1 to 25) mL	0.083 µL 0.86 µL	
Style E (Round)	Up to 1 mL (> 1 to 5) mL (> 5 to 10) mL	0.083 µL 0.28 µL 0.33 µL	
Style F (Round)	Up to 1 mL (> 1 to 2) mL	0.083 µL 0.14 µL	
Standard Test Measures (Seraphin Test Measures)	Up to 5 gal Up to 32 000 mL	0.69 mL 1 mL	Gravimetric method
Piston Operated Volumetric Apparatus –			
Piston Pipettes	(10 to 100) µL (> 100 to 200) µL (> 200 to 250) µL (> 250 to 500) µL (> 500 to 1000) µL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL	0.056 µL 0.057 µL 0.062 µL 0.075 µL 0.083 µL 0.14 µL 0.23 µL 0.28 µL 0.33 µL	Gravimetric method

Parameter/Equipment	Range	CMC[2] (±)	Comments
Piston Operated Volumetric Apparatus – (cont)			
Piston Burettes	Up to 1 mL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL	0.083 µL 0.14 µL 0.23 µL 0.28 µL 0.33 µL 0.51 µL 0.64 µL 0.86 µL 0.96 µL 1.5 µL 3.0 µL	Gravimetric method
Dispensers	(10 to 100) µL (> 100 to 200) µL (> 200 to 250) µL (> 250 to 500) µL (> 500 to 1000) µL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL	0.056 µL 0.057 µL 0.062 µL 0.075 µL 0.083 µL 0.14 µL 0.23 µL 0.28 µL 0.33 µL 0.51 µL 0.64 µL 0.86 µL 0.96 µL 1.5 µL 3.0 µL 4.6 µL 6.1 µL	
Volumetric Containers –			
Plastic, Metal, Glass	Up to 1000 µL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL	0.083 µL 0.14 µL 0.23 µL 0.28 µL 0.33 µL 0.51 µL 0.64 µL 0.86 µL 0.96 µL 1.5 µL 3.0 µL	Gravimetric method

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volumetric Containers – (cont) Plastic, Metal, Glass	(> 100 to 150) mL (> 150 to 200) mL (> 200 to 220) mL (> 220 to 500) mL (> 500 to 1000) mL (> 1000 to 1250) mL (> 1250 to 1500) mL (> 1500 to 3000) mL (> 3000 to 4500) mL (> 4500 to 6000) mL (> 6000 to 7500) mL (>7500 to 9000) mL (> 9000 to 15 000) mL (> 15 000 to 20 000) mL (> 20 000 to 25 000) mL (> 25 000 to 32 000) mL	4.6 µL 6.1 µL 6.7 µL 15 µL 30 µL 48 µL 53 µL 0.14 mL 0.16 mL 0.20 mL 0.41 mL 0.44 mL 0.56 mL 0.69 mL 0.82 mL 1.0 mL	Gravimetric method
Volumetric Flow/Infusion Pump[3]	(0.1 to 10) mL/h (> 10 to 25) mL/h (> 25 to 50) mL/h (> 50 to 100) mL/h (> 100 to 200) mL/h (> 200 to 300) mL/h (> 300 to 400) mL/h (> 400 to 500) mL/h (> 500 to 600) mL/h (> 600 to 700) mL/h (> 700 to 800) mL/h (> 800 to 900) mL/h (> 900 to 1000) mL/h (> 1000 to 1100) mL/h (> 1100 to 1200) mL/h (> 1200 to 1300) mL/h (> 1300 to 1500) mL/h	0.0058 mL/h 0.0060 mL/h 0.0065 mL/h 0.0080 mL/h 0.012 mL/h 0.027 mL/h 0.040 mL/h 0.045 mL/h 0.042 mL/h 0.049 mL/h 0.068 mL/h 0.054 mL/h 0.060 mL/h 0.066 mL/h 0.072 mL/h 0.078 mL/h 0.084 mL/h	Comparison using analytical balance and timer with distilled water as medium

