



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

CENTURY LABS II dba CENTURY CALIBRATIONS
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CALIBRATION

Valid To: May 31, 2020

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 calibrations¹:

I. Chemical Quantities

| Parameter/Equipment | Range | CMC ² (±) | 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 ³ 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 |

II. Dimensional Testing

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--------------------------|---------------|---------------------------|-----------------|
| Length – 1D ³ | Up to 12.0 in | 1.8 x 10 ⁻³ in | Digital caliper |

III. 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 | 0.41 V 1.7 V 4.7 V | HV Source monitored by Vitrek 4700 |
| | (9.0 to 25) kV (25 to 50) kV (50 to 60) kV | 35 V 58 V 81 V | HV Source monitored by Vitrek 4700/HVL-150 probe |
| DC Voltage – Measure ³ | (0 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 3.8 μV/V 5.5 μV/V 6.1 μV/V | 8508A DMM |
| | (0.1 to 1.0) kV (1.0 to 4.0) kV (4.0 to 9.0) kV | 0.41 V 1.7 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 | 35 V 58 V 81 V 0.10 kV 0.13 kV 0.14 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 |

| Parameter/Range | Frequency | CMC ^{2,4} (±) | Comments |
|-----------------------------------|--|---|------------------------------------|
| 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 | 0.021 mV 0.018 mV 0.015 mV 0.017 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 | 0.15 mV 0.13 mV 0.10 mV 0.12 mV 0.29 mV 0.82 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 1.2 mV 0.98 mV 1.3 mV 2.8 mV 8.1 mV 0.35 V | |
| (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 | 0.10 V 12 mV 9.8 mV 12 mV 28 mV 81 mV | |
| (200.1 to 1000) V | 40 Hz to 10 kHz | 0.18 V | |
| (0.1 to 1.0) kV | (50 to 60) Hz | 2.1 V | Vitrek 4700A |
| (1.0 to 4.0) kV | (50 to 60) Hz | 6.4 V | |
| (4.0 to 9.0) kV | (50 to 60) Hz | 18 V | |
| (9.0 to 20) kV | (50 to 60) Hz | 0.12 kV | Vitrek 4700A with Vitrek HVL150 |
| (20.0 to 40) kV | (50 to 60) Hz | 0.24 kV | |
| (40.0 to 60) kV | (50 to 60) Hz | 0.29 kV | |
| (60.0 to 80) kV | (50 to 60) Hz | 0.47 kV | |
| (80.0 to 100.0) kV | (50 to 60) Hz | 0.59 kV | |

| Parameter/Equipment | Range | CMC ^{2, 4} (±) | 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 2.99) A (2.2 to 11) A (11 to 20) A | 0.051 % 0.060 % 0.11 % | Fluke 5520A calibrator |
| | (20 to 100) A | 2.6 mA/A | Guildline 9211A shunt |
| | (16.5 to 149) A (150 to 1000) A | 0.72 % 0.76 % | Fluke 5520, 5500A coil |
| DC Current – Measure ³ | (0 to 100) nA (0.100 to 1.0) µA (1 to 10) µA (10 to 100) µA (0.100 to 1.0) mA (1.0 to 10.0) mA (10.0 to 100.0) mA (0.100 to 1.0) A | 0.017 % + 40 pA 36 µA/A + 40 pA 67 µA/A + 0.1 nA 2.9 µA/A + 0.80 nA 30 µA/A + 5.0 nA 30 µA/A + 50 nA 47 µA/A + 0.50 µA 0.013 % + 10 µA | 3458A option 002 DMM |
| | (1 to 10) A (10 to 100) A (100 to 300) A | 0.012 % + 3.0 µA 0.058 % + 30 µA 0.12 % + 30 µA | Guildline 9211A |
| | (300 to 700) A (700 to 1000) A | 2.6 % 2.6 % | Fluke 80i-1010 current probe |

