



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: September 30, 2021

Certificate Number: 1741.19

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1,8</sup>:

I. Chemical

| Parameter/Equipment              | Range   | CMC <sup>2</sup> (±)                             | Comments                        |
|----------------------------------|---|--|---------------------------------|
| pH Meters <sup>3</sup>           | 4 pH<br>7 pH<br>10 pH                               | 0.028 pH<br>0.028 pH<br>0.036 pH                 | Standard pH solutions           |
| Conductivity Meters <sup>3</sup> | 10 µS/cm<br>100 µS/cm<br>1000 µS/cm<br>10 000 µS/cm | 0.56 µS/cm<br>2.2 µS/cm<br>5.7 µS/cm<br>41 µS/cm | Standard conductivity solutions |
| Refractometers <sup>3</sup>      | (5, 15, 40, 70) % Brix                              | 0.033 % Brix                                     | Sucrose solutions               |

II. Dimensional

| Parameter/Equipment      | Range       | CMC <sup>2,5</sup> (±)  | Comments                |
|--------------------------|-------------|-------------------------|-------------------------|
| Calipers <sup>3</sup>    | Up to 60 in | (4.6 + 9.8L) µin + 0.6R | Gage blocks             |
| Micrometers <sup>3</sup> | Up to 60 in | (4.6 + 9.8L) µin + 0.6R | Gage blocks             |
| Micrometer Standards     | Up to 10 in | (33 + 8.2L) µin         | Pratt & Whitney Model C |

| Parameter/Equipment   | Range <sup>5</sup>                       | CMC <sup>2, 5, 7</sup> ( $\pm$ )       | Comments                           |
|---|--|--|------------------------------------|
| Linear Indicators –<br>Dial and Test <sup>3</sup>   | Up to 4 in                               | $(3 + 9.4L) \mu\text{in} + 0.6R$       | Gage blocks                        |
| Cylindrical Gages <sup>3</sup> –<br>Pins, Plain Plugs,<br>Discs, Spheres –<br>External Diameter | Up to 10 in                              | $(33 + 8.2L) \mu\text{in}$             | Pratt & Whitney Model<br>C         |
| One Dimensional–<br>Measure <sup>3</sup>  | Up to 1 in<br>Up to 6 in                 | 80 $\mu\text{in}$<br>0.0026 in         | Micrometer<br>Caliper              |
| Height Gages <sup>3</sup>   | Up to 48 in                              | $(53 + 8.9L) \mu\text{in} + 0.6R$      | Gage blocks w/surface<br>plate     |
| Steel Rules <sup>3</sup>  | Up to 72 in                              | $(1.5 + 10L) \mu\text{in} + 0.6R$      | Gage blocks                        |
| Tape Measures <sup>3</sup>  | Up to 25 ft                              | $(1.5 + 10L) \mu\text{in} + 0.6R$      | Gage blocks                        |
| Angle Indicators and<br>Protractors <sup>3</sup>  | 30°, 45°, 60°, 75°, 90°                  | 0.03°                                  | Angle block set                    |
| Feeler/Thickness<br>Gages <sup>3</sup>  | Up to 1 in                               | $(33 + 8.2L) \mu\text{in}$             | Pratt & Whitney Model<br>C         |
| Coating Thickness<br>Gages – Film,<br>Ultrasonic <sup>3</sup>                                   | Up to 60 mils                            | 0.1 mils                               | Coating thickness<br>standards     |
| Optical Comparators <sup>3</sup>  | Up to 12 in<br>10x to 250x<br>(0 to 90)° | 150 $\mu\text{in}$<br>0.014 in<br>0.1° | Glass scale<br><br>Angle block set |

| Parameter/Equipment   | Range <sup>5</sup>                               | CMC <sup>2,5</sup> ( $\pm$ )                                  | Comments   |
|---|--|---|--|
| Vision systems <sup>3</sup> –<br>X-Y Linearity<br>Z Axis  | Up to 18 in<br>Up to 4 in                        | (52 + 2.9L) $\mu$ in<br>60 $\mu$ in                           | Grid plate<br>Gage blocks                          |
| Surface Plates<br>Grades AA, A and B <sup>3</sup> –<br>Repeatability<br>Flatness  | 0.002 in<br>Up to 60 DL in<br>(>60 to 120) DL in | 40 $\mu$ in<br>(31 + 0.2DL) $\mu$ in<br>(30 + 0.3DL) $\mu$ in | Repeat-o-meter<br>Federal level system             |
| Interim Verification of<br>Coordinate Measuring<br>Machines <sup>3</sup><br>X, Y, Z Linearity<br>Volumetric Performance | Up to 36 in<br>Up to 10 in                       | (30 + 2.9L) $\mu$ in<br>120 $\mu$ in                          | Gage blocks<br>Ball bar                            |
| Bench Micrometers,<br>Universal Length<br>Measuring Machines <sup>3</sup> –<br>Linearity<br>Parallelism<br>Force        | Up to 20 in<br>Up to 1 in<br>Up to 80 oz         | (3.9 + 1.5L) $\mu$ in + 0.6R<br>5 $\mu$ in<br>0.32 oz         | Gage blocks<br>Reference sphere<br>Futek load cell |