V. Mechanical

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Vibration Measuring Devices[3] Peak Acceleration: 0.4 g_n (3.92 m/s^2) 0.8 g_n (7.84 m/s^2) 1 g_n (9.81 m/s^2)	 7 Hz 10 Hz 30 Hz to 2 kHz (> 2 to 4) kHz (> 4 to 5) kHz (> 5 to 8) kHz (> 8 to 10) kHz	 0.015 g_n (0.15 m/s^2) 0.026 g_n (0.25 m/s^2) 0.031 g_n (0.31 m/s^2) 0.042 g_n (0.41 m/s^2) 0.043 g_n (0.42 m/s^2) 0.042 g_n (0.41 m/s^2) 0.043 g_n (0.42 m/s^2)	Back-to-back comparison using portable reference calibrator (shaker and transducer) (g_n = acceleration of free fall, standard) = 9.80665 m/s^2)
Gauge Pressure[3] – Pneumatic, Hydraulic	(-12 to 0) psig (0 to 0.5) psig (> 0.5 to 4) psig (> 4 to 7) psig (> 7 to 8) psig (> 8 to 10) psig (> 10 to 50) psig (> 50 to 75) psig (> 75 to 100) psig (> 100 to 250) psig (> 250 to 500) psig (> 500 to 750) psig (> 750 to 1000) psig (> 1000 to 1250) psig (> 1250 to 1500) psig (> 1500 to 1750) psig (> 1750 to 2000) psig (> 2000 to 3626) psig (> 3626 to 5000) psig (> 10 000 to 36 000) psig	0.026 psig 0.0071 psig 0.0079 psig 0.0091 psig 0.012 psig 0.015 psig 0.016 psig 0.011 psig 0.012 psig 0.36 psig 0.84 psig 0.81 psig 0.78 psig 0.80 psig 0.70 psig 0.72 psig 0.69 psig 1.3 psig 1.7 psig 15 psig	Pressure gauges
Pressure/Blood Pressure Cuff[3]	(0 to 200) mmHg (> 200 to 300) mmHg	0.70 mmHg 0.74 mmHg	Patient calibrator
Non-Invasive Blood Pressure/Multi-Parameter Monitors[3]	(0 to 200) mmHg (> 200 to 300) mmHg	0.70 mmHg 0.74 mmHg	Patient calibrator

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Torque Wrench &Tools	1 N·m (> 1 to 20) N·m (20 to 40) N·m (40 to 60) N·m (60 to 100) N·m (100 to 400) N·m (400 to 1000) N·m	0.54 % 0.48 % 0.32 % 0.26 % 0.23 % 0.21 % 0.20 %	Torque transducers
Torque Transducers	1 N·m (> 1 to 2) N·m (> 2 to 8) N·m (> 8 to 1000) N·m	0.25 % 0.18 % 0.16 % 0.15 %	Comparison with torque arm& OIML class M1 weights
Scales & Balances[3]	1 mg to 1 g (> 1 to 10) g (> 10 to 20) g (> 20 to 50) g (> 50 to 100) g (> 100 to 150) g (> 150 to 220) g (> 220 to 250) g (> 250 to 500) g (> 500 to 750) g (> 750 to 1000) g (> 1000 to 2000) g (> 2000 to 4000) g (> 4000 to 6000) g (> 6000 to 10 000) g (> 10 000 to 20 000) g (> 20 000 to 32 000) g (> 32 to 62) kg (> 62 to 75) kg (> 75 to 100) kg (> 100 to 150) kg (> 150 to 200) kg (> 200 to 250) kg (> 250 to 300) kg (> 300 to 400) kg (> 400 to 500) kg (> 500 to 600) kg	0.011 mg 0.039 mg 0.067 mg 0.15 mg 0.20 mg 0.36 mg 0.55 mg 0.71 mg 0.98 mg 1.5 mg 1.8 mg 8.9 mg 0.047 g 0.036 g 0.089 g 0.10 g 0.13 g 0.41 g 1.2 g 1.3 g 1.5 g 1.8 g 2.0 g 2.1 g 4.7 g 5.2 g 5.3 g	OIML class E2 & F1 weights OIML class F1 weights OIML class M1 weights

Parameter/Equipment	Range	CMC[2] (±)	Comments
Weights –			OIML R 111-1 method using reference masses:
OIML Classes F1, F2, M1, M2 & M3	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g	0.012 mg 0.012 mg 0.0097 mg 0.0084 mg 0.013 mg 0.011 mg 0.012 mg 0.019 mg 0.0093 mg 0.012 mg 0.016 mg 0.022 mg 0.040 mg 0.066 mg	OIML Class E2
	50 g 100 g 200 g 500 g 1000 g 2000 g	0.15 mg 0.19 mg 0.33 mg 0.85 mg 1.6 mg 8.7 mg	OIML Class E2
OIML Classes F2, M1, M2 & M3	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g	0.013 mg 0.014 mg 0.012 mg 0.017 mg 0.020 mg 0.022 mg 0.027 mg 0.033 mg 0.042 mg 0.048 mg 0.066 mg 0.090 mg 0.095 mg 0.14 mg 0.22 mg 0.47 mg 0.71 mg 1.6 mg	OIML Class F1
	1000 g 2000 g	4.5 mg 8.7 mg	OIML Class F1
	10 kg 20 kg 25 kg	88 mg 99 mg 0.11 g	OIML Class F1 & OIML Class M1