| Parameter/Range | Frequency | CMC ^{2,4} (±) | Comments |
|---|---|--|------------------|
| AC Current – Generate ³ | | | |
| (9 to 220) µA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 0.10 % + 30 nA 0.057 % + 25 nA 0.032 % + 20 nA 0.12 % + 50 nA 0.25 % + 0.10 µA | 5700A calibrator |
| (29 to 190.0) µA (190.0 to 329.99) µA | (10 to 30) kHz (10 to 30) kHz | 4 µA 11 µA | 5520A 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 | 0.076 % + 50 nA 0.040 % + 40 nA 0.020 % + 40 nA 0.10 % + 0.50 µA 0.24 % + 1.0 µA | 5700A calibrator |
| (0.33 to 1.900) mA (1.900 to 3.299) mA | (10 to 30) kHz (10 to 30) kHz | 0.023 mA 0.084 mA | 5520A calibrator |
| (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 0.046 % + 0.40 µA 0.020 % + 0.40 µA 0.10 % + 5.0 µA 0.24 % + 10 µA | 5700A calibrator |
| (3.3 to 19.00) mA (19.00 to 32.999) mA | (10 to 30) kHz (10 to 30) kHz | 0.093 mA 0.53 mA | 5520A calibrator |
| (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 | 0.074 % + 5.0 µA 0.039 % + 4.0 µA 0.021 % + 4.0 µA 0.018 % + 50 µA 0.24 % + 0.10 mA | 5700A calibrator |
| (33 to 190.0) mA (190.0 to 329.99) mA | (10 to 30) kHz (10 to 30) kHz | 1.1 mA 3.8 mA | 5520A calibrator |
| (0.22 to 2.2) A | (0.020 to 1) kHz (1 to 5) kHz (5 to 10) kHz | 0.070 % + 40 µA 0.086 % + 0.10 mA 0.89 % | 5700A calibrator |
| (1.1 to 2.9) A | (10 to 45) Hz (0.45 to 1) kHz (1 to 5) kHz (5 to 10) kHz | 0.19 % 0.11% 0.56 % 2.34 % | 5520A calibrator |

| Parameter/Range | Frequency | CMC ^{2,4} (±) | Comments |
|--|--|---------------------------|---|
| AC Current – Generate ³ (cont) | | | |
| (3 to 10.9) A | (45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz | 0.36 % 0.38 % 2.5 % | Fluke 5520A Calibrator |
| (10.9 to 20.5) A | (45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz | 0.14 % 0.17 % 2.4 % | |
| (16.5 to 149) A | (45 to 65) Hz (65 to 440) Hz | 0.74 % 1.2 % | Fluke 5500A Coil w/ 5520A Calibrator |
| (150 to 1000) A | (45 to 65) Hz (65 to 440) Hz | 1.3 % 1.9 % | |



| Parameter/Range | Frequency | CMC ^{2,4} (±) | 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 | DC to 1 kHz | 0.16 % | 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} (±) | 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 20910) W | 0.027 % 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 | 0.15 % 0.11 % 0.10 % 0.20 % 0.18 % 0.17 % 0.19 % 0.17 % 0.16 % 0.18 % 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 (33.0 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} (±) | Comments |
|--|----------------|------------------------|------------------|
| Resistance – Generate ³ (cont) | | | |
| Fixed Points | 0.000 333 3 Ω | 0.3 uΩ | 9211A Guildline |
| | 0.001Ω | 0.5 uΩ | |
| | 0.01Ω | 1.0 uΩ | |
| | 0.1Ω | 10 uΩ | |
| | 1 Ω | 59 μΩ/Ω | 5700A Calibrator |
| | 1.9 Ω | 59 μΩ/Ω | |
| | 10 Ω | 34 μΩ/Ω | |
| | 19 Ω | 35 μΩ/Ω | |
| | 100 Ω | 22 μΩ/Ω | |
| | 190 Ω | 22 μΩ/Ω | |
| | 1 kΩ | 13 μΩ/Ω | |
| | 1.9 kΩ | 14 μΩ/Ω | |
| | 10 kΩ | 12 μΩ/Ω | |
| | 19 kΩ | 13 μΩ/Ω | |
| | 100 kΩ | 14 μΩ/Ω | |
| | 190 kΩ | 15 μΩ/Ω | |
| | 1 MΩ | 21 μΩ/Ω | |
| | 1.9 M | 22 μΩ/Ω | |
| | 10 MΩ | 46 μΩ/Ω | |
| | 19 MΩ | 52 μΩ/Ω | |
| | 100 MΩ | 0.014 % | |
| Resistance – Measure ³ | (0 to 2) Ω | 28 μΩ/Ω | 8508A DMM |
| | (2 to 20) Ω | 25 μΩ/Ω | |
| | (20 to 200) Ω | 17 μΩ/Ω | |
| | 200 Ω to 2 kΩ | 14 μΩ/Ω | |
| | (2 to 20) kΩ | 14 μΩ/Ω | |
| | (20 to 200) kΩ | 14 μΩ/Ω | |
| | 200 kΩ to 2 MΩ | 19 μΩ/Ω | |
| | (2 to 20) MΩ | 28 μΩ/Ω | |
| | (20 to 200) MΩ | 0.014 % | |
| | 200 MΩ to 2 GΩ | 0.12 % | |
| | (2 to 20) GΩ | 0.23 % | |