III. Electrical – DC/Low Frequency

| Parameter/Equipment                | Range  | CMC <sup>2, 6, 7</sup> ( $\pm$ )  | Comments  |
|------------------------------------|--|---|---|
| DC Voltage – Measure <sup>3</sup>  | (0 to 100) mV<br>(0.1 to 1.0) V<br>(1 to 10) V<br>(10 to 100) V<br>(100 to 1000) V<br><br>(1 to 10) kV<br>(10 to 100) kV   | 7.8 $\mu$ V/V + 0.2 $\mu$ V<br>4.4 $\mu$ V/V + 0.3 $\mu$ V<br>4.4 $\mu$ V/V + 0.5 $\mu$ V<br>6.8 $\mu$ V/V + 30 $\mu$ V<br>7 $\mu$ V/V + 0.5 mV<br><br>0.03 % + 0.03 V<br>0.05 % + 0.3 V            | Fluke 8588A<br><br><br><br><br><br>Vitrek 4700 w/ HVL-100             |
| DC Voltage – Generate <sup>3</sup> | (0 to 330) mV<br>330 mV to 3.3 V<br>(3.3 to 33) V<br>(33 to 330) V<br>(100 to 1020) V  | 25 $\mu$ V/V + 1 $\mu$ V<br>14 $\mu$ V/V + 2 $\mu$ V<br>15 $\mu$ V/V + 15 $\mu$ V<br>22 $\mu$ V/V + 150 $\mu$ V<br>22 $\mu$ V/V + 1.5 mV  | Fluke 5522A   |
| DC Current – Measure <sup>3</sup>  | (0 to 10) $\mu$ A<br>(10 to 100) $\mu$ A<br>(0.1 to 1.0) mA<br>(1 to 10) mA<br>(10 to 100) mA<br>(0.1 to 1.0) A<br>(1 to 10) A<br>(1 to 30) A<br><br>(1 to 1000) A | 28 $\mu$ A/A + 0.4 nA<br>10 $\mu$ A/A + 0.4 nA<br>10 $\mu$ A/A + 4 nA<br>15 $\mu$ A/A + 40 nA<br>58 $\mu$ A/A + 1 $\mu$ A<br>0.014% + 0.1mA<br>0.024% + 0.4 mA<br>0.056% + 4.4 mA<br><br>0.32 %     | Fluke 8588A<br><br><br><br><br><br><br><br>Empro shunt w/ Fluke 8588A |
| DC Current – Generate <sup>3</sup> | (0 to 330) $\mu$ A<br>(0 to 3.3) mA<br>(0 to 33) mA<br>(0 to 330) mA<br>(0 to 1.1) A<br>(1.1 to 3) A<br>(0 to 11) A<br>(11 to 21) A                                | 0.018 % + 0.02 $\mu$ A<br>0.012 % + 0.05 $\mu$ A<br>0.013 % + 0.25 $\mu$ A<br>0.015 % + 2.5 $\mu$ A<br>0.025 % + 40 $\mu$ A<br>0.046 % + 40 $\mu$ A<br>0.06 % + 500 $\mu$ A<br>0.12 % + 750 $\mu$ A | Fluke 5522A   |
| DC Clamp-On Meters <sup>3</sup> –  |  |   |   |
| Toroidal                           | (Up to 1000) A   | 0.39 % + 0.5 A  | Fluke 5522A w/5500 coil   |
| Non-Toroidal                       | (Up to 1000) A   | 0.65 % + 0.5 A  |   |

| Parameter/Equipment   | Range  | CMC <sup>2,6,7</sup> (±)  | Comments   |
|---|--|---|--|
| DC Power – Generate <sup>3</sup><br>33 mV to 1020 V<br>(0.33 to 329.99) mA<br>(0.33 to 2.9999) A<br>(3 to 20.5) A | (0.01 to 330) W<br>(0.33 to 3.3) kW<br>(3.3 to 20.5) kW  | 0.032 %<br>0.031 %<br>0.085 %   | Fluke 5522A                                      |
| Resistance – Measure <sup>3</sup>   | (0 to 1) Ω<br>(1 to 10) Ω<br>(10 to 100) Ω<br>(0.1 to 1) kΩ<br>(1 to 10) kΩ<br>(10 to 100) kΩ<br>(0.1 to 1) MΩ<br>(1 to 10) MΩ<br>(10 to 100) MΩ<br>(0.1 to 1) GΩ<br>(1 to 10) GΩ  | 19 μΩ/Ω + 4.0 μΩ<br>11 μΩ/Ω + 14 μΩ<br>9.6 μΩ/Ω + 50 μΩ<br>9.4 μΩ/Ω + 0.5 mΩ<br>9.4 μΩ/Ω + 5.0 mΩ<br>9.6 μΩ/Ω + 50 mΩ<br>11 μΩ/Ω + 1 Ω<br>24 μΩ/Ω + 100 Ω<br>0.013% + 10 kΩ<br>0.14% + 1 MΩ<br>0.14% + 10 MΩ  | Fluke 8588A                                      |
| Resistance – Generate <sup>3</sup><br><br>Decade Steps  | Up to 11 Ω<br>(11 to 33) Ω<br>(33 to 110) Ω<br>110 Ω to 1.1 kΩ<br>(1.1 to 11) kΩ<br>(11 to 110) kΩ<br>110 kΩ to 1.1 MΩ<br>(1.1 to 3.3) MΩ<br>(3.3 to 11) MΩ<br>(11 to 33) MΩ<br>(33 to 110) MΩ<br>(110 to 330) MΩ<br>(330 to 1100) MΩ<br><br>1 mΩ to 100 Ω | 49 μΩ/Ω + 0.001 Ω<br>51 μΩ/Ω + 0.0015 Ω<br>34 μΩ/Ω + 0.0014 Ω<br>34 μΩ/Ω + 0.002 Ω<br>34 μΩ/Ω + 0.02 Ω<br>34 μΩ/Ω + 0.2 Ω<br>39 μΩ/Ω + 2 Ω<br>73 μΩ/Ω + 30 Ω<br>0.014 % + 50 Ω<br>0.03 % + 2.5 kΩ<br>0.06 % + 3 kΩ<br>0.36 % + 100 kΩ<br>1.8 % + 500 kΩ<br><br>0.026 % + 1 mΩ | Fluke 5522A<br><br>IET decade resistor 1433-19-K |
| Insulation Resistance <sup>3</sup> –<br><br>Fixed Points  | 1 MΩ, 10 MΩ<br>100 MΩ, 1 GΩ,<br>2 GΩ, 5 GΩ,<br>10 GΩ, 100 GΩ   | 1.2 %   | Standard resistors                               |

