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

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CALIBRATION

Valid To: March 31, 2027 Certificate Number: 2208.03

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 to perform the following calibrations[1, 6]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Calipers	Up to 6 in	(310 + 23L) µin	Gage blocks, Kalmaster
Indicators, Dial Travel	Up to 1 in	260 µin	Micrometer head
Micrometers – Outside Measurement Only	Up to 3 in	(20 + 41L) µin	Gage blocks
Extensometers[3]	Up to 1 in	90 µin	TO Cal 60, micrometer fixtures, ASTM E83
Creep Harness[3]	Up to 1 in	180 µin	Mitutoyo micrometer, ASTM E83

Parameter/Equipment	Range	CMC[2] (±)	Comments
Microscopes – Optical Length of Reticule	Magnification: 12.5× 25× 50× 100× 200× 400× 500× 1000×	 1200 µin 640 µin 280 µin 170 µin 130 µin 120 µin 110 µin 110 µin	 Stage micrometer

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Voltage – Generate & Measure[3]	(0 to 100) mV > 100 mV to 1 V (> 1 to 10) V (> 10 to 100) V	2.9 µV 15 µV 140 µV 1.7 mV	HP 3458A plus voltage source
DC Current – Generate & Measure[3]	(0 to 10) mA (> 10 to 100) mA > 100 mA to 1 A	0.40 µA 5.6 µA 150 µA	HP 3458A plus current source
Electrical Simulation of Thermocouples[3] – Measure			
Type B	(600 to 1000) °F (> 1000 to 2000) °F (> 2000 to 3000) °F	0.98 °F 0.62 °F 0.48 °F	HP 3458A plus cold junction compensation
Type C	(0 to 850) °F (> 850 to 2100) °F (> 2100 to 3350) °F	0.43 °F 0.47 °F 0.50 °F	
Type E	(0 to 1832) °F	0.40 °F	
Type J	(0 to 2192) °F	0.23 °F	
Type K	(0 to 2400) °F	0.23 °F	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouples[3] – Measure (cont)			
Type R	(0 to 600) °F (> 600 to 1800) °F (> 1800 to 3214) °F	0.62 °F 0.44 °F 0.44 °F	HP 3458A plus cold junction compensation
Type S	(0 to 600) °F (> 600 to 1800) °F (> 1800 to 3214) °F	0.61 °F 0.46 °F 0.52 °F	
Type T	(0 to 752) °F	0.31 °F	
Electrical Simulation of Thermocouples[3] – Generate			
Type B	(600 to 1000) °F (> 1000 to 2000) °F (> 2000 to 3000) °F	1.1 °F 0.75 °F 0.63 °F	HP 3458A plus cold junction compensation & voltage source
Type C	(0 to 850) °F (> 850 to 2100) °F (> 2100 to 3350) °F	0.48 °F 0.51 °F 0.53 °F	
Type E	(0 to 1832) °F	0.18 °F	
Type J	(0 to 2192) °F	0.23 °F	
Type K	(0 to 2400) °F	0.27 °F	
Type R	(0 to 600) °F (> 600 to 1800) °F (> 1800 to 3214) °F	0.67 °F 0.50 °F 0.50 °F	
Type S	(0 to 600) °F (> 600 to 1800) °F (> 1800 to 3214) °F	0.61 °F 0.46 °F 0.52 °F	
Type T	(0 to 752) °F	0.19 °F	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouple Process Indicators[3] –			
Type B	(600 to 3000) °F	3.8 °F	Beamex MC2 calibrator
Type J	(0 to 2192) °F	0.6 °F	
Type K	(0 to 2400) °F	0.6 °F	
Type R	(100 to 3214) °F	1.6 °F	
Type S	(100 to 3214) °F	1.6 °F	

III. Fluid Quantities

Parameter / Equipment	Range	CMC[2, 4, 7] (±)	Comments
Gas Flow – Measure & Measuring Equipment N_2 & Air	(50 to 500) sccm	0.31 % of reading + 0.01 % FS + 0.6*R*	Fluke Molblox 1+ A700K2 /Laminar Molbloc

IV. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Pressure Gages & Transducers[3] –			
Gauge, Pneumatic	(1.4 to 25) psia (1.4 to 1000) psig	0.002 % of reading 0.002 % of reading	Ruska 2465