| 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 | 0.52 % + 0.01 nF 0.52 % + 0.01 nF 0.52 % + 0.01 nF 0.27 % + 0.01 nF 0.27 % + 0.10 nF 0.27 % + 0.10 nF 0.27 % + 0.30 nF 0.27 % + 1.0 nF 0.27 % + 3.0 nF 0.27 % + 10 nF 0.42 % + 30 nF 0.47 % + 0.10 µF 0.47 % + 0.30 µF 0.47 % + 1.0 µF 0.47 % + 3.0 µF 0.47 % + 10 µF 0.77 % + 30 µF 1.2 % + 0.10 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 | 0.34 % + 1 fF + 6 <i>cts</i> 0.34 % + 1 fF + 3 <i>cts</i> 0.34 % + 6 <i>cts</i> 0.34 % + 3 <i>cts</i> 0.34 % + 2 <i>cts</i> 0.34 % + 1 fF + 6 <i>cts</i> 0.34 % + 1 fF + 3 <i>cts</i> 0.34 % + 6 <i>cts</i> 0.34 % + 3 <i>cts</i> 0.34 % + 2 <i>cts</i> 0.34 % + 6 <i>cts</i> 0.34 % + 3 <i>cts</i> 0.34 % + 2 <i>cts</i> 0.34 % + 6 <i>cts</i> 0.34 % + 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) | | | | |
| (0.1 to 1) nF | 100 Hz | 0.3 % + 1 fF + 3 <i>cts</i> | Agilent 4274A LCR Meter <i>cts</i> : Counts of LSD | |
| | 120 Hz | 0.3 % + 1 fF + 3 <i>cts</i> | | |
| | 200 Hz | 0.3 % + 1 fF + 2 <i>cts</i> | | |
| | 400 Hz | 0.3 % + 1 fF + 6 <i>cts</i> | | |
| | 1 kHz | 0.3 % + 1 fF + 3 <i>cts</i> | | |
| | 2 kHz | 0.3 % + 1 fF + 2 <i>cts</i> | | |
| | 4 kHz | 0.3 % + 1 fF + 6 <i>cts</i> | | |
| | 10 kHz | 0.3 % + 1 fF + 3 <i>cts</i> | | |
| | 20 kHz | 0.3 % + 1 fF + 2 <i>cts</i> | | |
| | 40 kHz | 0.34 % + 1 fF + 6 <i>cts</i> | | |
| | 100 kHz | 0.34 % + 1 fF + 3 <i>cts</i> | | |
| | (1 to 10) nF | 100 Hz | | 0.3 % + 1 fF + 3 <i>cts</i> |
| | | 120 Hz | | 0.3 % + 1 fF + 3 <i>cts</i> |
| 200 Hz | | 0.3 % + 1 fF + 2 <i>cts</i> | | |
| 400 Hz | | 0.3 % + 1 fF + 6 <i>cts</i> | | |
| 1 kHz | | 0.3 % + 1 fF + 3 <i>cts</i> | | |
| 2 kHz | | 0.3 % + 2 <i>cts</i> | | |
| 4 kHz | | 0.34 % + 6 <i>cts</i> | | |
| 10 kHz | | 0.34 % + 3 <i>cts</i> | | |
| 20 kHz | | 0.34 % + 2 <i>cts</i> | | |
| 40 kHz | | 0.34 % + 1 fF + 6 <i>cts</i> | | |
| 100 kHz | | 0.34 % + 1 fF + 3 <i>cts</i> | | |
| (10 to 100) nF | | 100 Hz | 0.3 % + 3 <i>cts</i> | |
| | | 120 Hz | 0.3 % + 3 <i>cts</i> | |
| | 200 Hz | 0.3 % + 2 <i>cts</i> | | |
| | 400 Hz | 0.34 % + 6 <i>cts</i> | | |
| | 1 kHz | 0.34 % + 3 <i>cts</i> | | |
| | 2 kHz | 0.34 % + 2 <i>cts</i> | | |
| | 4 kHz | 0.34 % + 6 <i>cts</i> | | |
| | 10 kHz | 0.34 % + 3 <i>cts</i> | | |
| | 20 kHz | 0.34 % + 2 <i>cts</i> | | |
| | 40 kHz | 0.34 % + 6 <i>cts</i> | | |
| | 100 kHz | 0.34 % + 3 <i>cts</i> | | |

