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

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CALIBRATION

Valid To: November 30, 2027 Certificate Number: 1888.11

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with R205 – A2LA's Calibration Program Requirements), accreditation is granted to this laboratory at the location listed above as well as the satellite laboratory location listed below to perform the following calibrations and dimensional tests[1, 12, 14, 15]:

I. Chemical Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
pH Meters[3, 4]	4 pH 7 pH 10 pH	0.02 pH 0.02 pH 0.03 pH	Comparison to accredited pH solutions
Refractometers[3, 4]	0 % Brix	0.0058 % Brix	Comparison to distilled water

II. Dimensional

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Autocollimators	Up to 30 min	0.6″	Comparison to angle generator

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Bore Gages[3]	Up to 8 in	11 µin	Comparisons to master ring, indicator checker, universal length measuring machine
Calipers[3]	Up to 6 in (6 to 24) in (24 to 72) in	290 µin (280 + 1.1*L*) µin (240 + 2.7*L*) µin	Comparison to gage blocks
Coordinate Measuring Machines [3] –			
Linear Accuracy	Up to 120 in	(38 + 1.7*L*) µin	Comparisons to laser interferometer, ball bar, sphere
Volumetric Accuracy	Up to 120 in	(12 + 5.1*L*) µin	
Repeatability	Up to 120 in	22 µin	
Articulated Arm Coordinate Measurement Machine –			
Volumetric Performance	Up to 18 in	120 µin	Per ASME B89.4.22-2004 at 5.2, 5.3, & 5.4 using ball bar
Effective Diameter	Up to 1 in	43 µin	
Electronic Levels[3]	± 1000″	0.26″	Comparison to gage blocks, sine plate
Extensometers[3]	Up to 1 in	62 µin	Comparison to extensometer calibrator
Extrusion Plastometers[3] –			
Bore Diameter	Up to 0.25 in	87 µin	Comparison to depth micrometers, caliper, pin gages, gage blocks
Piston Diameter / Length	Up to 1 in	89 µin	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Gage Blocks	Up to 1 in (1 to 4) in	(2.8 – 0.37*L*) µin (1.2 + 1.2*L*) µin	Comparison to comparator, master gage blocks
Long Gage Blocks	(4 to 20) in	(3.9 + 1.2*L*) µin	Comparison to LVDT, master gage blocks
Glass Scales	Up to 12 in	(9.2 + 3.5*L*) µin	Comparison to measuring microscope, gage blocks, ULM
Height Gages[3]	Up to 24 in (24 to 72) in	(46 + 3.4*L*) µin (550 + 1.7*L*) µin	Comparison to gage blocks, surface plate
Indicators[3] –			
(0.000 01 in Resolution)	Up to 12 in	12 µin	Comparison to gage blocks, universal length measuring machine
(0.000 02 in Resolution)	Up to 12 in	16 µin	
(0.000 05 in Resolution)	Up to 12 in	31 µin	
(0.0001 in Resolution)	Up to 12 in	59 µin	
(0.0005 in Resolution)	Up to 12 in	290 µin	
(0.001 in Resolution)	Up to 12 in	580 µin	
Dial Test Indicators[3] –			
(0.001 in Resolution)	Up to 0.25 in	580 µin	Comparison to gage blocks
(0.0005 in Resolution)	Up to 0.25 in	290 µin	
(0.0001 in Resolution)	Up to 0.25 in	58 µin	
(0.000 05 in Resolution)	Up to 0.25 in	30 µin	
Machinist Levels[3]	Up to 15 in Up to 72 in	66 µin 320 µin	Comparison to surface plate, gage blocks

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Measuring Microscopes[3]	Up to 6 in (6 to 12) in (12 to 20) in	(29 + 3.1*L*) µin (21 + 4.3*L*) µin (10*L* – 51) µin	Comparison to laser interferometer, gage blocks, glass master
Micrometers[3]	Up to 6 in (6 to 24) in (24 to 72) in	(30 + 2.2*L*) µin (46 + 3.4*L*) µin (20 + 4.5*L*) µin	Comparison to gage blocks, universal length measuring machine
Optical Comparators[3] –			
Linearity	Up to 20 in	(12 + 24*L*) µin	Comparisons to glass scales
X-Y Axis Squareness	Up to 30 in	(23 + 20*L*) µin	Glass scales
Magnification	10x, 20x, 31.25x, 61.25x, 100x	250 µin	Glass scales, glass rule
Pi Tapes	Up to 96 in Diameter	(140 + 1.9*D*) µin	Comparison to cylindrical masters, CMM
Pin Gages[3]	Up to 2 in	(8.2 + 7.5*L*) µin	Comparison to bench micrometer
Plain Plug Gages	Up to 20 in	(3.1 + 2.4*D*) µin	Comparison to gage blocks, universal length measuring machine
Thread Plug Gages –			
Major Diameter	Up to 8 in	(3 + 2.4*D*) µin	Comparison to universal length measuring machine, thread wires
Pitch Diameter	Up to 8 in	41 µin	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Plain Ring Gages	Up to 4 in (4 to 8) in (8 to 18) in	(8.6 + 2.1*D*) µin (6.6*D* – 9.4) µin (42 + 0.18*D*) µin	Comparison to universal length measuring machine, master rings
Roughness Standards[3]	Up to 250 µin	5.6 µin	Comparison to profilometer
Steel Rules, Linear Scales[3]	Up to 96 in	(26 + 14*L*) µin	Comparison to measuring microscope
Surface Analyzers[3]	Up to 123 µin	(3.6 + 0.019*L*) µin	Comparison to roughness standard
Surface Plates[3] –			
Overall Flatness	(6 x 6) to (18 x 18) in (18 x 24) to (72 x 144) in	(49 + 0.37*L*) µin	In accordance with Fed Spec GGG-P-463 using height stand – LVDT electronic levels, autocollimator
Local Area Flatness (Repeat Readings)	0.002 in	31 µin	Repeat o meter
Tape Measures[3]	Up to 300 ft	0.0047 in	Comparison to measuring microscope
Thread Measuring Wires	Up to 80 TPI	4.1 µin	Comparison to universal length measuring machine, 0.750 roll, 0.125 roll

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Solid Thread Rings –			
Minor Diameter	Up to 8 in	45 µin	Comparison to universal length measuring machine
Pitch Diameter	Up to 8 in	100 µin	
Adjustable Thread Rings –			
Minor Diameter	Up to 8 in	45 µin	Universal length measuring machine, master setting plugs In accordance with ASME B1.2, para 5.1.1: the ring is sized to a plug, with the plug's uncertainty given.
Pitch Diameter	Up to 8 in	65 µin	
Universal Length Measuring Machines –			
Linearity	Up to 20 in	(2.7 + 1.2*L*) µin	Comparisons to master gage blocks
Anvil Parallelism	Up to 0.5 in	14 µin	Reference sphere
Anvil Force	Up to 8 ozf	0.32 ozf	Force gage
Coating Thickness Gages	Up to 156 mils	(0.0074 + 0.000 43*l*) mils	Comparison to thickness standards
Indicator Checker	Up to 1 in	47 µin	Comparison to gage blocks, universal length measuring machine
Roundness Tracing	Up to 0.02 in	5.1 µin	Roundness tester