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Vacuum –Measuring Instruments			
Stable Ion Gage	(1×10^{-5} to 1×10^{-3}) torr	2.0 % of reading	MKS spinning rotor gage
Stable Ion Gage	(1 to 20) microns	7.8 % of reading	SRG & BOC/MKS manometer
Cold Cathode Gage[3]	(1×10^{-5} to 1×10^{-3}) torr	7.0 % of reading	Grandville Phillips stable ion gage
Thermocouple & Convection Gages[3]	(1 to 20) microns	8.9 % of reading	Grandville Phillips stable ion gage
Scales & Balances	(0 to 20) mg	0.048 mg	Class 1 weights
	(0 to 200) mg (0 to 1000) mg (0 to 5) g (0 to 110) g (0 to 200) g (0 to 610) g (0 to 1600) g (0 to 4000) g (0 to 6000) g (0 to 15 000) g	0.05 mg 0.14 mg 1.8 mg 0.47 mg 0.68 mg 2.6 mg 16 mg 160 mg 150 mg 580 mg	Class 3 weights
Force Verification of Testing Machines[3] –			
Tension	(208 to 6000) lbf (1200 to 40 000) lbf	(0.86 + 0.000 18*F*) lbf (5.7 + 0.000 037*F*) lbf	Ultra-precision load cells
Compression	(0.1 to 1000) lbf (0.1 to 400 or 450 lbf)	(0.055 + 0.0022*F*) lbf	Class 6 weights & ultra-precision load cells

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell & Rockwell Superficial Hardness Testers[3]	HRBW: Low Medium High HREW Low Medium High HRC: Low Medium High HR15N Low Medium High HR30N: Low Medium High	 0.48 HRBW 0.38 HRBW 0.33 HRBW 0.26 HREW 0.25 HREW 0.15 HREW 0.22 HRC 0.21 HRC 0.19 HRC 0.21 HR15N 0.17 HR15N 0.15 HR15N 0.39 HR30N 0.29 HR30N 0.20 HR30N	Various Rockwell test blocks, ASTM E18
Indirect Verification of Brinell Hardness Testers – HBW 10/1500/15 HBW 10/3000/15	 Low Medium High Low Medium High	 0.87 HBW 2.7 HBW 4.4 HBW 3.4 HBW 6.9 HBW 8.3 HBW	 Indirect verification per ASTM E10, HBW hardness blocks
Mass – Nominal Values	(0.1 to 1.0) lb 5 lb 20 lb	0.000 020 lb 0.000 35 lb 0.0018 lb	Nominal value assumes nominal density of 8000 kg/m^3

V. Thermodynamics

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Temperature – Measuring Equipment	(32 to 70) °F (> 70 to 160) °F (> 160 to 310) °F (> 310 to 530) °F	0.06 °F 0.09 °F 0.13 °F 0.19 °F	Hart 1502A w/ PRT
Thermocouple Calibration			
Type B	(900 to 1470) °F (> 1470 to 2000) °F (> 2000 to 2650) °F (> 2650 to 3092) °F	0.12 % of reading 0.09 % of reading 0.13 % of reading 0.14 % of reading	ASTM E220, comparison testing using NIST traceable type B & S standards & temp point
Type K	(350 to 2000) °F (> 2000 to 2500) °F	0.06 % of reading 0.13 % of reading	
Type R	(600 to 2000) °F (> 2000 to 2650) °F	0.07 % of reading 0.13 % of reading	
Type S	(900 to 1470) °F (> 1470 to 2000) °F (> 2000 to 2650) °F (> 2650 to 3092) °F	0.10 % of reading 0.07 % of reading 0.13 % of reading 0.14 % of reading	
Relative Humidity – Measure[3]	(10 to 80) % RH 0 % RH	0.60 % RH 0.11 % RH	Thunder Scientific 2500 Michell Easidew
Relative Humidity – Measuring Equipment	(10 to 80) % RH	0.60 % RH	Thunder Scientific 2500
Temperature – Measure[3]	(50 to 90) °F	0.16 °F	Thunder Scientific 2500
Dew Point Measurement –			
Chilled Mirror	(-62 to 10) °C	0.21 °C	Thunder Scientific 3900
Dew Point Probes	(-62 to 10) °C	1.3 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Thermal Processing Equipment [3]			
System Accuracy Test (SAT)			
Type K	(100 to 2400) °F	0.6 °F	AMS2750, Beamex MC2
Type R	(100 to 2500) °F	1.6 °F	
Temperature Uniformity Surveys (TUS) [3]			
Type K	(900 to 2000) °F (> 2000 to 2400) °F	8.2 °F 16 °F	AMS2750, Agilent data acquisition, calibrated TC's
Type R	(600 to 2000) °F (> 2000 to 2650) °F	5.9 °F 7.3 °F	

VI. Time & Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
Timer[3]	15 s to 1 hr (> 1 to 24) hr	0.8 s 1.4 s	Reference stopwatch
Stopwatch[3]	15 s to 24 hr	0.5 s	WWV

[1] This laboratory offers commercial and field calibration service.

[2] Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for 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 Calibration and Measurement Capability, *F* is the numerical value of the nominal force measured in units of pound-force, *L* is the numerical value of the nominal length of the device measured in inches, *R* is the resolution of the device under test, and FS stands for full scale.

[5] The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Calibration and Measurement Capability is expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range 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

HOWMET RESEARCH CENTER

Whitehall, MI

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*).

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

Presented this 28th day of March 2025.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2208.03
Valid to March 31, 2027

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