The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

MICRO PRECISION CALIBRATION, INC./TISSCO

Doha, Qatar

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 9th day of September 2009.

President & CEO
For the Accreditation Council
Certificate Number 935.15
Valid to November 30, 2011

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

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

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CALIBRATION

Valid To: November 30, 2011 Certificate Number: 0935.15

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

I. Chemical Quantities

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Conductivity – Measure	111 mS 1015 µS 1408 µS	0.51 µS 0.51 µS 0.51 µS	Comparison to standard solutions
pH – Measure	(4, 7, 10) pH unit	0.02 pH unit	Comparison to standard solutions

II. Dimensional

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Calipers & Height Gages[3]	(0.10 to 24) in	(56 µin + 0.6L) µin	Gage blocks' length rods and optical flats

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Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Gage Blocks – length Only	(0 to 12) in	(56 + 0.6*L*) µin	Mahr measuring machine, master gage blocks
Surface Plates[3] Repeatability	(12x12 to 72x144) in	40 µin	Repeat-O-Meter (only valid in connection with flatness calibration)
Cylindrical Plug Gages	(0 to 12) in	(12 + 0.34*L*) µin	Mahr measuring machine
Thread Plug Gages – Major Diameter Pitch Diameter	(0 to 12) in	(50 + 0.6*D*) µin	Mahr measuring machine
Ring Gauges, Cylindrical & Tapered	(0.02 to 12) in	(11 + 1.5*L*) µin	Mahr measuring machine
Indicators, Resolution – 0.00005 in 0.0001 in 0.001 in	 (0 to 1) in (0 to 2) in (0 to 8) in	 46 µin 92 µin 870 µin	Mahr measuring machine
End Measuring Rods	(0 to 12) in	(5 + 0.6*L*) µin	Mahr measuring machine
Pin Gages, Diameter	(0.02 to 2.00) in	75 µin	Mahr measuring machine
Micrometers[3] – Length and Flatness Resolution: 100 µin 50 µin	 (0.10 to 12) in (0.10 to 4) in	 (55 + 15*L*) µin (34 + 15*L*) µin	Mitutoyo gage blocks, optical flat, monochromic light source

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Coating Thickness – Ferrous and non-Ferrous	(0.010 to 60) mil	130 µm	Thickness Standards
Pitch Diameter, External Threads	(0.10 to 4.00) in	(26 + 10*L*) µin	Mahr measuring machine

III. Electrical – DC /Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Voltage – Generate[3]	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	11 µV/V + 0.6 µV 10 µV/V + 1.0 µV 11 µV/V + 3.5 µV 10 µV/V + 6.5 µV 11 µV/V + 80 µV 13 µV/V + 500 µV	Fluke 5700A
DC Voltage – Measure[3]	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1000) V	13 µV/V + 3.0 µV 17 µV/V + 0.3 µV 13 µV/V + 0.5 µV 15 µV/V + 30 µV 27 µV/V + 100 µV	HP 3458A
DC Current – Generate[3]	(0 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 20.5) A	40 µA/A + 8 nA 35 µA/A + 40 nA 45 µA/A + 0.7 µA 80 µA/A + 12 µA 0.06 % + 330 µA 0.12 %	Fluke 5700A Fluke 5500A/ coil