III. Dimensional Testing/Calibration[1]

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Dimensional Measurement – 1D[13]	Up to 24 in	(130 + 3.7*L*) µin	Height measurements utilizing a height gage for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 20 in	(3.1 + 2.4*L*) µin	Length measurements utilizing a ULM for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 2 in	(8.2 + 7.5*L*) µin	Length measurements utilizing a bench micrometer for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 12 in	(76 + 4.2*L*) µin	Length measurements utilizing a measuring microscope for dimensional inspection
Dimensional Measurement – 1D[13]	X-Axis: Up to 12 in Y-Axis: Up to 8 in	150 µin 90 µin	Length measurements utilizing an optical comparator for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	23 µin	Parallelism measurements utilizing a height gage or LVDT for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	78 µin	Parallelism measurements utilizing a measuring microscope for dimensional inspection

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Dimensional Measurement – 1D[13]	Up to 0.02 in	23 µin	Squareness measurements utilizing a height gage or LVDT for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	38 µin	Squareness measurements utilizing laser interferometer for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	38 µin	Straightness measurements utilizing laser interferometer for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	23 µin	Flatness measurements utilizing a height gage or LVDT for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	42 µin	Flatness measurements utilizing an autocollimator for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	3.3 µin	Flatness measurements utilizing optical flats for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 0.02 in	5.1 µin	Roundness measurements utilizing a roundness tester for dimensional inspection
Dimensional Measurement – 1D[13]	Up to 4 in (4 to 160) in	(6.8 to 0.86L) µin (6.4 + 0.95L) µin	Length measurements utilizing gage blocks for dimensional inspection

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Dimensional Measurement – 2D[13]	Up to 0.02 in	84 µin	Squareness measurements utilizing a measuring microscope for dimensional inspection
Dimensional Measurement – 2D[13]	Up to 0.02 in	(84 + 1.9*L*) µin	Straightness measurements utilizing a measuring microscope for dimensional inspection
Dimensional Measurement – 2D[13]	Up to 360°	15″	Angle measurements utilizing a measuring microscope for dimensional inspection
Dimensional Measurement – 2D[13]	Up to 8 in	(82 + 4.6*D*) µin	Diameter measurements utilizing a measuring microscope for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 80	(41 + 4.3*L*) µin	CMM utilized for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 360°	10″	Angle measurements utilizing a CMM for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 40 in	(41 + 3.7*D*) µin	Diameter measurements utilizing a CMM for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 0.02 in	45 µin	Flatness measurements utilizing a CMM for dimensional inspection

Parameter/Equipment	Range	CMC[2] (±)	Comments
Dimensional Measurement – 3D[13]	Up to 0.02 in	45 µin	Parallelism measurements utilizing a CMM for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 0.02 in	45 µin	Sphericity measurements utilizing a CMM for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 0.02 in	45 µin	Squareness measurements utilizing a CMM for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 0.02 in	45 µin	Straightness measurements utilizing a CMM for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 9 ft	0.0027 in	Articulating arm CMM utilized for dimensional inspection
Dimensional Measurement – 3D[13]	Up to 9 ft	0.0033 in	Articulating arm CMM with laser utilized for dimensional inspection

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
DC Voltage – Generate[3]	Up to 330 mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1000) V (0 to 120) mV (> 0.12 to 1.2) V (> 1.2 to 12) V (> 12 to 120) V (> 120 to 1020) V	15 µV/V + 1 µV 8.1 µV/V + 3.7 µV 9.3 µV/V + 16 µV 14 µV/V + 0.12 mV 14 µV/V + 1.2 mV 8.7 µV/V + 0.88 µV 6.8 µV/V + 1.0 µV 6.4 µV/V + 10 µV 8.8 µV/V + 98 µV 8.7 µV/V + 0.99 mV	Comparison to multiproduct calibrator
DC Voltage – Measure[3]	(10 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	3.3 µV/V + 0.74 µV 2.1 µV/V + 1.3 µV 2.4 µV/V + 5.8 µV 3.8 µV/V + 96 µV 14 µV/V - 1.1 mV	Comparison to precision digital multimeter
DC High Voltage – Measure[3]	Up to 6 kV (6 to 40) kV	5.8 mV/V + 6.1 V 30 mV/V	Comparison to digital multimeter, high voltage probe
DC Current – Generate[3]	Up to 330 µA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20) A Up to 120 µA (> 0.12 to 1.2) mA (> 1.2 to 12) mA (> 12 to 120) mA (> 0.12 to 1.2) A (> 1.2 to 3.1) A (> 3.1 to 12) A (> 12 to 30.2) A	0.12 µA/A + 16 nA 74 nA/A + 60 nA 77 nA/A + 0.2 µA 80 nA/A + 3.1 µA 0.16 mA/A + 32 µA 0.3 mA/A + 31 µA 0.39 mA/A + 0.39 mA 1 mA/A + 0.75 mA 97 µA/A + 6.1 nA 79 µA/A + 15 nA 79 µA/A + 81 nA 79 µA/A + 0.82 µA 0.012 % + 10 µA 0.023 % + 350 µA 0.024 % + 260 µA 0.079 % + 350 µA	Comparison to multiproduct calibrator

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
DC Current Clamp-On Meters[3]	(20 to 200) A (200 to 1000) A	7.8 mA/A + 0.36 A 3.9 mA/A + 0.51 A	Comparison to multiproduct calibrator, 50-turn coil
DC Current – Measure[3]	Up to 100 nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 60) A (60 to 1000) A	0.58 nA 0.58 nA 0.58 nA 0.77 nA 8.4 nA/A + 7.1 nA 8.4 nA/A + 71 nA 18 nA/A + 0.68 µA 66 µA/A + 9.6 µA 0.6 mA/A 15 mA/A + 2 A	Comparison to precision digital multimeter Comparison to precision digital multimeter w/ shunt Comparison to clamp-on meter
DC Power – Generate[3]	0.1 nW to 30.8 kW	0.081 % + 0.0087 nW	Comparison to multiproduct calibrator
Resistance – Generate[3] (Simulation)	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ	15 µΩ/Ω + 0.96 mΩ 23 µΩ/Ω + 1.2 mΩ 22 µΩ/Ω + 1.1 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 0.16 Ω 22 µΩ/Ω + 0.16 Ω 25 µΩ/Ω + 1.6 Ω 25 µΩ/Ω + 1.6 Ω 46 µΩ/Ω + 24 Ω 0.1 mΩ/Ω + 39 Ω 0.2 mΩ/Ω + 1.9 kΩ 0.39 mΩ/Ω + 2.3 kΩ 2.3 mΩ/Ω + 78 kΩ 12 mΩ/Ω + 0.38 MΩ	Comparison to multiproduct calibrator