| Parameter/Equipment   | Range  | CMC <sup>2, 6, 7</sup> (±)   | Comments              |
|---|--|--|-----------------------|
| Inductance – Generate <sup>3</sup><br><br>Fixed Points  | 100 µH<br>50 mH<br>500 mH<br>2 H   | 0.32 %<br>0.14 %<br>1.2 %<br>0.14 %  | Genrad 1480 series    |
| Capacitance – Generate <sup>3</sup>   | (3.3 to 11) nF<br>(11 to 110) nF<br>(110 to 330) nF<br>(0.33 to 1.1) µF<br>(1.1 to 3.3) µF<br>(3.3 to 11) µF<br>(11 to 33) µF<br>(33 to 110) µF<br>(110 to 330) µF<br>330 µF to 1.1 mF<br>(1.1 to 3.3) mF<br>(3.3 to 11) mF<br>(11 to 33) mF<br>(33 to 110) mF | 0.34 % + 0.01 nF<br>0.32 % + 0.1 nF<br>0.32 % + 0.3 nF<br>0.32 % + 1 nF<br>0.32 % + 3 nF<br>0.32 % + 10 nF<br>0.5 % + 30 nF<br>0.57 % + 100 nF<br>0.57 % + 300 nF<br>0.58 % + 300 nF<br>0.56 % + 3 µF<br>0.56 % + 10 µF<br>0.9 % + 30 µF<br>2.2 % + 100 µF | Fluke 5522A           |
| Capacitance – Generate <sup>3</sup><br><br>Decade Steps   | 10 pF to 100 µF  | 1.3 %  | Time electronics 1071 |
| Capacitance – Measure <sup>3</sup><br><br>(0.1 to 1) nF<br>(1 to 10) nF<br>(10 to 100) nF<br>(0.1 to 1) µF<br>(1 to 10) µF<br>(10 to 100) µF<br>(0.1 to 1) mF<br>(1 to 10) mF<br>(10 to 100) mF | (50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz<br>(50 to 60) Hz   | 0.23% + 0.1 nF<br>0.13 % + 0.2 nF<br>0.1 % + 0.01 nF<br>0.1 % + 0.1 nF<br>0.1 % + 0.1 nF<br>0.11 % + 0.01 µF<br>0.11 % + 0.1 µF<br>0.12 % + 1 µF<br>0.12% + 0.1 mF   | Fluke 8588A           |

| Parameter/Range                    | Frequency   | CMC <sup>2, 4, 6, 7</sup> (±)  | Comments    |
|------------------------------------|---|--|-------------|
| AC Voltage – Generate <sup>3</sup> |   |  |             |
| (1 to 33) mV                       | (10 to 45) Hz<br>45 Hz to 10 kHz<br>(10 to 20) kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 500) kHz | 0.1 % + 6 μV<br>0.021 % + 6 μV<br>0.027 % + 6 μV<br>0.12 % + 6 μV<br>0.42 % + 12 μV<br>0.96 % + 50 μV          | Fluke 5522A |
| (33 to 330) mV                     | (10 to 45) Hz<br>45 Hz to 10 kHz<br>(10 to 20) kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 500) kHz | 0.036 % + 8 μV<br>0.018 % + 8 μV<br>0.02 % + 8 μV<br>0.042 % + 8 μV<br>0.096 % + 32 μV<br>0.24 % + 70 μV       |             |
| 330 mV to 3.3 V                    | (10 to 45) Hz<br>45 Hz to 10 kHz<br>(10 to 20) kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 500) kHz | 0.04 % + 50 μV<br>0.019 % + 60 μV<br>0.023 % + 60 μV<br>0.036 % + 50 μV<br>0.085 % + 130 μV<br>0.29 % + 600 μV |             |
| (3.3 to 33) V                      | (10 to 45) Hz<br>45 Hz to 10 kHz<br>(10 to 20) kHz<br>(20 to 50) kHz<br>(50 to 100) kHz                     | 0.04 % + 650 μV<br>0.019 % + 600 μV<br>0.029 % + 600 μV<br>0.043 % + 600 μV<br>0.11 % + 1.6 mV                 |             |
| (33 to 330) V                      | 45 Hz to 1 kHz<br>(1 to 10) kHz<br>(10 to 20) kHz<br>(20 to 50) kHz<br>(50 to 100) kHz                      | 0.024 % + 2 mV<br>0.025 % + 6 mV<br>0.03 % + 6 mV<br>0.038 % + 6 mV<br>0.25 % + 50 mV                          |             |
| (330 to 1020) V                    | 45 Hz to 10 kHz   | 0.037 % + 10 mV  |             |

| Parameter/Range                   | Frequency   | CMC <sup>2, 4, 6, 7</sup> (±)   | Comments                     |
|-----------------------------------|---|---|------------------------------|
| AC Voltage – Measure <sup>3</sup> |   |   |                              |
| (0 to 10) mV                      | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz<br>(100 to 300) kHz<br>(0.3 to 1) MHz | 0.034% + 1.1 μV<br>0.041% + 1.1 μV<br>0.042% + 1.1 μV<br>0.031% + 1.1 μV<br>1.1% + 4 μV<br>2.1% + 4 μV  | Fluke 8588A                  |
| (10 to 100) mV                    | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz<br>(100 to 300) kHz<br>(0.3 to 1) MHz | 0.01% + 0.5 μV<br>0.014% + 0.4 μV<br>0.024% + 1 μV<br>0.054% + 5 μV<br>0.22% + 30 μV<br>1.2% + 0.1 mV   |                              |
| (0.1 to 1) V                      | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz<br>(100 to 300) kHz<br>(0.3 to 1) MHz | 0.008 % + 5 μV<br>0.013% + 5 μV<br>0.024% + 10 μV<br>0.054% + 50 μV<br>0.22% + 0.3 mV<br>1.1% + 1 mV    |                              |
| (1 to 10) V                       | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz<br>(100 to 300) kHz<br>(0.3 to 1) MHz | 0.008 % + 50 μV<br>0.013% + 50 μV<br>0.024% + 0.1 mV<br>0.054% + 0.5 mV<br>0.22% + 3 mV<br>1.1% + 10 mV |                              |
| (10 to 100) V                     | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz<br>(100 to 300) kHz<br>(0.3 to 1) MHz | 0.016 % + 0.5mV<br>0.017% + 0.5mV<br>0.027% + 1 mV<br>0.061% + 5 mV<br>0.38% + 50 mV<br>1.2% + 0.5 V    |                              |
| (100 to 1000) V                   | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz                                       | 0.012% + 25 mV<br>0.012% + 25 mV<br>0.025% + 25 mV<br>0.06% + 0.1 V                                     |                              |
| (1 to 10) kV<br>(10 to 70) kV     | (50 to 60) Hz<br>(50 to 60) Hz  | 0.15 % + 0.1 V<br>0.15 % + 0.6 V  | Vitrek 4700 w/transfer probe |