| Parameter/Range | Frequency | CMC ^{2,4} (±) | Comments |
|--|--------------|------------------------|--|
| Capacitance – Measure ³ (cont) | | | |
| (100 to 1000) nF | 100 Hz | 0.34 % + 3 <i>cts</i> | Agilent 4274A LCR Meter <i>cts</i> : Counts of LSD |
| | 120 Hz | 0.34 % + 3 <i>cts</i> | |
| | 200 Hz | 0.34 % + 2 <i>cts</i> | |
| | 400 Hz | 0.34 % + 6 <i>cts</i> | |
| | 1 kHz | 0.34 % + 3 <i>cts</i> | |
| | 2 kHz | 0.34 % + 2 <i>cts</i> | |
| | 4 kHz | 0.34 % + 1 <i>cts</i> | |
| | 10 kHz | 0.34 % + 1 <i>cts</i> | |
| | 20 kHz | 0.34 % + 1 <i>cts</i> | |
| | 40 kHz | 0.34 % + 1 <i>cts</i> | |
| | 100 kHz | 0.34 % + 1 <i>cts</i> | |
| | (1 to 10) μF | 100 Hz | |
| 120 Hz | | 0.34 % + 3 <i>cts</i> | |
| 200 Hz | | 0.34 % + 2 <i>cts</i> | |
| 400 Hz | | 0.34 % + 1 <i>cts</i> | |
| 1 kHz | | 0.34 % + 1 <i>cts</i> | |
| 2 kHz | | 0.34 % + 1 <i>cts</i> | |
| 4 kHz | | 0.34 % + 1 <i>cts</i> | |
| 10 kHz | | 0.34 % + 1 <i>cts</i> | |
| 20 kHz | | 0.34 % + 1 <i>cts</i> | |
| 40 kHz | | 3.0 % + 1 <i>cts</i> | |
| 100 kHz | | 3.0 % + 1 <i>cts</i> | |
| (10 to 100) μF | | 100 Hz | 0.34 % + 1 <i>cts</i> |
| | 120 Hz | 0.34 % + 1 <i>cts</i> | |
| | 200 Hz | 0.34 % + 1 <i>cts</i> | |
| | 400 Hz | 0.34 % + 1 <i>cts</i> | |
| | 1 kHz | 0.34 % + 1 <i>cts</i> | |
| | 2 kHz | 0.34 % + 1 <i>cts</i> | |
| | 4 kHz | 1.0 % + 1 <i>cts</i> | |
| | 10 kHz | 1.0 % + 1 <i>cts</i> | |
| | 20 kHz | 3.0 % + 1 <i>cts</i> | |