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Resistance – Generate[3] (Simulation) (cont)	Up to 12 Ω (> 12 to 120) Ω (> 0.12 to 1.2) kΩ (> 1.2 to 12) kΩ (> 12 to 120) kΩ (> 0.12 to 1.2) MΩ (> 1.2 to 12) MΩ (> 12 to 120) MΩ (> 0.12 to 1.2) GΩ	12 µΩ/Ω + 1.0 mΩ 20 µΩ/Ω + 1.0 mΩ 21 µΩ/Ω + 2.1 mΩ 21 µΩ/Ω + 21 mΩ 21 µΩ/Ω + 0.20 Ω 21 µΩ/Ω + 2.1 Ω 23 µΩ/Ω + 30 Ω 0.035 % + 2.4 kΩ 0.33 % + 60 kΩ	Comparison to multiproduct calibrator
Resistance – Measure[3]	Up 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	0.6 mΩ/Ω + 94 µΩ 7.9 µΩ/Ω + 0.43 mΩ 6.6 µΩ/Ω + 0.92 mΩ 6.6 µΩ/Ω + 9.3 mΩ 6.6 µΩ/Ω + 0.13 Ω 10 µΩ/Ω + 2.5 Ω 33 µΩ/Ω + 0.12 kΩ 0.32 mΩ/Ω + 8.5 kΩ 3.3 mΩ/Ω + 0.24 MΩ	Comparison to precision digital multimeter
Electrical Simulation of Thermocouple Indicating Devices – Generate/Measure[3]			
Type B	(600 to 800) °C (> 800 to 1000) °C (> 1000 to 1550) °C (> 1550 to 1820) °C	0.34 °C 0.26 °C 0.23 °C 0.26 °C	Comparison to multiproduct calibrator
Type C	(0 to 150) °C (> 150 to 650) °C (> 650 to 1000) °C (> 1000 to 1800) °C (> 1800 to 2315) °C	0.19 °C 0.17 °C 0.20 °C 0.35 °C 0.61 °C	
Type D	(0 to 150) °C (> 150 to 650) °C (> 650 to 1000) °C (> 1000 to 1800) °C (> 1800 to 2315) °C	0.19 °C 0.17 °C 0.20 °C 0.34 °C 0.61 C	
Type E	(-250 to -100) °C (> -100 to -25) °C (> -25 to 350) °C (> 350 to 650) °C (> 650 to 1000) °C	0.31 °C 0.12 °C 0.10 °C 0.13 °C 0.17 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouple Indicating Devices – Generate/Measure[3] (cont)			
Type G	(0 to 150) °C (> 150 to 650) °C (> 650 to 1000) °C (> 1000 to 1800) °C (> 1800 to 2315) °C	0.39 °C 0.26 °C 0.20 °C 0.33 °C 0.60 °C	Comparison to multiproduct calibrator
Type J	(-210 to -100) °C (> -100 to -30) °C (> -30 to 150) °C (> 150 to 760) °C (> 760 to 1200) °C	0.19 °C 0.11 °C 0.10 °C 0.12 °C 0.17 °C	
Type K	(-200 to -100) °C (> -100 to -25) °C (> -25 to 120) °C (> 120 to 1000) °C (> 1000 to 1372) °C	0.22 °C 0.11 °C 0.10 °C 0.17 °C 0.27 °C	
Type L	(-200 to -100) °C (> -100 to 800) °C (> 800 to 900) °C	0.24 °C 0.17 °C 0.10 °C	
Type N	(-200 to -100) °C (> -100 to -25) °C (> -25 to 120) °C (> 120 to 410) °C (> 410 to 1300) °C	0.26 °C 0.13 °C 0.10 °C 0.10 °C 0.17 °C	
Type R	(0 to 250) °C (> 250 to 400) °C (> 400 to 1000) °C (> 1000 to 1767) °C	0.40 °C 0.23 °C 0.21 °C 0.26 °C	
Type S	(0 to 250) °C (> 250 to 1000) °C (> 1000 to 1400) °C (> 1400 to 1767) °C	0.32 °C 0.24 °C 0.25 °C 0.32 °C	
Type T	(-250 to -150) °C (> -150 to 0) °C (> 0 to 120) °C (> 120 to 400) °C	0.47 °C 0.17 °C 0.11 °C 0.10 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouple Indicating Devices – Generate/Measure[3] (cont)			
Type U	(-200 to 0) °C (> 0 to 600) °C	0.31 °C 0.10 °C	Comparison to multiproduct calibrator
Type BP	(0 to 1000) °C (> 1000 to 2000) °C (> 2000 to 2500) °C	0.31 °C 0.47 °C 0.62 °C	
Type XK	(-200 to 300) °C (> 300 to 800) °C	0.17 °C 0.23 °C	
Electrical Simulation of RTD Indicating Devices – Generate[3]			
Cu 427, 10 Ω	(-80 to 260) °C	0.25 °C	Comparison to multiproduct calibrator
Cu 428, 50 Ω	(-180 to 200) °C	0.31 °C	
Cu 428, 100 Ω	(-180 to < 40) °C (40 to 200) °C	0.31 °C 0.50 °C	
Pt 385, 100 Ω	(-200 to < -80) °C (-80 to 0) °C (> 0 to 100) °C (> 100 to 300) °C (> 300 to 400) °C (> 400 to 630) °C (> 630 to 800) °C	0.040 °C 0.41 °C 0.52 °C 0.72 °C 0.83 °C 0.94 °C 0.18 °C	
Pt 385, 200 Ω	(-200 to < -80) °C (-80 to 0) °C (> 0 to 100) °C (> 100 to 260) °C (> 260 to 300) °C (> 300 to 400) °C (> 400 to 600) °C (> 600 to 630) °C	0.031 °C 0.031 °C 0.032 °C 0.043 °C 0.092 °C 0.10 °C 0.11 °C 0.12 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of RTD Indicating Devices – Generate[3] (cont)			
Pt 385, 500 Ω	(-200 to < -80) °C (-80 to 100) °C (> 100 to 260) °C (> 260 to 300) °C (> 300 to 400) °C (> 400 to 600) °C (> 600 to 630) °C	0.030 °C 0.041 °C 0.052 °C 0.091 °C 0.067 °C 0.079 °C 0.10 °C	Comparison to multiproduct calibrator
Pt 385, 1 kΩ	(-200 to 0) °C (> 0 to 100) °C (> 100 to 260) °C (> 260 to 300) °C (> 300 to 400) °C (> 400 to 600) °C (> 600 to 630) °C	0.021 °C 0.033 °C 0.044 °C 0.054 °C 0.055 °C 0.058 °C 0.18 °C	
Pt 3916, 100 Ω	(-200 to < -190) °C (-190 to < -80) °C (-80 to 0) °C (> 0 to 100) °C (> 100 to 260) °C (> 260 to 300) °C (> 300 to 400) °C (> 400 to 600) °C (> 600 to 630) °C	0.19 °C 0.031 °C 0.041 °C 0.052 °C 0.053 °C 0.063 °C 0.074 °C 0.084 °C 0.18 °C	
Pt 3926, 100 Ω	(-200 to 0) °C (> 0 to 100) °C (> 100 to 300) °C (> 300 to 400) °C (> 400 to 630) °C	0.041 °C 0.052 °C 0.073 °C 0.083 °C 0.095 °C	
Ni 672, 120 Ω	(-80 to 0) °C (> 0 to 100) °C (> 100 to 260) °C	0.060 °C 0.061 °C 0.11 °C	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Generate[3]			
Up to 12 mV	(3 to < 5) Hz (5 to < 10) Hz 10 Hz to 20 kHz (> 20 to 50) kHz (> 50 to 100) kHz (> 100 to 500) kHz	0.19 % + 7.2 µV 0.067 % + 7.2 µV 0.011 % + 6.2 µV 0.028 % + 6.2 µV 0.12 % + 15 µV 0.62 % + 30 µV	Comparison to multiproduct calibrator
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	47 nV/V + 9.1 µV 48 nV/V + 5.8 µV 1.4 nV/V + 6.2 µV 12 µV 36 µV 0.1 mV	
(> 12 to 120) mV	(3 to < 5) Hz (5 to < 10) Hz 10 Hz to 20 kHz (> 20 to 50) kHz (> 50 to 100) kHz (> 100 to 500) kHz	0.19 % + 7.0 µV 0.068 % + 7.1 µV 0.011 % + 6.0 µV 0.028 % + 8.0 µV 0.064 % + 20 µV 0.21 % + 26 µV	
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	15 µV 10 µV 11 µV 16 µV 47 µV 0.11 mV	
(> 0.12 to 1.2) V	(3 to < 5) Hz (5 to < 10) Hz (10 to 40) Hz 10 Hz to 20 kHz (> 20 to 50) kHz (> 50 to 100) kHz (> 100 to 500) kHz	0.19 % + 76 µV 0.068 % + 74 µV 0.011 % + 62 µV 0.011 % + 8.4 µV 0.023 % + 15 µV 0.054 % + 41 µV 0.15 % + 84 µV	
(0.33 to 3.3) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.12 mV 87 µV 98 µV 0.12 mV 0.29 mV 1.1 mV	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Generate[3] (cont)			
(> 12 to 120) V	(3 to < 5) Hz (5 to < 10) Hz (10 to 40) Hz 10 Hz to 20 kHz (> 20 to 50) kHz (> 50 to 100) kHz (> 100 to 500) kHz	0.19 % + 7.6 mV 0.068 % + 7.5 mV 0.011 % + 3.7 mV 0.011 % + 0.60 mV 0.025 % + 0.49 mV 0.057 % + 1.2 mV 0.16 % + 21 mV	Comparison to multiproduct calibrator
(33 to 330) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.11 mV/V + 5.6 mV 0.64 µV/V + 11 mV 0.87 µV/V + 13 mV 0.9 mV/V + 95 mV 2 mV/V + 50 mV	
(> 120 to 330) V	(3 to < 5) Hz (5 to < 10) Hz 10 Hz to 20 kHz (> 20 to 50) kHz (> 50 to 100) kHz	0.19 % + 76 mV 0.066 % + 83 mV 0.012 % + 7.8 mV 0.025 % + 8.0 mV 0.12 % + 20 mV	
(> 330 to 1020) V	(3 to < 5) Hz (5 to < 10) Hz 10 Hz to 10 kHz	0.19 % + 75 mV 0.069 % + 75 mV 0.011 % + 80 mV	
(330 to 1020) V	45 Hz to 10 kHz	75 µV/V + 89 mV	
AC Voltage – Measure[3]			
(1 to 10) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	69 nV/V + 3.3 µV -1.1 nV/V + 2.1 µV -3.9 nV/V + 1.6 µV 0.36 nV/V + 2.7 µV 1.9 nV/V + 7.5 µV 5.5 µV	Comparison to precision digital multimeter
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz	0.11 µV/V + 3.3 µV -2.6 nV/V + 5.8 µV 2.3 nV/V + 4 µV 1.8 nV/V + 8 µV 8.5 nV/V + 12 µV 59 µV 0.1 mV 15 mV/V + 10 µV	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Measure[3] (cont)			
(0.1 to 1) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.65 µV/V + 39 µV 0.53 nV/V + 25 µV 30 µV 42 µV 80 µV 0.31 mV 0.87 mV 15 mV/V + 10 µV	Comparison to precision digital multimeter
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	12 nV/V + 3.4 mV 0.26 nV/V + 3.5 mV 0.26 nV/V + 3.5 mV 12 nV/V + 4.8 mV 98 nV/V + 11 mV 4 mV/V + 10 mV 15 mV/V + 10 mV	
(100 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 200) kHz (20 to 50) kHz (50 to 100) kHz	0.4 mV/V + 40 mV 0.55 nV/V + 47 mV 0.6 mV/V + 20 mV 1.3 mV/V + 20 mV 3 mV/V + 20 mV	
AC High Voltage – Measure[3]			
Up to 6 kV	Up to 500 Hz > 500 Hz to 1 kHz	1.5 % RDG 2.5 % RDG	Comparison to digital multimeter, high voltage probe
Up to 40 kV	60 Hz	5.9 % RDG	
AC Current – Generate[3]			
Up to 120 µA	3 Hz to 5 kHz (> 5 to 10) kHz (> 10 to 30) kHz	0.020 % + 10 nA 0.12 % + 40 nA 0.39 % + 1.0 µA	Comparison to multiproduct calibrator
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.7 µA/A + 58 nA 1.2 µA/A + 78 nA 0.97 µA/A + 78 nA 2.3 µA/A + 0.12 µA 6.2 µA/A + 0.15 µA 16 mA/A + 0.4 µA	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current – Generate[3] (cont)			
(> 0.12 to 1.2) mA	3 Hz to 5 kHz (> 5 to 10) kHz (> 10 to 30) kHz	0.020 % + 0.10 µA 0.12 % + 0.10 µA 0.39 % + 5.0 µA	Comparison to multiproduct calibrator
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.6 µA/A + 0.12 µA 0.97 µA/A + 0.12 µA 0.77 µA/A + 0.12 µA 1.6 µA/A + 0.15 µA 3.9 µA/A + 0.23 µA 10 mA/A + 0.6 µA	
(> 1.2 to 12) mA	3 Hz to 5 kHz (> 5 to 10) kHz (> 10 to 30) kHz	0.020 % + 1.0 µA 0.12 % + 1.0 µA 0.39 % + 10 µA	
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.4 µA/A + 1.6 µA 0.7 µA /A + 1.5 µA 0.31 µA /A + 1.5 µA 0.62 µA /A + 1.5 µA 1.6 µA/A + 2.3 µA 4 mA/A + 4 µA	
(> 12 to 120) mA	(3 to < 45) Hz 45 Hz to 1 kHz (> 1 to 5) kHz (> 5 to 10) kHz (> 10 to 30) kHz	0.019 % + 10 µA 0.013 % + 5.0 µA 0.020 % + 8.0 µA 0.12 % + 10 µA 0.39 % + 0.10 mA	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.4 mA/A + 16 µA 0.7 mA /A + 16 µA 0.31 mA /A + 16 µA 0.77 mA/A + 39 µA 1.6 mA/A + 78 µA 4 mA/A + 0.2 mA	
(> 0.12 to 1.2) A	(3 to < 45) Hz 45 Hz to 1 kHz (> 1 to 5) kHz (> 5 to 10) kHz (> 10 to 30) kHz	0.020 % + 0.10 mA 0.020 % + 50 µA 0.020 % + 80 µA 0.19 % + 0.30 mA 0.39 % + 0.30 mA	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current – Generate[3] (cont)			
(0.33 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.4 mA/A + 80 µA 0.34 mA /A + 0.45 mA 5.5 mA/A – 1.7 mA 25 mA/A + 5 mA	Comparison to multiproduct calibrator
(> 1.2 to 3.1) A	(3 to < 45) Hz 45 to 1 kHz (> 1 to 5) kHz (> 5 to 10) kHz	0.30 % + 0.50 mA 0.024 % + 0.30 mA 0.030 % + 0.31 mA 0.19 % + 0.49 mA	
(3 to 11) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.6 mA/A + 2 mA 1 mA/A + 2 mA 30 mA/A + 2 mA	
(> 3.1 to 12) A	(3 to < 45) Hz 45 to 1 kHz (> 1 to 5) kHz (> 5 to 10) kHz	0.029 % + 1.2 mA 0.025 % + 0.50 mA 0.031 % + 0.82 mA 0.19 % + 1.1 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	1.2 mA/A + 5 mA 1.5 mA/A + 5 mA 30 mA/A + 5 mA	
(> 12 to 30.2) A	(3 to < 45) Hz 45 to 1 kHz (> 1 to 5) kHz	0.079 % + 10 mA 0.056 % + 7.8 mA 0.39 % + 8.0 mA	
AC Current Clamp-on Meters[3]			
(20 to 40) A	(45 to 400) Hz	0.28 mA/A + 0.29 mA	Comparison to multiproduct calibrator, 50-turn coil
(40 to 400) A	(45 to 400) Hz	6.1 mA/A + 0.11 A	
(400 to 1000) A	(45 to 100) Hz	4.4 mA/A + 0.77 A	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current – Measure[3]			
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	2.7 nA/A + 21 nA 1 nA/A + 21 nA 0.39 nA/A + 22 nA 0.39 nA/A + 22 nA	Comparison to precision digital multimeter
(0.1 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	2.7 µA/A + 0.15 µA 0.99 µA/A + 0.15 µA 0.38 µA/A + 0.16 µA 0.19 µA/A + 0.16 µA 0.38 µA/A + 0.16 µA 2.7 µA/A + 0.28 µA 6 mA/A + 1.5 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	2.7 µA/A + 1.4 µA 0.99 µA/A + 1.5 µA 0.38 µA/A + 1.6 µA 0.19 µA/A + 1.6 µA 0.38 µA/A + 1.6 µA 2.7 µA/A + 2.7 µA 6 mA/A + 15 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	2.7 µA/A + 15 µA 0.99 µA/A + 15 µA 0.38 µA/A + 16 µA 0.19 µA/A + 16 µA 0.38 µA/A + 16 µA 2.7 µA/A + 28 µA 6 mA/A + 0.15 mA	
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz (5 to 20) kHz (20 to 50) kHz	2.7 mA/A + 0.15 mA 1.1 mA/A + 0.16 mA 0.51 mA/A + 0.16 mA 0.65 mA/A + 0.16 mA 2 mA/A + 0.15 mA 10 mA/A + 0.4 mA	
AC Current – Measure[3]			
(20 to 2000) A	(60 to 100) Hz	53 mA/A + 4.5 A	Comparison to clamp-on meter

