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

ARCONIC POWER AND PROPULSION RESEARCH CENTER
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CALIBRATION

Valid To: March 31, 2019 Certificate Number: 2208.03

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

I. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Calipers	Up to 6 in	(310 + 23*L*) µin	Gage blocks, Kalmaster
Indicators, Dial Travel	Up to 1 in	260 µin	Gage blocks
Micrometers – Outside Measurement Only	Up to 3 in	(21 + 39*L*) µin + 0.6*R*	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

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Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Height Gages, Lab	(1 to 10) in	(290 + 20*L*) µin	Gage blocks
Microscopes – Optical Length of Reticule	25× to 1000× Magnification	110 µin	Stage micrometer

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
DC Voltage – Generate & Measure[3, 5]	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V	2.5 µV 13 µV 120 µV 1.4 mV	HP 3458A plus voltage source
DC Current – Generate & Measure[3, 5]	(0 to 10) mA (10 to 100) mA 100 mA to 1 A	0.36 µA 4.9 µA 140 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	0.24 °F	
Type K	(0 to 2400) °F	0.24 °F	
Type R	(0 to 600) °F (600 to 1800) °F (1800 to 3214) °F	0.62 °F 0.44 °F 0.44 °F	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouples[3] – Measure (cont)			
Type S	(0 to 600) °F (600 to 1800) °F (1800 to 3214) °F	0.61 °F 0.46 °F 0.52 °F	HP 3458A plus cold junction compensation
Type T	(0 to 752) °F	0.32 °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 and 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	0.24 °F	
Type K	(0 to 2400) °F	0.28 °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	0.20 °F	
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	2.1 °F	
Type S	(100 to 3214) °F	2.1 °F	

III. Fluid Quantities

Parameter / Equipment	Range	CMC[2, 4] (±)	Comments
Gas Flow –			
N_2 and Air	(50 to 500) sccm	0.19 % of reading + 0.01 % FS + 0.6*R*	Fluke Molblox 1+ A700K2 /Laminar Molbloc

IV. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Pressure Gages and Transducers[3] –			
Gauge, Pneumatic	(1.4 to 25) psia (1.4 to 1000) psig	0.002 % of reading 0.002 % of reading	Ruska 2465
Vacuum Measuring Instruments –			
Stable Ion Gage	(1×10^{-5} to 1×10^{-3}) torr	8.2 % of reading	MKS spinning rotor gage
Stable Ion Gage	(1 to 20) microns	6.5 % of reading	SRG & BOC/MKS monometer
Cold Cathode Gage[3]	(1×10^{-5} to 1×10^{-3}) torr	10 % of reading	Grandville Phillips stable ion gage
Thermocouple & Convection Gages[3]	(1 to 20) microns	6.5 % of reading	Grandville Phillips stable ion gage

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Scales & Balances	(0 to 20) mg	0.01 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	0.025 mg 0.13 mg 1.8 mg 0.41 mg 0.61 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 (1300 to 25 000) lbf	(0.86 + 0.00016*F*) lbf (5.7 + 0.00013*F*) lbf	Ultra precision load cells
Compression	(0.1 to 1000) lbf	(0.055 + 0.0022*F*) lbf	Class 6 weights and ultra precision load cells
Indirect Verification of Rockwell and Rockwell Superficial Hardness Testers[3]	HRBW: Low Medium High HREW Low Medium High HRC: Low Medium High HR15N 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 0.19 HR15N 0.16 HR15N	Various Rockwell test blocks, ASTM E18

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell and Rockwell Superficial Hardness Testers[3] (cont)	HR30N: Low Medium High	 0.42 HR30N 0.33 HR30N 0.21 HR30N	Various Rockwell test blocks, ASTM E18
Mass – Nominal Values	(0.1 to 1.0) lb 5 lb 20 lb	0.000019 lb 0.00018 lb 0.0018 lb	Nominal value assume nominal density of 8000 kg/m^3

V. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Temperature – Measuring Equipment	(32 to 70) °F (70 to 160) °F (160 to 310) °F (310 to 510) °F	0.06 °F 0.09 °F 0.13 °F 0.19 °F	Hart MN 1502A
Thermocouple Calibration	(600 to 3180) °F	0.31 % of reading	ASTM E220, comparison testing using NIST traceable type B & S standards and HP 3478A
Relative Humidity – Measure[3]	(5 to 90) % RH	1.7 % RH	Vaisala HMI-46
Temperature – Measure[3]	(50 to 100) °F	0.67 °F	Vaisala HMI-46
Dew Point Measurement – Chilled Mirror Dew Point Probes	 (-62 to 10) °C (-62 to 10) °C	 0.21 °C 1.3 °C	Thunder Scientific MN3900

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 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.

[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, and R is the resolution of the device under test.

[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.

Accredited Laboratory

A2LA has accredited

ARCONIC POWER AND PROPULSION 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 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSLI 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 8 January 2009*).

Presented this 19th day of June 2017.

President and CEO
For the Accreditation Council
Certificate Number 2208.03
Valid to March 31, 2019

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