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

GREAT LAKES CALIBRATION, INC.
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CALIBRATION

Valid until: September 30, 2022 Certificate Number: 3312.01

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

I. Chemical

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
pH[3]	4 pH unit 7 pH unit 10 pH unit	0.04 pH 0.04 pH 0.04 pH	NIST traceable buffer solutions
Conductivity[3]	(1 to 10) µS/cm (50 to 100) µS/cm (500 to 1000) µS/cm (5000 to 10 000) µS/cm	0.45 µS/cm 2.3 µS/cm 23 µS/cm 38 µS/cm	NIST traceable conductivity solutions
Refractometers[3]	(10, 20, 30) % Brix	0.093 % Brix	Sucrose solutions

II. Dimensional

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Angular[3] –			
Displacement	(0.01 to 36 000) deg	0.024 degrees per revolution	Rotary encoder
Speed	Up to 100 RPM	0.024 % rdg + 0.021 degrees per minute	Rotary encoder and stopwatch
Calipers[3]	Up to 6 in (>6 to 20) in (>20 to 60 in	(46 + 0.6*R*) µin (80 + 0.6*R* + 25*L*) µin (300 + 0.6*R* + 25*L*) µin	Gage blocks, master rings
Dial/Digital Indicators[3] LVDT	Up to 2 in (2 to 10) in	(18 + 0.6*R*) µin (210 + 0.6*R*) µin	Gage blocks, indicator calibrator stand
Feeler/Thickness Gauges	Up to 0.5 in	37 µin	Universal measuring machine
Gage Blocks	Up to 4 in (>4 to 20) in	(30 + 25*L*) µin (120 + 25*L*) µin	Grade K gage blocks and gage block comparator Grade 0 gage blocks and UMM
Height Gages[3]	Up to 6 in (>6 to 24) in	(38 + 25*L* + 0.6*R*) µin (160 + 25*L* + 0.6*R*) µin	Gage blocks, height gage calibrator
Laser Micrometers	(0.025 to 1.5) in	58 µin	XX master pin gage, OEM cal procedures
Length Standards	Up to 4 in (>4 to 20) in	(26 + 1.9*L*) µin (19 + 8.2*L*) µin	Universal measuring machine

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Micrometers[3] –			
Inside, Depth, Outside	Up to 6 in (6 to 20) in (20 to 60) in	(46 + 0.6*R*) µin (80 + 25*L* + 0.6*R*) µin (300 + 25*L* + 0.6*R*) µin	Gage blocks
Microscopes[3] –			
Eyepiece Reticules and Video Systems	Up to 1 in Up to 25 mm	20 µin 3.1 µm	ASTM E1951 stage micrometers
Optical Comparators[3]			
Linear	Up to 12 in	(150 + 3.8*L* + 0.6*R*) µin	Stage micrometer
Magnification	Up to 100x	0.00022 in	Magnification checker
Angle	(15,30,45,60,90, 120,150,180,270,360) deg	(0.16 + 0.6*R*) deg	Stage micrometer
Plain Plugs/Pin gages[3]	Up to 2 in (2 to 6) in	56 µin (58 + 25*L*) µin	Universal measuring machine
Surface Flatness[3]	Up to 1.0 in Up to 6.0 in	4.7 µin 0.0008 in	Optical flat, monochromatic light Straight edge/feeler gauges
Universal Measuring Machines/Bench Micrometer[3] –			
Length Anvil Flatness Measuring Force	Up to 20 in Up to 1 in (4 to 40) oz	(81 + 8*L*) µin 4.7 µin 2.7 oz	Gage blocks Optical flat Load cells

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Vision Systems[3] –			
X-Y Linear Scale	Up to 12 in	(150 + 3.8*L* + 0.6*R*) µin	Stage micrometer
Z-Axis Scale	Up to 2 in	160 µin	Length probe, gage blocks
Angularity	(45, 90, 135, 180, 270, 360) deg	(0.16 + 0.6*R*) deg	Stage micrometer
Magnification	(10 to 100) x	0.00022 in	Magnification checker
Extensometer, COD Gage, Deflectometers[3] –	Up to 2 in (>2 to 25) in	29 µin 240 µin	ASTM E 83, ISO 9513 calibrator and encoder
Gage Length	(0.25 to 8) in	(0.0019) µin	Calipers