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Power – Generate[3]	PF=1		
39.6 µW to 30.8 kW	(45 to 65) Hz	0.084 % + 9.6 nW	Comparison to multiproduct calibrator
1.44 mW to 30.8 kW	> 65 Hz to 1 kHz	0.088 % - 0.38 µW	
14.4 mW to 1.55 kW	(> 1 to 5) kHz	0.071 % + 4.8 µW	
14.4 mW to 300 W	(> 5 to 10) kHz	0.31 % - 1.6 µW	
14.4 mW to 300 W	(> 10 to 30) kHz	1.0 % + 76 µW	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Capacitance – Generate[3]	(190 to 400) pF	5 mF/F + 1 pF	Comparison to multiproduct calibrator
	(0.4 to 1.1) nF	4 mF/F	
	(1.1 to 3.3) nF	3.6 mF/F	
	(3.3 to 11) nF	1.9 mF/F	
	(11 to 33) nF	1.7 mF/F	
	(33 to 110) nF	1.9 mF/F	
	(110 to 330) nF	1.4 mF/F + 0.57 nF	
	(0.33 to 1.1) µF	1.9 mF/F + 0.91 nF	
	(1.3 to 3.3) µF	1.5 mF/F + 5.6 nF	
	(3.3 to 11) µF	2 mF/F + 8.8 nF	
	(11 to 33) µF	2.6 mF/F + 53 nF	
	(33 to 110) µF	3.4 mF/F + 88 nF	
	(110 to 330) µF	2.9 mF/F + 0.52 µF	
	(0.33 to 1.1) mF	3.4 mF/F + 0.88 µF	
	(1.1 to 3.3) mF	3.2 mF/F + 4.9 µF	
	(3.3 to 11) mF	3.7 mF/F + 8 µF	
	(11 to 33) mF	11 mF/F - 20 µF	
	(33 to 110) mF	27 mF/F + 0.53 mF	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
Capacitance – Generate[3]			
(0.2 to 1.2) nF	100 Hz to 10 kHz	0.093 % + 4.1 pF	Comparison to multiproduct calibrator
(> 1.2 to 12) nF	150 Hz to 5 kHz	0.11 % + 5.0 pF	
(> 12 to 120) nF	200 Hz to 1.3 kHz	0.12 % + 28 pF	
(> 0.12 to 1.2) µF	(2 to 310) Hz	0.12 % + 0.28 nF	
(> 1.2 to 12) µF	(0.5 to 110) Hz	0.11 % + 3.0 nF	
(> 12 to 120) µF	(0.5 to 40) Hz	0.12 % + 25 nF	
(> 0.12 to 1.2) mF	(0.1 to 11) Hz	0.21 % + 0.24 µF	
(> 1.2 to 12) mF	(0.03 to 4) Hz	0.21 % + 2.9 µF	
(> 12 to 120) mF	(0.01 to 1.3) Hz	0.40 % + 30 µF	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
Inductance– Generate[3]			
(13 to 120) µH	1 kHz	0.24 % + 0.20 µH	Comparison to multiproduct calibrator
(> 0.12 to 1.2) mH	1 kHz	0.17 % + 1.0 µH	
(> 1.2 to 12) mH	110 Hz	0.18 % + 9.5 µH	
(> 12 to 120) mH	100 Hz	0.17 % + 99 µH	
(> 0.12 to 1.2) H	10 Hz	0.20 % + 0.99 mH	
(> 1.2 to 12) H	3 Hz	0.25 % + 9.8 mH	
(> 12 to 120) H	2 Hz	0.33 % + 99 mH	
Oscilloscopes[3]			
Amplitude DC Signal			
Into 50 Ω Load	Up to 50 mV	0.19 % + 43 µV	Comparison to multiproduct calibrator with scope option
	(> 50 to 500) mV	0.21 % + 20 µV	
	(> 0.5 to 6.6) V	0.20 % + 50 µV	
Into 1 MΩ Load	Up to 50 mV	0.056 % + 43 µV	
	(> 50 to 500) mV	0.083 % + 23 µV	
	(> 0.5 to 6.6) V	0.088 % + 25 µV	
	(> 6.6 to 15) V	0.083 % + 8.0 µV	
	(> 15 to 120) V	0.083 % + 250 µV	
Amplitude Square Wave			
Into 50 Ω Load	Up to 50 mV	0.19 % + 41 µV	
10 Hz to 10 kHz	(> 50 to 500) mVp-p	0.20 % + 38 µV	
10 Hz to 10 kHz	(> 0.5 to 6.6) Vp-p	0.20 % + 39 µV	
10 Hz to 10 kHz			
Into 1 MΩ Load	Up to 50 mVp-p	0.20 % + 100 µV	
(10 to 40) Hz		0.092 % + 40 µV	
> 40 Hz to 1 kHz		0.20 % + 100 µV	
(> 1 to 10) kHz			
(10 to 40) Hz	(> 50 to 500) mVp-p	0.20 % + 100 µV	
> 40 Hz to 1 kHz		0.096 % + 37 µV	
(> 1 to 10) kHz		0.20 % + 100 µV	
(10 to 40) Hz	(> 0.5 to 6.6) Vp-p	0.21 % + 100 µV	
> 40 Hz to 1 kHz		0.096 % + 40 µV	
(> 1 to 10) kHz		0.21 % + 100 µV	
(10 to 40) Hz	(> 6.6 to 15) Vp-p	0.21 % + 100 µV	
> 40 Hz to 1 kHz		0.097 %	
(> 1 to 10) kHz		0.21 % + 400 µV	
(10 to 40) Hz	(> 15 to 120) Vp-p	0.21 % + 100 µV	
> 40 Hz to 1 kHz		0.096 % + 250 µV	
(> 1 to 10) kHz		0.21 % + 100 µV	