| Parameter/Range                                      | Frequency   | CMC <sup>2, 4, 7</sup> (±)  | Comments                 |
|--|---|---|--------------------------|
| AC Clamp-On Meters <sup>3</sup> –<br><br>Up to 150 A |   |   |                          |
| Toroidal   | (45 to 65) Hz<br>(65 to 440) Hz   | 0.49 % + 0.025 A<br>1 % + 0.027 A   | Fluke 5522A w/ 5500 coil |
| Non-Toroidal   | (45 to 65) Hz<br>(65 to 440) Hz   | 0.76 % + 0.25 A<br>1.3 % + 0.25 A   |                          |
| (150 to 1025) A                                      |   |   |                          |
| Toroidal   | (45 to 65) Hz<br>(65 to 440) Hz   | 0.49 % + 0.09 A<br>1 % + 0.1 A  |                          |
| Non-Toroidal   | (45 to 65) Hz<br>(65 to 440) Hz   | 0.76 % + 0.9 A<br>1.3 % + 0.9 A   |                          |
| AC Current – Generate <sup>3</sup>                   |   |   |                          |
| Up to 0.33 mA  | (10 to 20) Hz<br>(20 to 45) Hz<br>45 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz<br>(10 to 30) kHz | 0.25 % + 0.1 μA<br>0.18 % + 0.1 μA<br>0.16 % + 0.1 μA<br>0.37 % + 0.15 μA<br>0.97 % + 0.2 μA<br>1.9 % + 0.4 μA  | Fluke 5522A              |
| (0.33 to 3.3) mA                                     | (10 to 20) Hz<br>(20 to 45) Hz<br>45 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz<br>(10 to 30) kHz | 0.24 % + 0.15 μA<br>0.15 % + 0.15 μA<br>0.13 % + 0.15 μA<br>0.25 % + 0.2 μA<br>0.6 % + 0.3 μA<br>1.2 % + 0.6 μA |                          |
| (3.3 to 33) mA                                       | (10 to 20) Hz<br>(20 to 45) Hz<br>45 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz<br>(10 to 30) kHz | 0.22 % + 2 μA<br>0.11 % + 2 μA<br>0.05 % + 2 μA<br>0.1 % + 2 μA<br>0.25 % + 3 μA<br>0.49 % + 4 μA               |                          |
| (33 to 330) mA                                       | (10 to 20) Hz<br>(20 to 45) Hz<br>45 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz<br>(10 to 30) kHz | 0.22 % + 20 μA<br>0.11 % + 20 μA<br>0.05 % + 20 μA<br>0.13 % + 50 μA<br>0.25 % + 100 μA<br>0.49 % + 200 μA      |                          |

| Parameter/Range                               | Frequency   | CMC <sup>2, 4, 7</sup> ( $\pm$ )  | Comments    |
|---|---|---|-------------|
| AC Current – Generate <sup>3</sup><br>(cont.) |   |   |             |
| (0.33 to 1.1) A                               | (10 to 45) Hz<br>45 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz    | 0.22 % + 100 $\mu$ A<br>0.063 % + 100 $\mu$ A<br>0.73 % + 1 mA<br>3 % + 5 mA              | Fluke 5522A |
| (1.1 to 3.0) A                                | (10 to 45) Hz<br>45 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz    | 0.22 % + 100 $\mu$ A<br>0.08 % + 100 $\mu$ A<br>0.73 % + 1 mA<br>3 % + 5 mA               |             |
| (3.0 to 11) A                                 | 45 Hz to 1 kHz<br>(1 to 5) kHz                                      | 0.13 % + 2 mA<br>3.6 % + 2 mA   |             |
| (11 to 20.5) A                                | 45 Hz to 1 kHz<br>(1 to 5) kHz                                      | 0.19 % + 5 mA<br>3.6 % + 5 mA   |             |
| AC Current – Measure <sup>3</sup>             |   |   |             |
| (0 to 10) $\mu$ A                             | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz                    | 0.21% + 2.5 nA<br>0.21% + 2.5 nA<br>0.21% + 2.5 nA  | Fluke 8588A |
| (10 to 100) $\mu$ A                           | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz | 0.029% + 5 nA<br>0.054% + 5 nA<br>0.075% + 5 nA<br>0.41% + 10 nA                          |             |
| (0.1 to 1) mA                                 | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz | 0.029% + 50 nA<br>0.054% + 50 nA<br>0.075% + 50 nA<br>0.41% + 0.1 $\mu$ A                 |             |
| (1 to 10) mA                                  | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz<br>(30 to 100) kHz | 0.029% + 0.5 $\mu$ A<br>0.054% + 0.5 $\mu$ A<br>0.075% + 0.5 $\mu$ A<br>0.41% + 1 $\mu$ A |             |
| (10 to 100) mA                                | 1 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz                    | 0.029% + 5 $\mu$ A<br>0.053% + 5 $\mu$ A<br>0.075% + 5 $\mu$ A                            |             |

| Parameter/Range   | Frequency        | CMC <sup>2, 4, 7</sup> (±) | Comments    |
|---|------------------|----------------------------|-------------|
| AC Current – Measure <sup>3</sup><br>(cont)                                     |                  |                            |             |
| (0.1 to 1) A  | 1 Hz to 2 kHz    | 0.031% + 0.1 mA            | Fluke 8588A |
| (1 to 10) A   | (2 to 10) kHz    | 0.056% + 0.1 mA            |             |
|   | (10 to 30) kHz   | 0.08% + 0.1 mA             |             |
| (10 to 30) A  | 10 Hz to 2 kHz   | 0.085% + 0.5 mA            |             |
|   | (2 to 10) kHz    | 0.085% + 0.5 mA            |             |
|   | 10 Hz to 2 kHz   | 0.085% + 12 mA             |             |
|   | (2 to 10) kHz    | 0.13% + 12 mA              |             |
| AC Power – Generate <sup>3</sup><br>(45 to 65) Hz; PF=1<br>(33 to 330) mV Range |                  |                            |             |
| (3.3 to 8.99) mA  | 110 μW to 3 mW   | 0.17 %                     | Fluke 5522A |
| (9 to 32.99) mA   | (3 to 11) mW     | 0.12 %                     |             |
| (33 to 89.99) mA  | (1.1 to 30) mW   | 0.17 %                     |             |
| (90 to 329.99) mA   | (3 to 110) mW    | 0.12 %                     |             |
| (0.33 to 0.8999) A  | (11 to 300) mW   | 0.16 %                     |             |
| (0.9 to 2.1999) A   | (30 to 730) mW   | 0.14 %                     |             |
| (2.2 to 4.4999) A   | 73 mW to 1.5 W   | 0.16 %                     |             |
| (4.5 to 20.5) A   | 150 mW to 6.8 W  | 0.14 %                     |             |
| (45 to 65) Hz; PF=1<br>330 mV to 1020 V Range                                   |                  |                            |             |
| (3.3 to 8.99) mA  | 1.1 mW to 9 W    | 0.15 %                     |             |
| (9 to 32.99) mA   | 3 mW to 33 W     | 0.1 %                      |             |
| (33 to 89.99) mA  | 11 mW to 90 W    | 0.15 %                     |             |
| (90 to 329.99) mA   | 30 mW to 330 W   | 0.1 %                      |             |
| (0.33 to 0.8999) A  | 110 mW to 900 W  | 0.14 %                     |             |
| (0.9 to 2.1999) A   | 300 mW to 2200 W | 0.11 %                     |             |
| (2.2 to 4.4999) A   | 730 mW to 4500 W | 0.15 %                     |             |
| (4.5 to 20.5) A   | (1.5 to 20.9) kW | 0.12 %                     |             |