Parameter/Equipment	Range	CMC[2] (±)	Comments
Weights – (cont) OIML Classes M1, M2 & M3	 5 kg	 47 mg	OIML R 111-1 method using reference masses: OIML Class E2 & OIML Class F1

VI. Thermodynamic

Parameter/Equipment	Range	CMC[2] (±)	Comments
Liquid Baths[3]	(-25 to 0) °C (0 to 140) °C (140 to 200) °C (200 to 250) °C (250 to 660) °C	0.041 °C 0.033 °C 0.066 °C 0.089 °C 0.091 °C	PRT probe & temperature indicator
Dry Blocks[3]	(-25 to 0) °C (0 to 140) °C (140 to 350) °C (350 to 660) °C	0.062 °C 0.057 °C 0.074 °C 0.091 °C	PRT probe & temperature indicator
Climatic Chambers[3] – (Including Oven, Incubator, Refrigerator, Freezer, Autoclave, Sterilizers, Muffles)	(-25 to 0) °C (0 to 60) °C (> 60 to 140) °C (> 140 to 300) °C (> 300 to 660) °C (> 660 to 1050) °C	0.9 °C 1.1 °C 1.3 °C 1.6 °C 3.6 °C 4.5 °C	PRT probe & temperature indicator, Elitech datalogger Thermocouple & readout
Bi-Metal Thermometers[3]	(0 to 140) °C (> 140 to 420) °C (> 420 to 660) ºC	0.12 °C 0.15 °C 0.36 °C	PRT probe & temperature indicator
Digital Thermometers (TC or RTD Probes & Indicators)[3]	(-25 to 0) °C (> 0 to 30) °C (> 30 to 140) °C (> 140 to 420) °C (> 420 to 660) °C	0.040 °C 0.047 °C 0.046 °C 0.099 °C 0.35 °C	PRT probe & precision multimeter

Parameter/Equipment	Range	CMC[2] (±)	Comments
IR Thermometers (Fixed emissivity of 0.95)	-15 °C (> -15 to 0) °C (> 0 to 50) °C (> 50 to 100) °C (> 100 to 120) ºC	1.2 °C 0.67 °C 0.67 °C 1.5 °C 1.8 ºC	Blackbody (8 to 14) µm spectral band & Emissivity of 0.95
Liquid-In-Glass Thermometers[3]	(-25 to 140) °C	0.29 °C	PRT probe & temperature indicator
Environmental Thermometers	(-5 to 25) °C (> 25 to 50) °C	0.24 °C 0.40 ºC	PRT probe & temperature indicator
Relative Humidity – Thermo-Hygrometer	20 % RH (> 20 to 30) % RH (> 30 to 70) % RH (> 70 to 90) % RH	0.95 % RH 1.1 % RH 1.9 % RH 1.3 % RH	Temperature sensor & readout
Humidity Chambers[3]	20 % RH (> 20 to 30) % RH (> 30 to 50) % RH (> 50 to 80) % RH	3.2 % RH 3.6 % RH 3.8 % RH 3.9 % RH	Humidity sensor & readout

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Frequency[3] – Measuring Equipment	(0 to 100) Hz 100 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz (1 to 10) MHz	1.2 mHz 12 mHz 0.12 Hz 0.23 Hz 0.58 Hz 1.2 Hz 12 Hz 0.12 kHz	Multifunction calibrator comparison
Frequency[3] – Measure	Up to 5 Hz (> 5 to 10) Hz (> 10 to 100) Hz	0.058 mHz 0.12 mHz 1.2 mHz	Multifunction calibrator