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Oscilloscopes[3] (cont)			
Leveled Sine Wave, Flatness			
Into 50 Ω Load	5 mVp-p to 5.5 Vp-p 50 kHz to 10 MHz (> 10 to 600) MHz 5 mVp-p to 3.5 Vp-p > 600 MHz to 1.1 GHz	 1.2 % + 500 µV 2.4 % + 100 µV 3.1 % + 100 µV	Comparison to multiproduct calibrator with scope option
Time Marker			
Sine Wave	(1 to 10) ns	0.034 %	
Square Wave	10 ns to 5 s	0.034 %	
Spike	20 ns to 5 s	0.034 %	
20 % Duty Cycle-Pulse	100 ns to 5 s	0.034 %	
Edge Rise Time			
Into 50 Ω Load	5 mVp-p to 2.5 Vp-p 900 Hz to 10 MHz	 180 ps	
Wave Generator			
Amplitude (Sine, Square, Triangle)			
Into 1 MΩ Load	10 Hz to 100 kHz 1 mV to 120 V	 2.3 % + 100 µV	
Into 50 Ω Load	10 Hz to 100 kHz 1 mV to 6.6 V	 2.3 % + 100 µV	
Frequency			
Into 50 Ω Load	10 Hz to 10 kHz	2.6 µHz/Hz	
Into 1 MΩ Load	10 Hz to 10 kHz	2.6 µHz/Hz	
Magnetic Particle Unit[9] DC Current Meter	Up to 20 000 A	8.3 A	Comparison to current timer/meter