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Voltage[3] – Measure	(0 to 100) mV 100 mV to 1.0 V (1.0 to 10) V (10 to 100) V (100 to 1000) V	5.8 µV/V + 1.7 µV 4.6 µV/V + 5.1 µV 4.6 µV/V + 25 µV 7.0 µV/V + 290 µV 7.1 µV/V + 6.0 mV	Agilent 3458A w/ OPT-002
Resistance[3] – Measure	(0 to 10) Ω (10 to 100) Ω (100 Ω to 1.0) kΩ (1.0 to 10) kΩ (10 to 100) kΩ (100 kΩ to 1.0) MΩ (1.0 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	17 µΩ/Ω + 0.10 µΩ 14 µΩ/Ω + 1.2 µΩ 12 µΩ/Ω + 7.4 µΩ 12 µΩ/Ω + 75 mΩ 12 µΩ/Ω + 1.1 Ω 17 µΩ/Ω + 8.0 Ω 58 µΩ/Ω + 12 Ω 0.58 mΩ/Ω + 22 kΩ 0.58 % + 19 kΩ	Agilent 3458A w/ OPT-002

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Current[3] – Measure	(0 to 100) µA (0.1 to 1.0) mA (1.0 to 10) mA (10 to 100) mA (0.1 to 1.0) A (1 to 3) A (3 to 25) A (25 to 50) A	23 µA/A + 32 pA 23 µA/A + 34 nA 23 µA/A + 140 nA 40 µA/A + 6.4 µA 130 µA/A + 46 µA 0.24 % + 0.66 µA 0.19 % + 1.0 mA 0.29 % + 5.9 mA	Agilent 3458A w/ OPT-002 HP 34401A current shunt
DC Voltage[3] – Generate	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V	35 µV/V + 4.9 µV 35 µV/V + 50 µV 35 µV/V + 500 mV 37 µV/V + 5.0 mV	Fluke 7526A
Resistance[3] – Generate	(5 to 400) Ω (400 to 4000) Ω	0.019 Ω 0.37 Ω	Fluke 7526A
DC Current[3] – Generate	(0 to 100) mA	58 µA/A + 2.6 µA	Fluke 7526A
Electrical Simulation of Thermocouple Indicating Devices[3] – Generate and Measure			
Type E	(-250 to -100) ºC (-100 to 1000) ºC	0.30 ºC 0.13 ºC	Fluke 7526A
Type J	(-210 to -100) ºC (-100 to 800) ºC (800 to 1200) ºC	0.18 ºC 0.13 ºC 0.14 ºC	
Type K	(-250 to -100) ºC (-100 to 1372) ºC	0.54 ºC 0.17 ºC	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Electrical Simulation of Thermocouple Indicating Devices[3] – Generate and Measure (cont)			
Type N	(-250 to -200) ºC (-200 to 100) ºC (100 to 1300) ºC	0.85 ºC 0.28 ºC 0.17 ºC	Fluke 7526A
Type R	(-50 to 100) ºC (100 to 1767) ºC	0.74 ºC 0.50 ºC	
Type S	(-50 to 100) ºC (100 to 1767) ºC	0.70 ºC 0.50 ºC	
Type T	(-250 to -100) ºC (100 to 400) ºC	0.41 ºC 0.15 ºC	
Electrical Calibration of RTD Indicators[3] – Generate and Measure			
Pt (385), 100 Ω	(-200 to 800) ºC	0.06 ºC	Fluke 7526A
Pt (385), 200 Ω	(-200 to 630) ºC	0.58 ºC	
Pt (385), 500 Ω	(-200 to 630) ºC	0.2 ºC	
Pt (385), 1000 Ω	(-200 to 630) ºC	0.11 ºC	

