SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: October 31, 2016 Certificate Number: 1115.01

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, 3] (±)	Comments[7]
Levels/Clinometers	Up to 45°	10 arc seconds	Gage blocks, sine bars
Gage Blocks	(0.01 to 4.0) in (4.0 to 20.0) in	(5.4 + 2.9*L*) µin (6 + 3.1*L*) µin	Federal comparator Edmunds 2200
Calipers – Digital, Dial, and Vernier	Up to 20 in	(1000 + 4.0*L*) µin	Comparison to gage blocks
Micrometers –			
Inside	Up to 14 in	(130 + 4.1*L*) µin	Pratt & Whitney Supermic™ and gage blocks
Outside	Up to 20 in	(110 + 3.9*L*) µin	Comparison to gage blocks
Ring Gages	(0.04 to 12) in	(13 + 3.9*D*) µin	Pratt & Whitney Labmaster™ and gage blocks

Parameter/Equipment	Range	CMC[2, 3] (±)	Comments
Height Gages	Up to 24 in	$0.58R + (530 + 4.0L)$ µin	Comparison to gage blocks
Surface Plate Flatness	Up to 48 in x 96 in	$(6.6 + 8.1\sqrt{L})$ µin	Mahr 832 Note: CMC is to be no less than the acceptable closure error for the procedure
Bore Gages, Intrimikes	(0.275 to 8) in	$(120 + 4.0D)$ µin	Comparison to ring gages

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Voltage – Generate	220 mV 2.2 V 11 V 22 V 220 V 1100 V	7.5 µV/V + 0.40 µV 5.0 µV/V + 0.70 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4.0 µV 5.0 µV/V + 40 µV 6.5 µV/V + 400 µV	Fluke 5720A
DC Voltage – Measure	100 mV 1 V 10 V 100V 1000 V	11 µV/V + 0.36 µV 10 µV/V + 0.36 µV 10 µV/V + 0.60 µV 12 µV/V + 36 µV 12 µV/V + 120 µV	HP 3458A
DC Current – Generate	220 µA 2.2 mA 22 mA 220 mA 2.2 A 11 A	40 µA/A + 6.0 nA 35 µA/A + 7.0 nA 35 µA/A + 40 nA 45 µA/A + 0.70 µA 80 µA/A + 12 µA 0.036 % + 480 µA	Fluke 5720A Fluke 5720A & 5725A

Parameter/Equipment	Range	CMC[2, 4, 5, 6] (±)	Comments
DC Current – Measure	100 µA 1 mA 10 mA 100 mA 1 A	25 µA/A + 0.80 nA 25 µA/A + 5.0 nA 25 µA/A + 50 nA 40 µA/A + 0.50 µA 0.012 % + 10 µA	HP 3458A
DC Resistance – Measure	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	18 µΩ/Ω + 50 µΩ 15 µΩ/Ω + 500 µΩ 13 µΩ/Ω + 500 µΩ 13 µΩ/Ω + 5.0 mΩ 13 µΩ/Ω + 50 mΩ 18 µΩ/Ω + 2.0 Ω 53 µΩ/Ω + 100 Ω 0.050 % + 1.0 kΩ 0.50 % + 10 kΩ	HP 3458A
DC Resistance – Generate	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	40 µΩ 3.4 µΩ/Ω 95 µΩ/Ω 3.8 µΩ/Ω 23 µΩ/Ω 2.4 µΩ/Ω 10 µΩ/Ω 2.7 µΩ/Ω 9.0 µΩ/Ω 3.4 µΩ/Ω 9.0 µΩ/Ω 5.0 µΩ/Ω 11 µΩ/Ω 9.0 µΩ/Ω 21 µΩ/Ω 40 µΩ/Ω 47 µΩ/Ω 0.010 %	Fluke 5720A L&N 4010 Fluke 5720A L&N 4025B Fluke 5720A L&N 4030B Fluke 5720A L&N 4035B Fluke 5720A L&N 4040B Fluke 5720A L&N 4045B Fluke 5720A L&N 4050B Fluke 5720A Fluke 5720A Fluke 5720A Fluke 5720A