V. Magnetic Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Magnetometer/Gaussmeter, Hall-Effect Probes	Up to 100 G	1.3 % rdg + 0.007 G	Comparison to Helmholtz coil, current source

VI. Mechanical

Parameter/Equipment	Range	CMC[2, 4, 5, 8] (±)	Comments
Duro-Calibrators –			
A-Scale	(0 to 822) gf	0.072 gf	Comparison to master weights
D-Scale	(0 to 10) gf	0.42 gf	
Durometers[10] (Types A & D)			
Indenter Dimensions			
Extension	0.25 in	110 µin	Direct verification per ASTM D2240 using measuring microscope
Diameter	0.25 in	110 µin	
Angle	(0 to 35)°	21″	
Spring Force	(0 to 100) Duro	0.25 Duro	Duro-calibrator
Force – Measuring Equipment[3] (Compression / Tension)	Up to 1000 gf	0.058 gf	Comparison to ASTM E617 Class 1 thru Class 6 weights
	Up to 10 lbf	0.01 % rdg	
	(10 to 50) lbf	0.0064 % rdg + 0.0005 lbf	
	(50 to 2000) lbf	0.0069 % rdg + 0.005 lbf	
	Up to 10 lbf	0.0052 lbf	Comparison to master load cell
	(10 to 50) lbf	0.052 lbf	
	(50 to 1000) lbf	0.55 lbf	
	(1000 to 5000) lbf	3.2 lbf	
	(5000 to 15 000) lbf	7.9 lbf	
	(15 000 to 50 000) lbf	23 lbf	
	(50 000 to 150 000) lbf	61 lbf	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Brinell Hardness Testers[3]	3000 kgf 1500 kgf 500 kgf	5.6 HBW 1.2 HBW 1.1 HBW	Indirect verification per ASTM E10 using hardness test blocks
Knoop Hardness Tester[3]	(100 to 200) HK > 200 HK	3 HK 7.1 HK	Indirect verification per ASTM E92 using hardness test blocks
Leeb Hardness Tester[3]	783 HLD	6.7 HLD	Indirect verification per ASTM A596 using Leeb test block
Rockwell Hardness & Superficial Hardness Testers[3]	(20 to 65) HRA (70 to 78) HRA (80 to 84) HRA (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW (20 to 30) HRC (35 to 55) HRC (60 to 65) HRC (40 to 48) HRD (51 to 67) HRD (71 to 75) HRD (70 to 79) HRE (84 to 90) HRE (93 to 100) HRE (60 to 75) HRF (80 to 90) HRF (94 to 100) HRF (30 to 50) HRG (55 to 75) HRG (80 to 94) HRG HRR Low HRR High HRS Low HRS High	0.27 HRA 0.18 HRA 0.18 HRA 0.36 HRBW 0.26 HRBW 0.4 HRBW 0.39 HRC 0.25 HRC 0.32 HRC 0.28 HRD 0.28 HRD 0.15 HRD 0.37 HRE 0.17 HRE 0.46 HRE 0.46 HRF 0.47 HRF 0.46 HRF 0.39 HRG 0.23 HRG 0.25 HRG 0.35 HRR 0.24 HRR 0.54 HRS 0.13 HRS	Indirect verification per ASTM E18 using hardness test blocks