IV. Mechanical

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Scales and Balances[3]	(1 to 500) mg (0.5 to 5) g (5 to 200) g (200 to 500) g (500 to 1000) g (1 to 2) kg (2 to 5) kg (5 to 11) kg (0.001 to 0.1) lb (0.1 to 1.0) lb (1.0 to 10) lb (10 to 50) lb (50 to 500) lb (500 to 1000) lb	0.02 mg 0.04 mg 0.59 mg 1.2 mg 3.1 mg 5.9 mg 15 mg 83 mg 0.0001 lb 0.0002 lb 0.002 lb 0.008 lb 0.08 lb 0.17 lb	Class 1 weights Class F weights
Verification of Test Weights[3]	(0.001 to 50) lb	0.12 %	ASTM E-139 and NIST TN-577, comparison to Class F weights
Force[3] –			
Tension	(0 to 2000) lbf (2000 to 10 000) lbf (10 000 to 120 000) lbf (120 000 to 200 000) lbf (200 000 to 1 000 000) lbf	0.09 % + 0.22 lbf 0.11 % + 0.22 lbf 0.15 % + 5.7 lbf 0.12 % + 12 lbf 0.12 % + 88 lbf	ASTM E4 and Class A load cells
Compression	(8 to 100) lbf (100 to 1000) lbf (1000 to 60 000) lbf (60 000 to 200 000) lbf (200 000 to 1 000 000) lbf (1 000 000 to 1 500 000) lbf	0.17 % + 0.028 lbf 0.14 % + 0.12 lbf 0.12 % + 0.91 lbf 0.12 % + 42 lbf 0.12 % + 0.14 klbf 0.18 % + 0.19 klbf	

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Force –			ISO 7500-1 & 7500-2 w/
Tension	(50 to 1000) lbf (1000 to 10 000) lbf (3000 to 120 000) lbf	0.13 % + 0.19 lbf 0.08 % + 0.18 lbf 0.21 % + 0.18 lbf	Class 0.5 Class 0.5 Class 0.5
Compression	(50 to 1000) lbf (1000 to 10 000) lbf (3000 to 120 000) lbf	0.08 % + 0.20 lbf 0.08 % + 0.17 lbf 0.21 % + 0.18 lbf	Class 0.5 Class 0.5 Class 0.5
Force –			ASTM E-4 and ISO 7500-1,
Tension and Compression	(0.01 to 500) lbf 1 g to 10 kg	0.06 lbf 0.12 %	Class 6 dead weights Class 1gram weights
Dynamic Force[3] –	(0.5 to 200 000) lbf	0.54 % of Force Indication	ASTM E-467 and NASM 1312, dynamometers & load cells
Verification of Test Frames[3] –			ASTM E2309, E2658
Crosshead Displacement	(0.01 to 1) in (1 to 25) in (25 to 50) in	160 µin 0.001 in 0.06 in	Linear gauge Digital encoder
Crosshead Speed	(0.1 to 1) in/min	0.0003 in/min	Linear gage w/ stopwatch
	(0.1 to 20) in/min	0.001 in/min	Digital encorder w/ stopwatch
Crosshead Parallelism	Up to 1.0 in	0.001 in	Linear gage
Strain Rate	(0.001 to 1) in/in/min	0.17 %	Extensometer and stopwatch
Load Rate	(20 to 600 000) lb/min	0.34 %	Load cell and stopwatch
Specimen Alignment	(0 to 50) % Bending	1.0 % Bending	ASTM E1012, ISO 23788