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Generate			
2.2 mV	(10 to 20) Hz	0.024 % + 4.0 µV	Fluke 5720A
	(20 to 40) Hz	90 µV/V + 4.0 µV	
	40 Hz to 20 kHz	80 µV/V + 4.0 µV	
	(20 to 50) kHz	0.020 % + 4.0 µV	
	(50 to 100) kHz	0.050 % + 5.0 µV	
	(100 to 300) kHz	0.11 % + 10 µV	
	(300 to 500) kHz	0.14 % + 20 µV	
	(0.5 to 1) MHz	0.27 % + 20 µV	
22 mV	(10 to 20) Hz	0.024 % + 4.0 µV	
	(20 to 40) Hz	90 µV/V + 4.0 µV	
	40 Hz to 20 kHz	80 µV/V + 4.0 µV	
	(20 to 50) kHz	0.020 % + 4.0 µV	
	(50 to 100) kHz	0.050 % + 5.0 µV	
	(100 to 300) kHz	0.11 % + 10 µV	
	(300 to 500) kHz	0.14 % + 20 µV	
	(0.5 to 1) MHz	0.27 % + 20 µV	
220 mV	(10 to 20) Hz	0.024 % + 12 µV	
	(20 to 40) Hz	90 µV/V + 7.0 µV	
	40 Hz to 20 kHz	80 µV/V + 7.0 µV	
	(20 to 50) kHz	0.020 % + 7.0 µV	
	(50 to 100) kHz	0.046 % + 17 µV	
	(100 to 300) kHz	0.090 % + 20 µV	
	(300 to 500) kHz	0.14 % + 25 µV	
	(0.5 to 1) MHz	0.27 % + 45 µV	
2.2 V	(10 to 20) Hz	0.024 % + 40 µV	
	(20 to 40) Hz	90 µV/V + 15 µV	
	40 Hz to 20 kHz	45 µV/V + 8.0 µV	
	(20 to 50) kHz	75 µV/V + 10 µV	
	(50 to 100) kHz	0.011 % + 30 µV	
	(100 to 300) kHz	0.042 % + 80 µV	
	(300 to 500) kHz	0.10 % + 200 µV	
	(0.5 to 1) MHz	0.17 % + 300 µV	
22 V	(10 to 20) Hz	0.024 % + 400 µV	
	(20 to 40) Hz	90 µV/V + 150 µV	
	40 Hz to 20 kHz	45 µV/V + 50 µV	
	(20 to 50) kHz	75 µV/V + 100 µV	
	(50 to 100) kHz	0.010 % + 200 µV	
	(100 to 300) kHz	0.028 % + 600 µV	
	(300 to 500) kHz	0.10 % + 2.0 mV	
	(0.5 to 1) MHz	0.15 % + 3.2 mV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Generate (cont)			
220 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.024 % + 4.0 mV 90 µV/V + 1.5 mV 52 µV/V + 0.6 mV 80 µV/V + 1.0 mV 0.015 % + 2.5 mV	Fluke 5720A
1100 V	50 Hz to 1 kHz	70 µV/V + 3.5 mV	
1100 V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	90 µV/V + 4.0 mV 0.017 % + 6.0 mV 0.060 % + 11 mV	Fluke 5720A & 5725A
750 V	(30 to 50) kHz (50 to 100) kHz	0.060 % + 11 mV 0.23 % + 45 mV	
AC Current – Generate			
220 µA	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.012 % + 0.08 nA 0.028 % + 12 nA 0.11 % + 65 nA	Fluke 5720A
2.2 mA	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.012 % + 35 nA 0.020 % + 110 nA 0.11 % + 650 nA	
22 mA	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.012 % + 350 nA 0.020 % + 550 nA 0.11 % + 5.0 µA	
220 mA	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.012 % + 2.5 µA 0.020 % + 3.5 µA 0.11 % + 10 µA	
2.2 A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 35 µA 0.045 % + 80 µA 0.70 % + 160 µA	Fluke 5720A
11 A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.046 % + 170 µA 0.095 % + 380 µA 0.36 % + 750 µA	Fluke 5720A & 5725A

III. Fluid Quantities

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Volume, Air	(2 to 20) ft^3	0.29 %	Bell 1093A1 prover
Air Flowrate	(1 to 60) ft^3/m 1 cm^3/m to 1000 L/m	0.54 % 0.58 %	Bell 1093A1 prover DHI Molbloc/Molbox system

IV. Ionizing Radiation

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Gamma Source Calibration for Air KERMA Rate – ^{137}Cs	2 mR/hr to 250 R/hr	7.6 %	Hopewell Designs G10

V. Mechanical

Parameter/Range	Range	CMC[2, 6] (±)	Comments
Air Velocity	(30 to 40) fpm (40 to 80) fpm (80 to 250) fpm (250 to 2000) fpm (400 to 8000) fpm	18 % 8.0 % 4.1 % 1.3 % 0.90 %	Short ridge air foil, TSI 8390 wind tunnel system Pitot static tube, TSI 8390 wind tunnel system
Force – Tension Gauges	(240 to 10 000) lbf (10 000 to 240 000) lbf	0.51 % 0.24 %	Tinius Olsen Super "L"