Parameter/Equipment	Range	CMC[2] (±)	Comments
Rockwell Hardness & Superficial Hardness Testers[3] (cont)	(70 to 77) HR15N (78 to 88) HR15N (90 to 92) HR15N (42 to 50) HR30N (55 to 73) HR30N (77 to 82) HR30N (20 to 31) HR45N (37 to 61) HR45N (66 to 72) HR45N (74 to 80) HR15TW (81 to 86) HR15TW (87 to 93) HR15TW (43 to 56) HR30TW (57 to 69) HR30TW (70 to 83) HR30TW (13 to 32) HR45TW (33 to 52) HR45TW (53 to 73) HR45TW	0.41 HR15N 0.43 HR15N 0.4 HR15N 0.25 HR30N 0.23 HR30N 0.24 HR30N 0.26 HR45N 0.26 HR45N 0.12 HR45N 0.28 HR15TW 0.31 HR15TW 0.43 HR15TW 0.55 HR30TW 0.24 HR30TW 0.21 HR30TW 0.72 HR45TW 0.42 HR45TW 0.40 HR45TW	Indirect verification per ASTM E18 using hardness test blocks
Vickers Hardness Tester[3]	(100 to 650) HV (650 to 940) HV	5 HV 2.5 HV	Indirect verification per ASTM E92 using hardness test blocks
Mass Determination	Up to 1 g (1 to 100) g (100 to 200) g (200 to 500) g Up to 5 lb (5 to 10) lb (10 to 20) lb (20 to 50) lb (50 to 100) lb Up to 600 lb (600 to 1250) lb	64 µg 66 µg 96 µg 1 mg 0.74 mg 2 mg 7.9 mg 15 mg 0.17 g 0.27 lb 0.11 % rdg + 0.000 67 lb	Single substitution using ASTM E617 Class 1 weights, ASTM E617 Class 2 weights, ASTM E617 Class 3 weights, & precision balances Comparison to master load cell

Parameter/Equipment	Range	CMC[2] (±)	Comments
Pressure Gages & Transducers[3] (Gauge)	(-15 to 15) psig (10 to 50) psig (50 to 500) psig (500 to 1000) psig (1000 to 10 000) psig (10 000 to 16 000) psig (-30 to 30) inH_2O (-5 to 5) inH_2O	0.000 99 psi 0.0017 psi 0.014 psi 0.025 psi 0.52 psi 1.3 psi 0.003 inH_2O 0.0005 inH_2O	Comparison to pressure calibrator, deadweight tester Comparison to pressure calibrator, deadweight tester
Deadweight Pressure Testers – Low Pressure High Pressure	 Up to 1500 psi Up to 16 000 psi	 0.0039 % rdg 0.0085 % rdg	Comparison to ASTM E617 Class 1 thru Class 3 weights using precision balances & the universal length measuring machine for the effective area determination for each piston
Scales & Balances[3,11] (SI)	Up to 1 g (1 to 5) g (5 to 50) g (50 to 500) g (500 to 1000) g (1 to 2) kg (2 to 5) kg (5 to 20) kg	0.002 % rdg + 6.2 µg 0.000 29 % rdg + 23 µg 0.000 092 % rdg + 33 µg 0.000 16 % rdg – 2.4 µg 0.000 17 % rdg – 56 µg 0.000 16 % rdg + 0.11 mg 0.000 45 % rdg – 5.7 mg 0.000 14 % rdg + 9.7 mg	ASTM E617 Class 1 weights & NIST Handbook 44 utilized for the calibration of the weighing system
Weighing Systems[3,11] (Avoirdupois)	Up to 1500 lb (1500 to 2000) lb (2000 to 7000) lb	0.0057 % rdg 0.071 % rdg – 0.98 lb 0.35 % rdg – 6.5 lb	NIST Class F weights & NIST Handbook 44 utilized for the calibration of the weighing system

Parameter/Equipment	Range	CMC[2] (±)	Comments
Torque Analyzers[3]	(20 to 110) ozf·in (5 to 60) lbf·in (40 to 450) lbf·in (100 to 1150) lbf·in (25 to 280) lbf·ft (60 to 680) lbf·ft (200 to 1200) lbf·ft (1200 to 2000) lbf·ft	0.014 % rdg + 0.0047 ozf·in 0.012 % rdg + 0.000 09 lbf·in 0.01 % rdg + 0.003 lbf·in 0.0066 % rdg + 0.052 lbf·in 0.0097 % rdg + 0.0038 lbf·ft 0.011 % rdg + 0.0012 lbf·ft 0.009 % rdg + 0.012 lbf·ft 0.0093 % rdg + 0.027 lbf·ft	Comparison to torque arms, torque wheels, NIST Class F weights
Torque Wrenches[3]	Up to 100 ozf·in Up to 50 lbf·in (50 to 400) lbf·in Up to 250 lbf·ft (100 to 600) lbf·ft (400 to 2000) lbf·ft	0.027 % rdg + 0.09 ozf·in 0.12 % rdg + 0.093 lbf·in 0.3 % rdg + 0.0041 lbf·in 0.0069 % rdg + 0.14 lbf·ft 0.096 % rdg + 0.17 lbf·ft 0.19 % rdg + 0.47 lbf·ft	Comparison to torque analyzer
Torque Angle[3]	Up to 360°	0.46°	Comparison to torque analyzer
Viscosity Cups[3]	(34 to 120) cSt	0.61 % rdg + 0.06 cSt	Comparison to viscosity standards
Volumetric Dispensers	Up to 1 µL (1 to 1000) µL (1000 to 5000) µL Up to 100 mL (100 to 1000) mL	0.081 µL 0.12 µL 0.14 µL 0.0031 mL 0.11 mL	Comparison to analytical balance

VII. Optical Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
UV-A Light Meters (Typical for NDT Testing)	Up to 19 990 µW/cm^2	5.1 % of reading + 0.008 µW/cm^2	Comparison to master digital radiometer per ASTM E1444 & NADCAP audit criteria AC7114/2 rev. G.