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current – Measure[3]	(10 to 100) µA 100 µA to 10 mA (10 to 100) mA 100 mA to 1 A	26 µA/A + 5 µA 26 uA/A + 5 µA 60 µA/A + 5 µA 0.013 % + 10 µA	HP 3458A
High DC Current	(1 to 500) A	1.3 %	Fluke 5500A with current coil hall effect
Resistance – Generate[3]	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 kΩ 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	0.12 % + 0.008 Ω 0.53 % + 0.015 Ω 0.02 % + 0.015 Ω 0.014 % + 0.015 Ω 0.017 % + 0.06 Ω 0.013 % + 0.06 Ω 0.017 % + 0. 6 Ω 0.013 % + 0.6 Ω 0.02 % + 6 Ω 0.016 % + 6 Ω 0.024 % + 55 Ω 0.02 % + 55 Ω 0.076 % + 550 Ω 0.12 % + 550 Ω 0.58 % + 5.5 kΩ 0.58 % + 17 Ω	Fluke 5500A
Fixed Points[3]	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.013 % 39 parts in 10^6 24 parts in 10^6 18 parts in 10^6 17 parts in 10^6 19 parts in 10^6 27 parts in 10^6 54 parts in 10^6 0.016 %	Fluke 5700A
Resistance – Measure[3]	(0 to 10) Ω (10 to 100) Ω 100 Ω to 100 kΩ 100 k Ω to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	19 parts in 10^6 + 0.06 mΩ 15 parts in 10^6 + 0.6 mΩ 13 parts in 10^6 + 0.6 mΩ 18 parts in 10^6 + 2.4 Ω 59 parts in 10^6 + 120 Ω 0.058 % + 1.2 kΩ 1.8 % + 10 kΩ	HP 3458A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Capacitance – Generate[3]	(0.33 to 0.49) nF (0.50 to 1.09) nF (1.10 to 3.29) nF (3.30 to 10.9) nF (11.0 to 32.9) nF (33 to 109.9) nF (110 to 329.9) nF (0.33 to 1.09) µF (1.10 to 3.29) µF	3.3 % 1.7 % 0.93 % 0.69 % 0.64 % 0.40 % 0.40 % 0.40 % 0.51 %	Fluke 5500A
Electrical Calibration of Thermocouple Indicators –			
Type E	-250 ºC to -100 ºC -100 ºC to 650 ºC 650 to 1000 ºC	0.5 ºC 0.16 ºC 0.21 ºC	Fluke 5500A
Type J	-210 ºC to -100 ºC -100 ºC to 760 ºC 760 ºC to 1200 ºC	0.27 ºC 0.17 ºC 0.23 ºC	
Type K	-200 ºC to -100 ºC -100 ºC to 120 ºC 120 ºC to 1000 ºC 1000 ºC to 1372 ºC	0.33 ºC 0.18 ºC 0.26 ºC 0.04 ºC	
Type S	0 ºC to 250 ºC 250 ºC to 1400 ºC 1400 ºC to 1767 ºC	0.47 ºC 0.37 ºC 0.46 ºC	
Type T	-250 ºC to -150 ºC -150 ºC to 0 ºC 0 ºC to 400 ºC	0.63 ºC 0.24 ºC 0.16 ºC	

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Electrical Calibration of RTD Indicating Systems[3] –			
Pt 385, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 400 °C 400 °C to 630 °C 630 °C to 800 °C	0.05 °C 0.07 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5500A
Pt 3926, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 400 °C 400 °C to 630 °C	0.05 °C 0.07 °C 0.10 °C 0.12 °C	
Pt 3916, 100 Ω	-200 °C to -190 °C -190 °C to 0 °C 0 °C to 300 °C 300 °C to 600 °C 600 °C to 630 °C	0.25 °C 0.05 °C 0.08 °C 0.10 °C 0.23 °C	
Pt 385, 200 Ω	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.04 °C 0.05 °C 0.14 °C 0.16 °C	
Pt 385, 500 Ω	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.05 °C 0.06 °C 0.09 °C 0.11 °C	
Pt 385, 1 kΩ	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.03 °C 0.05 °C 0.07 °C 0.23 °C	
PtNi 385, 100 Ω	-80 °C to 100 °C 100 °C to 260 °C	0.08 °C 0.14 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.3 °C	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Generate			
(0 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.055 % + 13 µV 0.021 % + 8 µV 0.011 % + 8 µV 0.037 % + 8 µV 0.085 % + 25 µV 0.34 % + 80 µV	Fluke 5700A
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.05 % + 80 µV 0.016 % + 25 µV 75 µV/V + 6 µV 0.012 % + 16 µV 0.025 % + 70 µV 0.22 % + 850 µV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.05 % + 0.8 mV 0.016 % + 0.25 mV 75 µV/V + 0.06 mV 0.012 % + 0.16 mV 0.025 % + 0.35 mV 0.34 % + 8.5 mV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.05 % + 8 mV 0.016 % + 2.5 mV 80 µV/V + 0.8 mV 0.022 % + 3.5 mV 0.05 % + 8 mV 1.6 % + 190 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.06 % + 11 mV 0.23 % 45 mV	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.04 % + 16 mV 90 µV/V + 4 mV	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Measure[3]			
Up 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	0.03 % + 3 µV 0.02 % + 2 µV 0.03 % + 2 µV 0.12 % + 2 µV 0.58 % + 2 µV 4.6 % + 2 µV	HP 3458A, synchronous sub-sampled mode
10 mV to 10 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	80 µV/V + 0.4 mV 80 µV/V + 0.2 mV 0.02 % + 0.2 mV 0.03 % + 0.2 mV 0.09 % + 0.2 mV 0.35 % + 1 mV 1.2 % + 1 mV 1.7 % + 1 mV	
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.02 % + 4 mV 0.02 % + 2 mV 0.04 % + 2 mV 0.14 % + 2 mV 0.46 % + 10 mV 1.7 % + 10 mV	
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz	0.05 % + 40 mV 0.05 % + 20 mV 0.07 % + 20 mV	
(1 to 20) kV	(20 to 50) kHz (50 to 100) kHz	0.14 % + 20 mV 0.35 % + 20 mV	
AC Current – Generate			
(1 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A	40 Hz to 1 kHz	0.09 % 0.024 % 0.026 % 0.093 %	Fluke 5700A w/opt3