Parameter/Range	Range	CMC[2, 6] (±)	Comments
Mass	Up to 500 mg 500 mg to 2 g (2 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 200) g (200 to 500) g 500 g to 1 kg (1 to 2) kg (2 to 3) kg (3 to 5) kg (5 to 10) kg (10 to 20) kg (20 to 25) kg	1.9 µg 4.2 µg 5.8 µg 8.3 µg 13 µg 21 µg 44 µg 82 µg 0.12 mg 0.23 mg 0.83 mg 0.90 mg 1.4 mg 4.7 mg 20 mg 24 mg	Troemner Class 0 & 1 weights and precision balances ANSI/ASTM E617, Class 3 weights and precision balances
Scales	(100 to 400) lb capacity	0.13 lb	ANSI/ASTM E617, Class 3 and 4 weights, and Class 6 and 7 cast iron grip handle weights and stainless steel weights
Balances	0.01 mg resolution 0.1 mg resolution 1 mg resolution 0.1 g resolution 1 g resolution	0.17 mg 0.27 mg 1.7 mg 0.27 g 0.59 g	ANSI/ASTM E617, Class 3 and 4 weights
Pressure –	(0.5 to 10 000) psi	0.015 % of full scale of each range	DH Instruments RPM-3
Pneumatic	Up to 50 psig	1.2 Pa (0.00017 psi) + 0.0012 %	PG7601 with 10 kPa/kg Piston-Cylinder
	Up to 2 900 psig	0.15 kPa (0.021 psi) + 0.0019 %	PG7202 with 200 kPa/kg Piston-Cylinder
Hydraulic	Up to 1150 psig	0.11 kPa (0.016 psi) + 0.0018 %	PG7302 with 100 kPa/kg Piston-Cylinder
	Up to 23 000 psig	0.33 kPa (0.048 psi) + 0.0034 %	PG7302 with 2 MPa/kg Piston-Cylinder
Torque Wrenches	(20 to 200) in·lbf (20 to 200) ft·lbf (100 to 1000) ft·lbf	2.9 % 1.3 % 0.73 %	A.K.O. TorqueMaster TSD 6000 calibration system

Parameter/Range	Range	CMC[2, 6] (±)	Comments
Accelerometers (1 to 10) g	(5 to 9.99) Hz (10 to 99) Hz 100 Hz (101 to 920) Hz (921 to 5000) Hz (5001 to 10 000) Hz (10 to 15) kHz (15 to 20) kHz	0.85 % 0.86 % 0.69 % 0.82 % 0.96 % 1.7 % 1.7 % 4.8 %	Back to back comparison with 9155D accelerometer calibration workstation

VI. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Temperature – Measuring Equipment, Fixed Points			Hart 1590 Super-thermometer II with baths, Rosemount SPRTs, Hart Scientific 5901A TPW cell
	-75 °C -38 °C 0.01 °C 25 °C 75 °C 100 °C 232 °C 420 °C	0.010 °C 0.0090 °C 0.0020 °C 0.010 °C 0.0050 °C 0.0080 °C 0.017 °C 0.017 °C	Hart Scientific 7080 bath Hart Scientific 7080 bath Triple point of water cell Hart Scientific 7341 bath Hart Scientific 7012 bath Hart Scientific 6045 furnace Hart Scientific 6055 furnace Hart Scientific 6055 furnace
Relative Humidity	(10 to 95) % RH	0.76 % RH	Thunder Scientific humidity generator T2500S

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
Frequency – Measuring Equipment, Fixed Point	10 MHz	2.1 parts in 10^9 Hz	Datum Exac Time ET6000-75 opt 72 GPS receiver

[1] This laboratory does not offer commercial 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] In the statement of 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 microinches; D is the numerical value of the nominal diameter of the device measured in inches.

[4] The measurands stated are generated with the Fluke 5720A & 5725A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

[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. CMCs are 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] In the statement of CMC, the value is defined as the percentage of reading unless otherwise noted.

[7] "Supermicrometer" and "Labmaster" are registered trademarks with a last listed owner of Pratt & Whitney Measurement Systems, Inc., Connecticut U.S.A.

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

U.S. ARMY TMDE SUPPORT CENTER ABERDEEN

Aberdeen Proving Ground, MD

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/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. 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 15th day of April 2014.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 1115.01
Valid to October 31, 2016
Revised on July 29, 2016

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