| Parameter/Equipment                    | Range   | CMC <sup>2,4</sup> (±)   | Comments    |
|--|---|--|-------------|
| Thermocouple Simulation <sup>3</sup> – |   |  |             |
| Type B                                 | (600 to 800) °C<br>(800 to 1550) °C<br>(1550 to 1820) °C  | 0.44 °C<br>0.36 °C<br>0.3 °C   | Fluke 7526A |
| Type E                                 | (-250 to -200) °C<br>(-200 to -100) °C<br>(-100 to 0) °C<br>(0 to 600) °C<br>(600 to 1000) °C   | 0.32 °C<br>0.18 °C<br>0.15 °C<br>0.14 °C<br>0.16 °C                                  |             |
| Type J                                 | (-210 to -100) °C<br>(-100 to 800) °C<br>(800 to 1200) °C   | 0.2 °C<br>0.15 °C<br>0.16 °C   |             |
| Type K                                 | (-250 to -200) °C<br>(-200 to -100) °C<br>(-100 to 500) °C<br>(500 to 800) °C<br>(800 to 1372) °C   | 0.56 °C<br>0.22 °C<br>0.16 °C<br>0.16 °C<br>0.19 °C                                  |             |
| Type R                                 | (-50 to -25) °C<br>(-25 to 0) °C<br>(0 to 100) °C<br>(100 to 400) °C<br>(400 to 600) °C<br>(600 to 1000) °C<br>(1000 to 1600) °C<br>(1600 to 1767) °C | 0.67 °C<br>0.55 °C<br>0.48 °C<br>0.36 °C<br>0.29 °C<br>0.28 °C<br>0.26 °C<br>0.31 °C |             |
| Type S                                 | (-50 to -25) °C<br>(-25 to 0) °C<br>(0 to 100) °C<br>(100 to 400) °C<br>(400 to 600) °C<br>(600 to 1000) °C<br>(1000 to 1600) °C<br>(1600 to 1767) °C | 0.63 °C<br>0.54 °C<br>0.48 °C<br>0.37 °C<br>0.31 °C<br>0.29 °C<br>0.3 °C<br>0.34 °C  |             |
| Type T                                 | (-250 to -200) °C<br>(-200 to 0) °C<br>(0 to 200) °C<br>(200 to 400) °C   | 0.44 °C<br>0.23 °C<br>0.17 °C<br>0.17 °C   |             |



| Parameter/Equipment  | Range                            | CMC <sup>2</sup> (±)         | Comments                          |
|--|----------------------------------|------------------------------|-----------------------------------|
| Oscilloscopes <sup>3</sup> – (cont)<br>(cont)<br><br>Rise Time:<br><br>1 kHz to 2 MHz<br>(2 to 10) MHz | <br><br><br>≤ 300 ps<br>≤ 350 ps | <br><br><br>130 ps<br>130 ps | <br><br><br>Fluke 5522A w/ SC1100 |

#### IV. Electrical – RF/Microwave

| Parameter/Equipment                        | Range                             | CMC <sup>2, 6, 7</sup> (±) | Comments                      |
|--|-----------------------------------|----------------------------|-------------------------------|
| RF Power – Measure<br><br>10 MHz to 18 GHz | (-20 to 30) dBm<br>1 μW to 100 mW | 1.8 %                      | HP EMP-442A/8481A             |
|  | (0 to 44) dBm<br>1 mW to 25 W     | 1.8 %                      | HP EMP-442A/8481B             |
|  | (-10 to 35) dBm<br>100 μW to 3 W  | 1.8 %                      | HP EMP-442A/8481H             |
| 50 MHz                                     | 1 μW to 10 mW                     | 1.4 %                      | HP 432A w/ 478A               |
| Power Meters – Range<br>Calibration        | 3 μW to 100 mW                    | 0.3 %                      | HP 11683A range<br>calibrator |

#### V. Fluid Quantities

| Parameter/Equipment                            | Range              | CMC <sup>2</sup> (±) | Comments              |
|--|--------------------|----------------------|-----------------------|
| Fume Hoods – Air<br>Velocity Only <sup>3</sup> | (20 to 200) ft/min | 4.5 %                | Anemometer<br>RCC-561 |

| Parameter/Equipment           | Range   | CMC <sup>2</sup> (±)  | Comments                            |
|-------------------------------|---|---|-------------------------------------|
| Viscosity Meters <sup>3</sup> | 202 cP<br>480 cP<br>2000 cP<br>4800 cP<br>16 000 cP<br>25 000 cP<br>32 000 cP | 1.5 cP<br>1.4 cP<br>1.4 cP<br>1.4 cP<br>1.5 cP<br>90 cP<br>150 cP | Standard viscosity solution w/ bath |