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Measure[3]			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.46 % + 0.03 µA 0.18 % + 0.03 µA 0.078 % + 0.03 µA	HP 3458A
100 µA to 100 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 20 µA 0.17 % + 20 µA 0.073 % + 20 µA 0.042 % + 20 µA	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 200 µA 0.19 % + 200 µA 0.10 % + 200 µA 0.12 % + 200 µA	
(1 to 500) A	(50 to 70) Hz	0.32 %	Fluke 5500 with Fluke coil

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2] (±)	Comments
RF Tuned Power[3] – Generate, Connector			
Type N, (0 to -100) dB	Up to 1.3 GHz Up to 26.5 GHz	0.40 dB 0.72 dB	HP 8902A, HP11722A, HP 11792A
RF Absolute Power[3] – Generate Connector Type N			
50 MHz to 26.5 GHz	(-30 to -20) dB (-20 to 10) dB (10 to 20) dB	0.06 dB 0.068 dB 1.2 dB	HP438A, 8484A, 8481A, 8487A

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Amplitude Modulation[3] – Measure			
Rate: 150 kHz to 10 MHz Depth: (5 to 99) %	50 Hz to 10 kHz 20 Hz to 100 kHz	4.0 % 4.6 %	HP 8902A
Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	 50 Hz to 50 kHz 20 Hz to 100 kHz	 3.6 % 4.6 %	
Frequency Modulation – Measure[3]			
Rate: 250 kHz to 10 MHz Dev: ≤ 40 kHz	20 Hz to 10 kHz	3.1 %	HP 8902A
Rate: 10 MHz to 1.3 GHz Dev: ≤ 400 kHz	20 Hz to 200 kHz 50 Hz to 100 kHz	7.7 % 1.6 %	
Phase Modulation[3] – Measure			
Rate: 10 MHz to 1.3 GHz	200 Hz to 20 kHz	7.0 %	HP 8902A

V. Mechanical

Parameter/Equipment	Range[8]	CMC[2] (±)	Comments
Torque – Measure	(0 to 18) in·lb (8 to 220) in-lb (6 to 110) ft·lb	0.92 % of rdg 0.7 % of rdg 0.68 % of rdg	Norbar torque system
Scales and Balances[3]	1mg to 30 kg (10 to 660) lb	1.0 LSVD 0.30 lb	Verification with class 1 weights Class F weights

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Mass –	(1 to 500) mg	2 µg	Class 1 with balance
Fixed Points	1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g	3 µg 4 µg 5 µg 8 µg 10 µg 23 µg 36 µg 44 µg	Class 1 with balance
	10 kg	3 mg	Class 4 with balance
Pressure	Up to 100 psi UP to 1500 psi Up to 15000 psi	0.032 psi of rdg 0.066 psi of rdg 0.070 psi of rdg	Druck PM 620

VI. Optical Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Optical Power[3] – Measure			
850 nm	(6 to -60) dB	4.9 % of reading	Agilent 81554SM, 81689A, 8156A, 81532A
1310 nm	(10 to -110) dB	4.9 % of reading	
1550 nm	(10 to -110) dB	4.7 % of reading	
Optical Wavelength[3] – Measure	(700 to 1650) nm	3.9 % of reading	Agilent 86120B
Fiber Optics Wavelength[3] –Measuring Equipment	(1510 to 1540) nm	1.5 parts in 10^6	NIST SRM 2517A

VII. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Humidity – Measuring Equipment[3]	11 % RH 33 % RH 75.4 % RH 97 % RH	1.6 % RH of rdg 1.7 % RH of rdg 1.5 % RH of rdg 2 % RH of rdg	Saturated salt solutions
Temperature – Measuring Equipment	(-40 to 650) ºC (300 to 1200) ºC	0.57 ºC 2.6 ºC	PRT and Ametek ITC 650A Nagman Calibrator

VIII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Frequency – Measure Fixed Point	 10 MHz Up to 26.5 GHz	 1×10^{-11} Hz 1×10^{-11} Hz	 Trembel GPS HP53132A driven by GPS

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

[2] Calibration and Measurement Capability (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. CMC's 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] The measurands stated are generated with the Fluke 5500A, Fluke 5700A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Best measurement uncertainties 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 series of instruments. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Best measurement uncertainties 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, *L* is the numerical value of the nominal length of the device measured in inches and *D* is the numerical value of the nominal diameter of the device measured in inches. Pitch diameter is measured by the three-wire method.