Parameter/Equipment	Range	CMC[2] (±)	Comments
Visible Light Meters (Typical for NDT Testing)	Up to 4000 fc	4.9 % of reading + 0.000 002 fc	Comparison to master digital radiometer per ASTM E1444 & NADCAP audit criteria AC7114/2 rev. G.
Magnetic Particle Unit[3, 9] –			
Black Light	Up to 19 990 µW/cm^2	4.1 % of reading + 30 µW/cm^2	Comparison to digital radiometer
White Light	Up to 199.9 fc	3 % of reading + 4.9 fc	

VIII. Thermodynamics

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Extrusion Plastometers[3] Temperature	(-30 to 660) °C	0.12 °C	Comparison to PRT, temperature indicator
Infrared Thermometer (Non-Contact)	(35 to 50) °C (50 to 300) °C (300 to 500) °C	0.35 °C 0.84 °C 1.3 °C	Comparison to black body source (flat plate) Ɛ = 0.95, λ = (8 to 14) µm
Humidity – Measure[3]	(5 to 90) % RH	0.0035 of reading + 0.5 % RH	Comparison to hygrometer
Temperature – Measure[3]	(-200 to 660) °C	0.03 °C	Comparison to PRT, calibrator
Temperature – Measuring Equipment[3] (Temperature Indicating Devices)	(-40 to 660) °C	0.5 °C	Comparison to dry block

IX. Time & Frequency

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Frequency – Measuring Equipment/Measure[3]	Up to 1.3 GHz	0.11 nHz	Comparison to GPS reference
Timers, Stopwatches[3]	Up to 24 hr	4.4 ms 0.031 s	Comparison to GPS reference, frequency counter, function generator Comparison to Timometer
Magnetic Particle Unit[3, 9] Timer	10 ms to 9.99 s	56 ms	Comparison to current timer/meter

SATELLITE LOCATION

11145 Luschek Drive
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I. Dimensional

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Bore Gages[3]	Up to 8 in	12 µin	Comparison to master ring, indicator checker, ULM
Calipers	Up to 6 in (6 to 24) in (24 to 72) in	290 µin (280 + 1.1*L*) µin (240 + 2.7*L*) µin	Comparison to gage blocks
Gage Blocks	Up to 4 in	(4.2 + 0.37*L*) µin	Comparison to comparator, master gage blocks
Height Gages	Up to 24 in (24 to 72) in	(46 + 3.4*L*) µin (550 + 1.7*L*) µin	Comparison to gage blocks, surface plate
Indicators –			
(0.000 02 in Resolution)	Up to 12 in	16 µin	Comparison to gage blocks, ULM
(0.000 05 in Resolution)	Up to 12 in	31 µin	
(0.0001 in Resolution)	Up to 12 in	59 µin	
(0.0005 in Resolution)	Up to 12 in	290 µin	
(0.001 in Resolution)	Up to 12 in	580 µin	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Dial Test Indicators –			
(0.000 05 in Resolution)	Up to 0.25 in	30 µin	Comparison to gage blocks
(0.0001 in Resolution)	Up to 0.25 in	58 µin	
(0.0005 in Resolution)	Up to 0.25 in	290 µin	
(0.001 in Resolution)	Up to 0.25 in	580 µin	
Machinist Levels[3]	Up to 15 in Up to 72 in	66 µin 0.000 32 in	Comparison to surface plate, gage blocks
Linear Scales, Steel Rules	Up to 72 in	(400 + 9.3*L*) µin	Comparison to measuring microscope
Micrometers	Up to 6 in (6 to 24) in (24 to 72) in	(30 + 2.2*L*) µin (46 + 3.4*L*) µin (20 + 4.5*L*) µin	Comparison to gage blocks, ULM
Pin Gages	Up to 1 in	(12 + 9.2*L*) µin	Comparison to bench micrometer
Plain Plug Gages	Up to 20 in	(10 + 1.9*D*) µin	Comparison to ULM, gage blocks
Length	Up to 4 in Up to 48 in Up to 60 in	(12 + 0.8*L*) µin (20 + 0.89*L*) µin (44 + 0.75*L*) µin	Comparison to ULM, length comparator, gage blocks
Thread Plug Gages –			
Major Diameter	Up to 8 in	(11 + 1.4*D*) µin	Comparison to ULM, thread wires
Pitch Diameter	Up to 8 in	42 µin	
Plain Ring Gages	(0.08 to 18) in	(14 + 0.55*D*) µin	Comparison to ULM, master rings

Parameter/Equipment	Range	CMC[2] (±)	Comments
Adjustable Thread Rings – Minor Diameter Pitch Diameter	 Up to 8 in Up to 8 in	 46 µin 65 µin	ULM, master setting plugs in accordance with ASME B1.2, para 5.1.1: the ring is sized to a plug, with the plug's uncertainty given
Thread Measuring Wires	Up to 80 TPI	12 µin	Comparison to ULM, 0.750 roll, 0.125 roll
Roughness Standards	Up to 250 µin	6.6 µin	Comparison to profilometer
Surface Analyzers	Up to 123 µin	6.2 µin	Comparison to roughness standard

II. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Torque Wrenches[3]	Up to 50 lbf·in (50 to 1000) lbf·in Up to 600 lbf·ft	0.091 % rdg + 0.042 lbf·in 0.044 % rdg + 2.4 lbf·in 0.52 % rdg + 3.6 lbf·ft	Comparison to torque analyzer

[1] This laboratory offers commercial dimensional testing/calibration service 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 this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] The values presented in the Range column represent a Nominal value. During calibration, the actual value will be utilized along with the corresponding inherent uncertainty.

[5] In the statement of CMC, *L* is the numerical value of the nominal length of the device measured in inches; ″ = arc-second; *D* = diameter in inches; *l* = length in mils.

[6] 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.

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

[8] 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.

[9] The parameter, Magnetic Particle Unit, is found in three major parameters: Electrical – DC/Low Frequency; Optical Quantities; and Time and Frequency.

[10] Durometers that are calibrated onsite are a Partial Verification for the Spring Force only.

[11] The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The CMC presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration

[12] This accreditation covers calibrations performed at the main laboratory and the following satellite laboratory listed above.

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

[14] This CAB is owned by ATS, Inc.

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

Accredited Laboratory

A2LA has accredited

ACCU-CHEK LLC

Corydon, IN

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL 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 28th day of April 2026.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1888.11
Valid to November 30, 2027

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