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Frequency[3] – Measure (cont)	>100 Hz to 1 kHz (> 1 to 10) kHz (> 10 to 100) kHz > 100 kHz to 1 MHz (> 1 to 10) MHz (> 10 to 500) MHz > 500 MHz to 1 GHz	13 mHz 0.12 Hz 1.2 Hz 13 Hz 0.12 kHz 0.58 kHZ 40 kHz	Multifunction calibrator
Stopwatches, Hour Meters & Timers[3]	10 s to 1.0 h (> 1.0 to 2.5) h (> 2.5 to 5.0) h (> 5.0 to 10.0) h (> 10.0 to 15.0) h (> 15.0 to 20.0) h (> 20.0 to 24.0) h	0.098 s 0.11 s 0.16 s 0.27 s 0.39 s 0.49 s 0.56 s	Reference stopwatch
Tachometers	(60 to 600) RPM (> 600 to 6000) RPM (> 6000 to 60 000) RPM (> 60 000 to 100 000) RPM	0.070 RPM 0.090 RPM 0.90 RPM 1.5 RPM	Multifunction calibrator & LED artifact
Cardiac Rate ECG/Multiparameter Monitor[3] (-6 to 14) mV	(20 to 300) BPM	0.82 BPM	Comparison with rigel defibrillator analyzer with pacer
Cardiac Rate/Electrocardiogram[3] (-6 to 14) mV	(20 to 300) BPM	0.82 BPM	Defibrillator analyzer with pacer
Cardiac Rate (Pacer)[3] (5 to 200) mA	(20 to 300) BPM	0.82 BPM	Defibrillator analyzer with pacer
Centrifuges[3]	Up to 1000 (> 1000 to 5000) RPM	0.60 RPM 1.1 RPM	Optical tachometer
RCD Trip Time[3] (Electronically Activated)	Up to 390 ms (390 to 900) ms	1.0 ms 8.1 ms	Multifunction calibrator

SATELLITE

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CALIBRATION

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Voltage[3] – Measure	(0 to 100) mV (0.1 to 100) V (100 to 1000) V	22 µV 4.6 mV 46 mV	Precision multimeter
DC Voltage[3] – Generate	(0 to 20) mV (20 to 50) mV (50 to 100) mV (0.1 to 0.2) V (0.2 to 0.5) V (0.5 to 1) V (1 to 2) V (2 to 5) V (5 to 10) V (10 to 50) V (50 to 100) V (100 to 200) V (200 to 500) V (500 to 1000) V	13 µV 16 µV 21 µV 0.15 mV 0.16 mV 0.20 mV 1.6 mV 1.7 mV 1.9 mV 8.8 mV 13 mV 49 mV 84 mV 0.13 V	Multifunction calibrator

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Resistance[3] – Generate			
Simulated	(0 to 3) Ω (3 to 10) Ω (10 to 20) Ω (20 to 30) Ω (30 to 100) Ω (0.1 to 0.2) kΩ (0.2 to 0.3) kΩ (0.3 to 1) kΩ (1 to 2) kΩ (2 to 4) kΩ (4 to 6) kΩ (6 to 8) kΩ (8 to 9) kΩ (9 to 10) kΩ (10 to 30) kΩ (30 to 100) kΩ (0.1 to 0.3) MΩ (0.3 to 1) MΩ (1 to 10) MΩ	58 mΩ 60 mΩ 63 mΩ 65 mΩ 81 mΩ 0.20 Ω 0.84 Ω 0.88 Ω 1.3 Ω 6.5 Ω 6.6 Ω 6.7 Ω 6.8 Ω 6.9 Ω 62 Ω 66 kΩ 0.11 kΩ 1.5 kΩ 70 kΩ	Multifunction calibrator
Resistance[3] – Generate			
Passive 2 Wire	10.755 Ω 100.536 Ω 1.001 25 kΩ 10.0013 kΩ 99.964 kΩ 0.999 39 MΩ 9.9792 MΩ 99.38 MΩ	64 mΩ 0.12 Ω 0.87 Ω 7.0 Ω 67 Ω 1.4 kΩ 71 kΩ 0.42 MΩ	Multifunction calibrator
Resistance[3] – Measure			
2 Wire	(Up to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ	1.4 mΩ 13 mΩ 0.13 mΩ	Precision multimeter
Resistance[3] – Measure			
4 Wire	(Up to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ	1.4 mΩ 13 mΩ 0.13 mΩ	Precision multimeter