## VI. Mechanical

| Parameter/Equipment  | Range  | CMC <sup>2, 5, 6, 7</sup> (±)  | Comments                                       |
|--|--|--|--|
| Force – Measuring Equipment <sup>3</sup>                                   | Up to 500 lbf<br><br>Up to 5 lbf<br>Up to 250 lbf<br>Up to 500 lbf<br>Up to 1000 lbf<br>Up to 5000 lbf<br>Up to 10 000 lbf<br>Up to 20 000 lbf   | 0.03 % + 0.6R<br><br>0.02 lbf<br>0.24 lbf<br>0.46 lbf<br>1.3 lbf<br>4.2 lbf<br>7.3 lbf<br>18 lbf   | Class F weights<br><br>Load cells w/ indicator |
| Scales and Balances <sup>3</sup>   | (1 to 20 000) g<br><br>Up to 500 lbs<br><br>(1 to 500) mg<br>Up to 5 g<br>Up to 10 g<br>Up to 30 g<br>Up to 50 g<br>Up to 100 g<br>Up to 200 g<br>Up to 300 g<br>Up to 500 g<br>Up to 1000 g<br>Above 1000 g | 0.017 % + 0.6R<br><br>0.017 % + 0.6R<br><br>0.013 mg + 0.6R<br>0.043 mg + 0.6R<br>0.062 mg + 0.6R<br>0.092 mg + 0.6R<br>0.17 mg + 0.6R<br>0.31 mg + 0.6R<br>0.63 mg + 0.6R<br>0.93 mg + 0.6R<br>1.5 mg + 0.6R<br>3.1 mg + 0.6R<br>3.1 mg per 1000 g + 0.6R | Class F weights (applied load)                 |
| Torque – Measuring Equipment <sup>3</sup><br><br>Wrenches and Screwdrivers | 5 in·lbf to 600 ft·lbf   | 0.65 %   | CDI Suretest 5000-ST                           |

| Parameter/Equipment  | Range  | CMC <sup>2, 5, 6, 7</sup> ( $\pm$ )                                  | Comments                                     |
|--|--|--|--|
| Rotary Torque Tools <sup>3</sup><br>Pneumatic, DC, Pulse             | (0.02 to 2) N·m<br>(1 to 10) N·m<br>(02 to 20) N·m<br>(0.75 to 75) N·m<br>(18 to 180) N·m<br>(50 to 500) N·m | 1.3 % FS<br>1.3 % FS<br>1.3 % FS<br>1.3 % FS<br>1.3 % FS<br>1.3 % FS | Crane – torque star<br>w/rotary transducers  |
| Torque Testers <sup>3</sup>  | Up to 250 ft·lbf   | 0.13 %   | Class F weights & arms                       |
| Atmospheric Pressure<br>Vacuum <sup>3</sup> – Measuring<br>Equipment | (0.01 to 28.5) inHg  | 0.015 inHg   | Heise ST-2H with HQS<br>series modules       |
| Barometric Pressure –<br>Measuring Equipment <sup>3</sup>            | (0 to 17) psia   | 0.015 psia   | Fluke 6270 w/ PM600<br>A700K and A7M modules |
| Pressure – Measuring<br>Equipment <sup>3</sup>                       |  |  |  |
| Differential   | (-0.25 to 0.25) in<br>H <sub>2</sub> O   | 0.002 in H <sub>2</sub> O  | Heise ST-2H with HQS<br>series modules       |
| Pneumatic  | (-60 to 60) in H <sub>2</sub> O  | Greater of 0.016 %<br>Rdg or 0.0036 % Span                           | Fluke 6270 w/PM600<br>series modules         |
|  | (-12 to 100) psi<br>(100 to 1000) psi  | Greater of 0.016 %<br>Rdg or 0.0036 % Span                           | Fluke 6270 w/ PM600<br>A700K and A7M modules |
| Absolute   | Up to 100 psig +<br>atmospheric  | 0.015 psi  |  |
|  | (100 to 250) psig +<br>atmospheric   | 0.04 psi   |  |



| Parameter/Equipment   | Range                          | CMC <sup>2, 6, 7</sup> (±)             | Comments  |
|---|--------------------------------|--|---|
| Pressure – Measuring Equipment <sup>3</sup> (cont)              |                                |  |   |
| Absolute  | 250 to 500 psig + atmospheric  | 0.06 psi                               | Fluke 6270 w/ PM600 A700K and A7M Modules                               |
|   | 500 to 750 psig + atmospheric  | 0.09 psi                               |   |
|   | 750 to 1000 psig + atmospheric | 0.12 psi                               |   |
|   | Up to 1000 psig                | 0.26 psi                               |   |
|   | (0 to 3000) psig               | 1.9 psi                                |   |
| Hydraulic   | (5 to 15 000) psig             | 9.4 psi                                | Fluke 2700G-BG7M<br>Druck DPI-104-3000<br>Additel ADT681-05-GP15K-PSI-N |
| Indirect Verification of Rockwell Hardness Testers <sup>3</sup> | HRC:<br>Low<br>Medium<br>High  | 0.77 HRC<br>0.77 HRC<br>0.76 HRC       | Indirect verification per ASTM E18                                      |
|   | HRBW:<br>Low<br>Medium<br>High | 0.9 HRBW<br>0.87 HRBW<br>0.81 HRBW     |   |
|   | HRA:<br>Low<br>Medium<br>High  | 0.79 HRA<br>0.77 HRA<br>0.76 HRA       |   |
|   | HREW<br>Low<br>Medium<br>High  | 0.76 HREW<br>0.77 HREW<br>0.76 HREW    |   |
|   | HR15N<br>Low<br>Medium<br>High | 0.81 HR15N<br>0.81 HR15N<br>0.81 HR15N |   |



| Parameter/Equipment   | Range   | CMC <sup>2, 6</sup> (±)   | Comments                           |
|---|---|---|------------------------------------|
| Indirect Verification of Rockwell Hardness Testers <sup>3</sup> (cont)                  | HR30N<br>Low<br>Medium<br>High<br><br>HR45N<br>Low<br>Medium<br>High<br><br>HR15TW<br>Low<br>Medium<br>High<br><br>HR30TW<br>Low<br>Medium<br>High<br><br>HR45TW<br>Low<br>Medium<br>High | 0.82 HR30N<br>0.82 HR30N<br>0.82 HR30N<br><br>0.82 HR45N<br>0.81 HR45N<br>0.82 HR45N<br><br>0.81 HR15TW<br>0.81 HR15TW<br>0.82 HR15TW<br><br>0.82 HR30TW<br>0.81 HR30TW<br>0.81 HR30TW<br><br>0.81 HR45TW<br>0.81 HR45TW<br>0.81 HR45TW | Indirect verification per ASTM E18 |
| Indirect Verification of Vickers Hardness Testers <sup>3</sup><br><br>Vickers < 1 kgf   | HV:<br>Low<br>Mid<br>High   | 2.9 HV<br>11 HV<br>11 HV  | ASTM E384 w/ ASTM E92              |
| Indirect Verification of Brinell Hardness Testers <sup>3</sup> –<br><br>HBW 10mm/3000kg | HBW:<br>Low<br>Medium<br>High   | 4.5 HBW<br>4.5 HBW<br>2.6 HBW   | ASTM E10                           |