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Torque – Measuring Equipment[3]	(0.02 to 5000) in·lbf	0.07 %	ASTM E2624
Indirect Verification of Rockwell Hardness Testers[3]	HRA: Low Middle High HRBW: Low Middle High HRC: Low Middle High HREW: Low Middle High HRFW: Low Middle High HRHW: Low Middle HRLW: Low Middle HRGW: Low Middle High	 0.48 HRA 0.35 HRA 0.31 HRA 0.65 HRBW 0.73 HRBW 0.59 HRBW 0.41 HRC 0.44 HRC 0.36 HRC 0.60 HREW 0.53 HREW 0.55 HREW 0.54 HRFW 0.50 HRFW 0.61 HRFW 0.72 HRHW 0.44 HRHW 0.53 HRLW 0.46 HRLW 0.69 HRGW 0.58 HRGW 0.49 HRGW	ASTM E18
Indirect Verification of Rockwell Superficial Hardness Testers[3]	HR15TW: Low Middle High	 0.54 HR15TW 0.62 HR15TW 0.20 HR15TW	ASTM E18

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Superficial Hardness Testers[3] (cont)	HR30TW: Low Middle High HR45TW: Low Middle High HR15N: Low Middle High HR30N: Low Middle High HR45N: Low Middle High HR15Y: Low High	 0.52 HR30TW 0.44 HR30TW 0.47 HR30TW 0.56 HR45TW 0.57 HR45TW 0.61 HR45TW 0.54 HR15N 0.56 HR15N 0.41 HR15N 0.59 HR30N 0.70 HR30N 0.51 HR30N 0.65 HR45N 0.62 HR45N 0.51 HR45N 0.53 HR15Y 0.51 HR15Y	ASTM E18
Indirect Verification of Brinell Hardness Testers[3] –			
10/3000/15	(100 to 499) HBW (500 to 650) HBW	2.6 HBW 10 HBW	ASTM E10 and ASTM E110, error uncertainty is given as a Brinell hardness number
10/1500/15	(45 to 199) HBW (200 to 345) HBW	2.1 HBW 4.6 HBW	
10/1000/15	(40 to 134) HBW (135 to 230) HBW	2.5 HBW 4.7 HBW	
10/500/15	(50 to 109) HBW (110 to 140) HBW	1.1 HBW 2.5 HBW	
5/750/15	(96 to 499) HBW (499 to 650) HBW	2.6 HBW 14 HBW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Brinell Hardness Testers[3] – (cont)			
2.5/187.5/10	(100 to 499) HBW (500 to 650) HBW	9.8 HBW 12 HBW	ASTM E10 and ASTM E110, error uncertainty is given as a Brinell hardness number
2.5/62.5/10	(40 to 134) HBW (135 to 230) HBW	3.7 HBW 9.5 HBW	
Indirect Verification Leeb Hardness Testers[3]	714 HLD	9.9 HLD	ASTM A956
Direct Verification of Brinell Hardness Testers[3] –			ASTM E10
Verification of Test Force	(62.5, 187.5, 500, 1000, 1500, 2000, 3000) kgf	0.29 %	ASTM E74 load cells
Verification of Brinell Scope	(0 to 10) mm	0.017 mm	Stage micrometer
Verification of Test Cycle	Up to 15 sec	0.02 sec	Stopwatch
Direct Verification of Rockwell Hardness Testers[3] –			ASTM E18
Verification of Test Force	Up to 150	0.3 %	Load cells ASTM E74
Verification of Depth Measuring	Up to 0.25 mm	0.63 µm	Length gauge
Verification of Machine Hysteresis	Up to 2 HR	0.25 HR	
Verification of Testing Cycle	Up to 8 sec	0.02 sec	Stopwatch

Parameter/Equipment	Range	CMC[2] (±)	Comments
Direct Verification of Micro Hardness Testers[3] –			ASTM E92
Verification of Test Force	Up to 1 kg Over 1 kg	3.1 mg 0.28 %	Class 1 weights Load cells ASTM E74
Verification of Indentation Measuring System	Up to 1000 µm	1.2 µm	Stage micrometer
Verification of Testing Cycle	Up to 15 sec	0.02 sec	Stopwatch
Verification of Indenter Velocity	Up to 200 mm/sec	0.61 µm/sec	Stopwatch and linear gauge
Indirect Verification of Microindentation Hardness Testers[3] – (Knoop & Vickers)			
Mean Hardness Value ≥1 kgf	(100 to 240) HV (240 to 600) HV (≥ 650) HV	1.4 % 0.82 % 0.64 %	ASTM E384/ ASTM E92/ISO 6507-2
Mean Hardness Value ≤1 kgf	(100 to 240) HV (240 to 600) HV (≥ 650) HV (100 to 250) HK (250 to 650) HK (≥ 650) HK	0.71 % 0.46 % 0.33 % 0.76 % 0.47 % 0.21 %	
Stage Micrometer Verification	(0 to 2) in (0 to 25) mm	24 µin 3.5 µm	Glass stage micrometer