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Current[3] – Measure	(0 to 10) mA (10 to 100) nA (0.1 to 2) A	6.4 µA 64 µA 1.8 mA	Precision multimeter
DC Current[3] – Generate	(0 to 20) µA (20 to 50) µA (50 to 100) µA (0.1 to 0.2) mA (0.2 to 0.5) mA (0.5 to 1) mA (1 to 2) mA (2 to 4) mA (4 to 6) mA (6 to 8) mA (8 to 10) mA (10 to 20) mA (20 to 50) mA (50 to 100) mA (0.1 to 0.2) A (0.2 to 0.5) A (0.5 to 1) A (1 to 2) A (2 to 5) A (5 to 10) A	0.042 µA 0.052 µA 0.069 µA 0.21 µA 0.30 µA 0.47 µA 2.1 µA 2.7 µA 3.4 µA 4.0 µA 4.7 µA 20 µA 30 µA 47 µA 0.47 mA 0.53 mA 0.65 mA 9.9 mA 11 mA 12 mA	Multifunction calibrator

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Generate			
(0 to 50) mV	(10 to 206) Hz	0.17 mV	Multifunction calibrator
(0 to 50) mV	206 Hz to 20 kHz	0.23 mV	
(50 to 100) mV	10 Hz to 1 kHz	0.20 mV	
(50 to 100) mV	1 kHz to 20 kHz	0.30 mV	
(0.1 to 0.5) V	10 Hz to 1 kHz	1.5 mV	
(0.1 to 0.5) V	1 kHz to 20 kHz	2.1 mV	
(0.5 to 1) V	10 Hz to 1 kHz	1.8 mV	
(0.5 to 1) V	1 kHz to 20 kHz	2.9 mV	
(1 to 2) V	(10 to 206) Hz	18 mV	
(1 to 2) V	206 Hz to 20 kHz	20 mV	
(2 to 3) V	(10 to 206) Hz	18 mV	
(3 to 4) V	(10 to 206) Hz	18 mV	
(4 to 6) V	(10 to 206) Hz	19 mV	
(6 to 8) V	(10 to 206) Hz	20 mV	
(8 to 10) V	10 Hz to 1 kHz	21 mV	
(2 to 10) V	(1 to 20) kHz	30 mV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Generate (cont)			
(10 to 50) V	10 Hz to 1 kHz	0.17 V	Multifunction calibrator
(50 to 100) V	10 Hz to 1 kHz	0.20 V	
(100 to 500)	10 Hz to 1 kHz	1.7 V	
(0.5 to 1) kV	10 Hz to 1 kHz	1.9 V	
AC Current[3] – Measure			
(0 to 10) mA	60 Hz	16 µA	Precision multimeter
(10 to 100) mA	60 Hz	0.16 mA	
(0.1 to 2) A	60 Hz	3.4 mA	
AC Current[3] – Generate			
(0 to 20) µA	10 Hz to 2 kHz	0.51 µA	Multifunction calibrator
(0 to 50) µA	200 Hz	0.54 µA	
(20 to 100) µA	10 Hz to 2 kHz	0.60 µA	
(0.1 to 0.2) mA	10 Hz to 2 kHz	1.7 µA	
(0 .05 to 0.5) mA	200 Hz	2.0 µA	
(0.2 to 1) mA	10 Hz to 2 kHz	2.5 µA	
(1 to 2) mA	10 Hz to 2 kHz	25 µA	
(0.5 to 5) mA	200 Hz	27 µA	
(2 to 10) mA	10 Hz to 2 kHz	31 µA	
(10 to 20) mA	10 Hz to 2 kHz	0.26 mA	
(5 to 50) mA	200 Hz	0.27mA	
(20 to 100) mA	10 Hz to 2 kHz	0.31 mA	
(0.1 to 0.2) A	10 Hz to 2 kHz	2.8 mA	
(0.05 to 0.5) A	200 Hz	3.0 mA	
(0.2 to 1) A	10 Hz to 2 kHz	3.3 mA	
(1 to 2) A	10 Hz to 2 kHz	28 mA	
(0.5 to 5) A	200 Hz	29 mA	
(2 to 10) A	10 Hz to 2 kHz	31 mA	