| Parameter/Range | Frequency | CMC ^{2,4} (±) | Comments |
|--|---|---|--|
| Capacitance – Measure ³ (cont) | | | |
| (100 to 1000) µF | 100 Hz 120 Hz 200 Hz 400 Hz 1 kHz 2 kHz 4 kHz 10 kHz 20 kHz | 0.34 % + 1 <i>cts</i> 0.34 % + 1 <i>cts</i> 0.34 % + 1 <i>cts</i> 1.0 % + 1 <i>cts</i> 1.0 % + 1 <i>cts</i> 1.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> | Agilent 4274A LCR Meter <i>cts</i> : Counts of LSD |
| (1 to 10) mF | 100 Hz 120 Hz 200 Hz 400 Hz 1 kHz 2 kHz | 1.0 % + 1 <i>cts</i> 1.0 % + 1 <i>cts</i> 1.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> | |
| (10 to 100) mF | 100 Hz 120 Hz 200 Hz 400 Hz 1 kHz 2 kHz | 3.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> 3.0 % + 1 <i>cts</i> 5.0 % + 1 <i>cts</i> 10 % + 1 <i>cts</i> 10 % + 1 <i>cts</i> | |
| (100 to 1000) mF | 100 Hz 120 Hz 200 Hz | 10 % + 1 <i>cts</i> 10 % + 1 <i>cts</i> 10 % + 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 to 1000) nH (1 to 10) μH (10 to 100) μH | (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 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> | |
| | (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> | |
| | (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} (±) | Comments |
|---|-----------------|------------------------|--|
| Inductance – Measure ³ (cont) | | | |
| (0.100 to 1) H | (100 or 120) Hz | 0.12 % + 1 <i>cts</i> | Multi-frequency LCR meter cts: 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 | 0.12 % + 1 <i>cts</i> | |
| | 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 | |

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---|--|------------------|
| 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} (±) | 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 @ 0.25V _{p-p} | (1 to 999) KHz (1 to 10) MHz | 0.03 % 0.03 % | 5520A SC1100 calibrator |
| 50 Ω load @ 0.5V _{p-p} | (1 to 999) KHz (1 to 10) MHz | 0.03 % 0.03 % | |
| 50 Ω load @ 1V _{p-p} | (1 to 999) KHz (1 to 10) MHz | 0.03 % 0.03 % | |
| 50 Ω load @ 2.5V _{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 | 1 mV to 130 V _{p-p} | 0.12 % + 40 μV | |
| Up to 1 kHz | 1 mV to 130 V _{p-p} | 0.29 % + 40 μV | |
| ≥ 1 kHz | 1 mV to 6.6 V _{p-p} | 0.29 % + 40 μV | |
| 50 Ω Load | | | |

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

III. Mechanical

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---------------------|----------------------|----------------------|--|
| Torque ³ | (1.0 to 2.0) in·lbf | 0.025 in·lbf | Torque transducers with torque analyzer |
| | (2.0 to 10.0) in·lbf | 0.073 in·lbf | |
| | (5 to 10) in·lbf | 0.13 in·lbf | |
| | (10 to 50) in·lbf | 0.42 in·lbf | |
| | (10 to 20) in·lbf | 0.13 in·lbf | |
| | (20 to 100) in·lbf | 0.60 in·lbf | |
| | (50 to 100) in·lbf | 1.2 in·lbf | |
| | (100 to 500) in·lbf | 3.2 in·lbf | |
| | (25 to 50) ft·lbf | 0.63 ft·lbf | |
| | (50 to 250) ft·lbf | 1.8 ft·lbf | |
| | (100 to 200) ft·lbf | 2.8 ft·lbf | |
| | (200 to 1000) ft·lbf | 7.1 ft·lbf | |