| Parameter/Equipment  | Range   | CMC <sup>2, 6, 7</sup> (±)                 | Comments  |
|--|---|--|---|
| Speed – Measure <sup>3</sup><br><br>Optic/Non-Contact:<br>RPM<br>Totalizer/Rate Meters<br><br>Contact:<br>RPM<br>Totalizer/Rate Meters | (5 to 200 000) rpm<br>(2 to 3300) fpm<br><br>(0.5 to 12 000) rpm<br>(2 to 3300) fpm | 0.017 %<br>0.017 %<br><br>0.22 %<br>0.22 % | Monarch PLT200                                    |
| Speed/RPM/Rate Simulation <sup>3</sup>   | (6 to 200 000) rpm  | 0.003 %                                    | Agilent 33120A                                    |
| Totalize Meters <sup>3</sup> –<br><br>Distance Measure<br><br>Mechanical<br>Counter/Totalizers   | Up to 200 ft<br><br>Up to 999 999<br>counts   | 0.64 %<br><br>(0.02 % + 0.6R)              | Monarch PLT200 w/<br>10cm wheel                   |
| Tensile Testers <sup>3</sup> –<br><br>Speed / Rate<br><br>Displacement   | Up to 50 in/min<br><br>Up to 20 in  | 0.025 %<br><br>0.000 25 in                 | Timer and caliper<br><br>Gage blocks w/ indicator |
| Mass – Field Check Weight<br>Comparison <sup>3</sup><br><br>Load Fixtures, Hangers,<br>Package and Check Weights                       | Up to 50 lbs  | 0.024 %                                    | Scale w/ weights                                  |

VII. Optical Quantities

| Parameter/Equipment  | Range                                | CMC <sup>2</sup> (±) | Comments                         |
|--|--------------------------------------|----------------------|----------------------------------|
| Light Booths <sup>3</sup> –<br>Illuminance<br>Color Temperature<br>(CCT) | Up to 10 000 Lux<br>(1700 to 6500) K | 2.8 %<br>51 K        | Illuminance<br>spectrophotometer |

VIII. Thermodynamics

| Parameter/Equipment   | Range   | CMC <sup>2,7</sup> (±)                             | Comments   |
|---|---|--|--|
| Relative Humidity –<br>Measure <sup>3</sup>                         | (10 to 90) % RH   | 1.0 % RH   | Rotronic HC2A-SH   |
| Plate Temperature –<br>Infrared Measuring<br>Equipment <sup>3</sup> | 35 °C<br>(35 to 100) °C<br>(100 to 200) °C<br>(200 to 350) °C<br>(350 to 500) °C                | 0.84 °C<br>1 °C<br>1.2 °C<br>1.7 °C<br>2.3 °C      | Fluke 4181   |
| Temperature – Measure <sup>3</sup>                                  | (-200 to 200) °C<br>(200 to 420) °C<br>(420 to 660) °C<br>(660 to 1100) °C<br>(1100 to 1200) °C | 0.046 °C<br>0.063 °C<br>0.1 °C<br>1.8 °C<br>2.5 °C | Fluke 1524 w/ 5609 PRT<br>Probe<br><br>Fluke 1524 w/ Isotech 935-<br>14-91   |
| Temperature – Measuring<br>Equipment <sup>3</sup>                   | (-30 to 125) °C<br>(150 to 660) °C<br>(660 to 1200) °C  | 0.087 °C<br>3.1 °C<br>4.8 °C                       | Fluke 7103 micro bath w/<br>reference probe<br><br>Hart 9150 furnace w/5609<br>PRT probe<br><br>Hart 9150 furnace<br>w/reference probe |

| Parameter/Equipment  | Range             | CMC <sup>2,7</sup> (±) | Comments                        |
|--|-------------------|------------------------|---------------------------------|
| Ovens, Furnaces, Refrigerators, Freezers, Incubators, Environmental Chambers, Baths and Dry Blocks <sup>3, 7</sup><br><br>(System Accuracy Tests and Uniformity Surveys) |                   |                        |                                 |
| Temperature  | (-200 to 200) °C  | 0.046 °C               | Fluke 1524 w/ 5609 PRT Probe    |
|  | (200 to 420) °C   | 0.063 °C               |                                 |
|  | (420 to 660) °C   | 0.2 °C                 |                                 |
|  | (660 to 1100) °C  | 1.8 °C                 | Fluke 1524 w/ Isotech 935-14-91 |
|  | (1100 to 1200) °C | 2.5 °C                 |                                 |
| Humidity   | (10 to 90) % RH   | 1.0 % RH               | Rotronic HC2A-SH                |

#### IX. Rubber and Plastics Industry Specific Equipment

| Parameter/Equipment                       | Range             | CMC <sup>2,6</sup> (±) | Comments              |
|---|-------------------|------------------------|-----------------------|
| Extrusion Plastometers <sup>3</sup>       |                   |                        | ASTM D1238            |
| Cylinder Bore (Section 5.2)               | (8 to 10) mm      | 0.0015 mm              | Bore micrometer       |
| Die Orifice (Section 5.3)                 | (0.992 to 2.1) mm | 0.000 83 mm            | Go no go pin gages    |
| Piston Land (Foot) Diameter (Section 5.4) | Up to 30 mm       | 0.0015 mm              | Micrometer            |
| Piston Rod Diameter (Section 5.4)         | Up to 30 mm       | 0.0015 mm              |                       |
| Piston Land Foot Length (Section 5.4)     | Up to 30 mm       | 0.0015 mm              |                       |
| Die (Orifice) Length (Section 5.3)        | Up to 30 mm       | 0.0015 mm              |                       |
| Piston & Load Weight (Section 5.4)        | Up to 5000 g      | 0.13 %                 | Bench scale w/weights |

| Parameter/Equipment                           | Range         | CMC <sup>2,6</sup> (±) | Comments            |
|---|---------------|------------------------|---------------------|
| Extrusion Plastometers <sup>3</sup><br>(cont) |               |                        | ASTM D1238          |
| Temperature (Section 5.5)                     | (0 to 400) °C | 0.08 °C                | Digital thermometer |
| Timing Devices<br>(Section 5.6)               | (0 to 3600) s | 0.2 s                  | Stopwatch           |