IV. Fluid Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume[3] –			
Single Volume Pipettes	Up to 0.5 mL (> 0.5 to 1) mL (> 1 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL	0.26 µL 0.27 µL 0.34 µL 0.36 µL 0.41 µL 0.57 µL 0.68 µL 0.87 µL 1.6 µL 3.0 µL	Gravimetric method
One-Mark Volumetric Flasks	Up to 1 mL (> 1 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL (> 1000 to 1500) mL (> 1500 to 2000) mL (> 2000 to 3000) mL	0.26 µL 0.34 µL 0.41 µL 0.68 µL 0.87 µL 1.6 µL 3.0 µL 4.6 µL 6.1 µL 28 µL 31 µL 40 µL 52 µL 76 µL 0.10 mL	
Graduated Pipettes	Up to 0.5 mL (> 0.5 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL	0.26 µL 0.27 µL 0.34 µL 0.41 µL 0.68 µL 0.87 µL	
Graduated Measuring Cylinders	Up to 2 mL (> 2 to 3) mL (> 3 to 4) mL (> 4 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 75) mL (> 75 to 100) mL	0.27 µL 0.29 µL 0.33 µL 0.34 µL 0.41 µL 0.55 µL 0.68 µL 0.87 µL 1.6 µL 2.3 µL 3.0 µL	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume[3] – (cont)			
Graduated Measuring Cylinders	(> 100 to 150) mL (> 150 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 750) mL (> 750 to 1000) mL (> 1000 to 1500) mL (> 1500 to 2000) mL	4.6 µL 6.1 µL 27 µL 30 µL 34 µL 40 µL 52 µL 76 µL	Gravimetric method
Plastic Graduated Measuring Cylinders	Up to 1 mL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 4) mL (> 4 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 75) mL (> 75 to 100) mL (> 100 to 150) mL (> 150 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 750) mL (> 750 to 1000) mL (> 1000 to 1500) mL (> 1500 to 2000) mL	0.27 µL 0.28 µL 0.31 µL 0.36 µL 0.39 µL 0.55 µL 0.79 µL 1.0 µL 1.3 µL 2.4 µL 3.6 µL 4.8 µL 7.2 µL 9.6 µL 29 µL 35 µL 44 µL 55 µL 77 µL 0.10 mL	
Burettes	Up to 2 mL (> 2 to 3) mL (> 3 to 4) mL (> 4 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 40) mL (> 40 to 50) mL (> 50 to 60) mL (> 60 to 70) mL	0.29 µL 0.30 µL 0.32 µL 0.34 µL 0.41 µL 0.55 µL 0.68 µL 0.87 µL 0.98 µL 1.3 µL 1.6 µL 1.9 µL 2.2 µL	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume[3] – (cont)			
Burettes	(> 70 to 80) mL (> 80 to 90) mL (> 90 to 100) mL	2.4 µL 2.7 µL 3.0 µL	Gravimetric method
Pyknometer Type 3 (Gay-Lussac), Type 4 (Reischauer), Type 5 (Hubbard), Type 6 (With Thermometer Coupled)	Up to 2 mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL	0.27 µL 0.34 µL 0.41 µL 0.68 µL 0.87 µL 0.98 µL 1.6 µL 3.0 µL	
Centrifuge Tube (6 in, 8 in)	Up to 0.5 mL (> 0.5 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL	0.26 µL 0.27 µL 0.34 µL 0.41 µL 0.68 µL 0.87 µL 0.98 µL 1.6 µL 3.0 µL	
Imhoff Cone	Up to 0.5 mL (> 0.5 to 2) mL (> 2 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL (> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL	0.26 µL 0.27 µL 0.34 µL 0.41 µL 0.68 µL 0.87 µL 1.6 µL 3.0 µL 4.6 µL 6.1 µL 27 µL 30 µL 40 µL	
Beaker	Up to 10 mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL	0.41 µL 0.55 µL 0.68 µL 0.87 µL 1.6 µL 3.0 µL 4.6 µL 6.1 µL	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Volume[3] – (cont)			
Beaker	(> 200 to 250) mL (> 250 to 500) mL (> 500 to 1000) mL	27 µL 30 µL 40 µL	Gravimetric method
Water Trap (Dean-Stark Trap) –			
Style A (Conical)	Up to 1 mL (> 1 to 5) mL (> 5 to 10) mL	0.27 µL 0.34 µL 0.41 µL	
Style B, C, D (Conical)	Up to 1 mL (> 1 to 5) mL (> 5 to 10) mL (> 10 to 20) mL (> 20 to 25) mL	0.27 µL 0.34 µL 0.41 µL 0.68 µL 0.87 µL	
Style E (Round)	Up to 1 mL (> 1 to 5) mL (> 5 to 10) mL	0.27 µL 0.34 µL 0.41 µL	
Style F (Round)	Up to 1 mL (> 1 to 2) mL	0.27 µL 0.34 µL	
Piston Operated Volumetric Apparatus –			
Piston Pipettes	(10 to 100) µL (> 100 to 200) µL (> 200 to 250) µL (> 250 to 500) µL (> 500 to 1000) µL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL Up to 1 mL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL	0.28 µL 0.26 µL 0.38 µL 0.35 µL 0.27 µL 0.28 µL 0.30 µL 0.39 µL 0.55 µL 0.26 µL 0.28 µL 0.30 µL 0.39 µL 0.55 µL 0.78 µL 1.0 µL 1.3 µL	Gravimetric method