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|----------------------------------|--|--|-------------------------------|
| Vacuum & Pressure ³ – | | | |
| Compressed Air ³ | (-12 to 0) psi | 0.039 psi | Fluke 700G05 gauge |
| | (0 to 1) psi | 0.0012 psi | Fluke 700G02 gauge |
| | (0 to 30) psi | 0.017 psi | Fluke 700G05 gauge |
| | (30 to 300) psi | 0.13 psi | Fluke 3130 pressure system |
| | (0 to 30) in H ₂ O | 0.033 in H ₂ O | Fluke 700G02 gauge |
| Manometer Pressure ³ | (0 to 800) in H ₂ O | 0.47 in H ₂ O | Fluke 700G05 gauge |
| Absolute ³ | (0 to 900) mmHg | 2.0 mmHg | Miriam 350 absolute manometer |
| Hydraulic-Water ³ | (300 to 3000) psi | 0.72 psi | Fluke 2700G-G20M |
| | (700 to 1000) psi | 3.2 psi | Ashcroft 700 |
| | (1001 to 7000) psi | 5.0 psi | Omega dyne DP4 transducers |
| | (1000 to 10 000) psi | 20 psi | |
| Force – Generate ³ | (1.0 to 2.0) g (2.0 to 10.0) g (10.0 to 20.0) g (20.0 to 50.0) g (50.0 to 100.0) g (100.0 to 200.0) g (200.0 to 300.0) g (300.0 to 500.0) g (500.0 to 1000.0) g (1000.0 to 5000.0) g (0.25 to 1.0) Lb. (1.0 to 2.0) Lb. (2.0 to 5.0) Lb. (5.0 to 10.0) Lb. (10.0 to 20.0) Lb. (20.0 to 100.0) Lb. (100.0 to 200.0) Lb. | 2.4 x 10 ⁻⁴ g 3.6 x 10 ⁻⁴ g 1.5 x 10 ⁻⁴ g 1.8 x 10 ⁻⁴ g 3.1 x 10 ⁻⁴ g 5.9 x 10 ⁻⁴ g 8.7 x 10 ⁻⁴ g 1.4 x 10 ⁻³ g 1.1 x 10 ⁻¹ g 1.0 x 10 ⁻¹ g 6.9 x 10 ⁻⁴ Lb. 1.1 x 10 ⁻³ Lb. 1.9 x 10 ⁻³ Lb. 3.3 x 10 ⁻³ Lb. 4.8 x 10 ⁻³ Lb. 5.3 x 10 ⁻³ Lb. 1.2 x 10 ⁻² Lb. | Reference weights |

IV. Thermodynamics

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---|--|--|
| Infrared – Measuring Equipment ³ | (50 to 100) °C (100 to 500) °C (500 to 1000) °C (1000 to 1100) °C (1100 to 1400) °C (1400 to 1500) °C | 3 °C 4 °C 7 °C 10 °C 11 °C 12 °C | Black body sources Micron 305, 310, 335 |
| Infrared – Measure ³ | (0 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 °C 4 °C 5 °C 6 °C 3 °C 6 °C 7 °C 8 °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 (0.0 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 | 0.027 °C 0.031 °C 0.028 °C 0.033 °C 0.035 °C 0.034 °C 0.045 °C 0.046 °C 0.065 °C | Fluke 9142 with/Hart Scientific 5615-12 PRT Fluke 9144 with/Hart Scientific 5615-12 PRT |

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|------------------------------------|---|--|-----------------------------|
| Temperature – Measure ³ | (-196 to -39) °C (-39 to 0.0) °C (0.0 to 232) °C (232 to 420) °C (420 to 550) °C (550 to 660) °C | 0.052 °C 0.073 °C 0.050 °C 0.061 °C 0.064 °C 0.096 °C | Hart Scientific 5615-12 PRT |
| | (660 to 700) °C (700 to 800) °C (800 to 900) °C (900 to 1000) °C | 2.1 °C 2.4 °C 2.8 °C 3.0 °C | Pyromation S-type probe |

V. Time & Frequency

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|----------------------------------|---|---|--|
| Frequency – Measuring Equipment | 10 MHz 5 MHz 1 Hz | 1.2 x 10 ⁻⁹ Hz 1.6 x 10 ⁻⁹ Hz 3.8 x 10 ⁻⁹ Hz | Fluke 910 GPS receiver |
| Frequency – Measure ³ | 20 Hz to 200 MHz (200 to 550) MHz (550 to 1300) MHz | 1 x 10 ⁻⁸ Hz 1 x 10 ⁻⁵ Hz 1 x 10 ⁻⁵ Hz | Frequency counter and 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 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.

⁵ 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.



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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 17025:2005 *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 7th day of September 2018.

A handwritten signature in black ink, appearing to be "L. J. ...", written over a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 2417.01
Valid to May 31, 2020
Revised October 4, 2018

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