#### X. Time and Frequency

| Parameter/Equipment                             | Range            | CMC <sup>2,6,7</sup> (±) | Comments        |
|---|------------------|--------------------------|-----------------|
| Timers & Stopwatches <sup>3</sup>               | (1 to 3600) s    | 0.2 s                    | Stopwatch       |
| Frequency – Measuring<br>Equipment <sup>3</sup> | 0.01 Hz to 2 MHz | 5.6 µHz/Hz + 5 µHz       | Fluke 5522A     |
|   | Up to 15 MHz     | 0.003 %                  | HP 33120A       |
|   | 5 kHz to 3 GHz   | 0.44 µHz/Hz              | R&S Model SME03 |
| Frequency – Measure <sup>3</sup>                | Up to 3 GHz      | 0.33 µHz/Hz              | Agilent 53181A  |

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CALIBRATION

I. Chemical

| Parameter/Equipment    | Range                 | CMC <sup>2</sup> (±)            | Comments              |
|------------------------|-----------------------|---------------------------------|-----------------------|
| pH Meters <sup>3</sup> | 4 pH<br>7 pH<br>10 pH | 0.03 pH<br>0.029 pH<br>0.036 pH | Standard pH solutions |

II. Dimensional

| Parameter/Equipment               | Range       | CMC <sup>2,5</sup> (±)  | Comments                    |
|-----------------------------------|-------------|-------------------------|-----------------------------|
| Pin Gage – Class ZZ               | Up to 1 in  | 80 μin                  | Micrometer                  |
| Calipers                          | Up to 23 in | (4.6 + 9.8L) μin + 0.6R | Gage blocks                 |
| Micrometers                       | Up to 23 in | (4.6 + 9.8L) μin + 0.6R | Gage blocks                 |
| Linear Indicators – Dial and Test | Up to 4 in  | (3 + 9.4L) μin + 0.6R   | Gage blocks                 |
| Height Gauges                     | Up to 23 in | (53 + 8.9L) μin + 0.6R  | Gage blocks w/surface plate |
| Steel Rules <sup>3</sup>          | Up to 72 in | (1.5 + 10L) μin + 0.6R  | Gage blocks                 |
| Tape Measures <sup>3</sup>        | Up to 25 ft | (66 + 8.8L) μin + 0.6R  | Gage blocks                 |
| Feeler/Thickness Gages            | Up to 1 in  | 80 μin                  | Micrometer                  |



| Parameter/Equipment         | Range                            | CMC <sup>2,5</sup> (±) | Comments             |
|-----------------------------|----------------------------------|------------------------|----------------------|
| Ring Gages / Cylinder Rings | (6 to 100) mm                    | 0.0047 mm              | Tri mic set          |
| Tri – Mics                  | (6 to 100) mm<br>(100 to 200) mm | 0.0023 mm<br>0.0034 mm | Mitutoyo ring gauges |

### III. Dimensional Testing/Calibration

| Parameter/Equipment | Range       | CMC <sup>2,6</sup> (±) | Comments                |
|---------------------|-------------|------------------------|-------------------------|
| Length              |             |                        |                         |
| X - Axis            | Up to 47 in | (280 + 5.5L) μin       | Brown & Sharpe Xcel CMM |
| Y - Axis            | Up to 79 in | (280 + 6.9L) μin       |                         |
| Z - Axis            | Up to 39 in | (280 + 5L) μin         |                         |
| Volumetric          | Up to 79 in | (850 + 3.9L) μin       |                         |

### IV. Electrical – DC/Low Frequency

| Parameter/Equipment   | Range        | CMC <sup>2,6,7</sup> (±) | Comments     |
|-----------------------|--------------|--------------------------|--------------|
| DC Voltage – Measure  | Up to 50 V   | 0.06 % + 2 mV            | Druck DPI610 |
| DC Voltage – Generate | 10 V<br>24 V | 0.014 %<br>6 %           | Druck DPI610 |
| DC Current – Measure  | Up to 55 mA  | 0.061 % + 2 μA           | Druck DPI610 |
| DC Current – Generate | Up to 20 mA  | 0.061 % + 2 mA           | Druck DPI610 |



V. Mechanical

| Parameter/Equipment   | Range  | CMC <sup>2, 5, 6, 7</sup> (±)                     | Comments                               |
|---|--|---|--|
| Force – Measuring Equipment                                   | Up to 1000 lbf   | 0.03 % + 0.6R                                     | Class F weights                        |
| Scales and Balances   | Up to 1000 lbs   | 0.017 % + 0.6R                                    | Class F weights (applied load)         |
| Torque – Measuring Equipment<br><br>Wrenches and Screwdrivers | <br><br>5 in·lbf to 600 ft·lbf   | <br><br>0.65 %                                    | <br><br>CDI Suretest 5000-ST           |
| Rotary Torque Tools<br><br>Pneumatic, DC, Pulse               | <br><br>(2 to 20) Nm<br>(18 to 180) Nm<br>(50 to 500) Nm<br>(140 to 1400) Nm<br>(300 to 3000) Nm | <br><br>3.3 %<br>4.9 %<br>1.5 %<br>1.8 %<br>1.8 % | <br><br>Atlas opco torque analyzer     |
| Atmospheric Pressure & Vacuum – Measuring Equipment           | Up to 27 inHg  | 0.09 inHg   | Druck DPI610                           |
| Pressure – Measuring Equipment<br><br>Pneumatic               | <br><br>Up to 300 psig   | <br><br>0.11 psi                                  | <br><br>Druck DPI610                   |
| Leak Testers – Fixed Points                                   | 250 sccm<br><br>50 sccm  | 6.7 %<br><br>6.7 %                                | Cincinnati test systems leak standards |

<sup>1</sup> This laboratory offers commercial calibration and field calibration services, where noted.

- <sup>2</sup> Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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.
- <sup>3</sup> 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.
- <sup>4</sup> 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.
- <sup>5</sup> The statement of the CMC,  $L$  is the numerical value of the nominal length of the device measured in inches,  $R$  is the numerical value of the resolution of the device. In the statement of the Range or the CMC,  $DL$  is the diagonal length of the device in inches.
- <sup>6</sup> In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.
- <sup>7</sup> 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.
- <sup>8</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.



# Accredited Laboratory

A2LA has accredited

**CROSS TECHNOLOGIES, INC DBA CROSS (FORMERLY J.A. KING)**

*Louisville, KY*

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 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 23<sup>th</sup> day of July 2019.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1741.19  
Valid to September 30, 2021  
Revised May 11, 2021

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