Parameter/Equipment	Range	CMC[2] (±)	Comments
Piston Operated Volumetric Apparatus –			
Piston Pipettes	(> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL	1.5 µL 2.4 µL 4.8 µL	Gravimetric method
Dispensers	Up to 1000 µL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL	0.26 µL 0.28 µL 0.30 µL 0.39 µL 0.55 µL 0.78 µL 1.0 µL 1.3 µL 1.5 µL 2.4 µL 4.8 µL 7.2 µL 9.6 µL	
Volumetric Containers –			
Plastic, Metal, Glass	Up to 1000 µL (> 1 to 2) mL (> 2 to 3) mL (> 3 to 5) mL (> 5 to 10) mL (> 10 to 15) mL (> 15 to 20) mL (> 20 to 25) mL (> 25 to 30) mL (> 30 to 50) mL (> 50 to 100) mL (> 100 to 150) mL (> 150 to 200) mL (> 200 to 220) mL (> 220 to 500) mL (> 500 to 1000) mL (> 1000 to 1250) mL (> 1250 to 1500) mL (> 1500 to 2000) mL (> 2000 to 3000) mL	0.26 µL 0.34 µL 0.30 µL 0.34 µL 0.41 µL 0.55 µL 0.68 µL 0.87 µL 0.99 µL 1.6 µL 3.0 µL 4.6 µL 6.1 µL 6.7 µL 30 µL 40 µL 46 µL 52 µL 67 µL 0.1 mL	Gravimetric method

V. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Gauge Pressure[3] – Pneumatic, Hydraulic	(-12 to 0) psig (0 to 50) psig (> 50 to 100) psig (> 100 to 250) psig (> 250 to 500) psig (> 500 to 1000) psig (> 1000 to 2000) psig (> 2000 to 3500) psig (> 3500 to 5000) psi	0.041 psig 0.026 psig 0.020 psig 0.55 psig 1.3 psig 1.2 psig 1.1 psig 2.0 psi 2.6 psi	Pressure gauges

VI. Thermodynamic

Parameter/Equipment	Range	CMC[2] (±)	Comments
Bi-Metal Thermometers[3]	(-25 to 140) °C (> 140 to 375) °C	0.13 °C 0.49 °C	PRT & precision multimeter
Digital Thermometers (TC or RTD Probes & Indicators)[3]	(-25 to 140) °C (> 140 to 375) °C	0.060 °C 0.48 °C	PRT & precision multimeter
Liquid-In-Glass Thermometers[3]	(-25 to 140) °C	0.30 °C	PRT & precision multimeter
Environmental Thermometers	(10 to 50) ºC	1.3 ºC	Humidity sensor & readout
Relative Humidity – Thermo-Hygrometer	(33 to 90) % RH	2.1 % RH	Humidity sensor & readout

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Frequency[3] – Measuring Equipment	(0 to 100) Hz 100 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	20 mHz 2.3 Hz 18 Hz 20 Hz 20 Hz 20 Hz	Multifunction calibrator comparison
Stopwatches, Hour Meters & Timers[3]	10 s to 20.0 h (> 20.0 to 24.0) h	1.5 s 1.6 s	Reference stopwatch
Photo Tachometers	(60 to 6000) RPM (> 6000 to 60 000) RPM (> 60 000 to 100 000) RPM	1.3 RPM 1.5 RPM 1.9 RPM	Multifunction calibrator comparison & LED artifact

[1] This laboratory offers commercial 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 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.

[4] In the statement of CMC, percentages are to be read as percent of reading, unless otherwise noted.

[5] The 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.

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

[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. 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

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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*).

American Association for Laboratory Accreditation
CORPORATE SEAL 1978
DISTRICT OF COLUMBIA
A2LA

Presented this 28th day of September 2022.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4038.01
Valid to July 31, 2024

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