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Charpy Impact Testers[3] Distance Between Anvils	(9 to 20) J (88 to 135) J (175 to 250) J Level Torque Radius Measurements 	1.2 % 1.4 % 3.2 % 1.3° 5.5 % 0.005° 0.03 mm	ASTM E23 ISO 148-2
Pressure Gauges[3] – Vacuum Pressure	 (-14.5 to 1000) psi (-25 to 25) in·H_2O (1000 to 10 000) psi	 0.06 psi 0.0032 in·H_2O 0.17 psi	 Mensor CPG2500 Nagman MPCH+

V. Thermodynamics

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Temperature – Measuring Equipment[3]	(-196 to -45) ºC (-45 to 25) ºC (25 to 420) °C (420 to 500) °C (500 to 1100) ºC	0.21 ºC 0.076 ºC 0.10 °C 0.20 °C 2.3 ºC	Bath, dry well, furnace, Hart 5628 PRT, Fluke 7526, Type-S T/C
Temperature – Measure[3]	(-196 to 500) ºC (500 to 1100) ºC (1100 to 1400) ºC	0.054 ºC 1.0 ºC 2.0 ºC	PRT w/Fluke 7526 Thermocouples w/ digital thermometer
Furnace Uniformity Survey[3]	(32 to 2000) ºF (2000 to 2400) ºF	2.2 ºF 3.8 ºF	AMS 2750F or CQI-9 Thermocouple scanner / Type-K or N TC

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Humidity[3] – Measuring Equipment and Measure[3]	(0 to 80) % RH (80 to 97) % RH	1.4 % RH 2.1 % RH	Vaisala HM77B and chamber
Calibration of Thermocouples[3] – Measuring Equipment			
Type E	(-200 to 500) ºC (500 to -1000) °C	0.24 ºC 2.5 ºC	ASTM E2846 / ASTM E220
Type J	(-196 to 500) ºC (500 to 1200) °C	0.25 ºC 2.5 ºC	
Type K	(-200 to 500) °C (500 to -1372) °C	0.26 °C 2.5 °C	
Type N	(-200 to 500) °C (500 to -1300) °C	0.31 °C 2.5 °C	
Type R	(-50 to 100) °C (100 to 500) °C (500 to 1400) °C	0.59 °C 0.33 °C 2.5 °C	
Type S	(-50 to 100) °C (100 to 500) °C (500 to 1400) °C	0.55 °C 0.30 °C 2.6 °C	
Type T	(-200 to 400) °C	0.26 °C	

VI. Time & Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Time[3]	(0 to 24) hrs	0.10 sec/24 hrs 0.02 sec/min	Stopwatch
	(0 to 24) hrs	0.04 sec/24 hrs	Timometer
Frequency – Measuring Equipment[3]	Up to 100 Hz	0.01 % + 0.1 mHz	Keysight 1202A monitoring generator
	Up to 30 MHz	0.012 % + 12 mHz	Keysight 3458A monitoring generator

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[1] This laboratory offers commercial 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] In the statement of CMC, the percentage is defined as the percentage of reading. *L* is defined as the length of the unit under test in inches. *R* is defined as the resolution of the unit under test in inches.

[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.

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

[7] 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.

Accredited Laboratory

A2LA has accredited

GREAT LAKES CALIBRATION, INC.

Addison, IL

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 26th of January 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3312.01
Valid to September 30, 2022
Revised February 22, 2022

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