



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

MICRO PRECISION CALIBRATION / TISSCO
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CALIBRATION

Valid To: February 28, 2012

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 calibrations¹:

I. Chemical Quantities

Parameter/Equipment	Range	CMC ² (±)	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 – Length Only	(0.10 to 24) in	(56 + 0.6L) µin	Gage blocks length rods

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
Gage Blocks – Length Only	(0 to 12) in	$(56 + 0.6L) \mu\text{in}$	Mahr measuring machine, master gage blocks
Surface Plates ³ Repeatability	(12x12 to 72x144) in	40 μin	Repeat-O-Meter
Cylindrical Plug Gages	(0 to 12) in	$(12 + 0.34L) \mu\text{in}$	Mahr measuring machine
Solid Thread Plug Gages – Major Diameter	(0 to 1) in (1 to 6) in	25 μin $(25 + 7D) \mu\text{in}$	Mahr measuring machine, thread wires
Pitch Diameter	(0 to 1) in (1 to 6) in	35 μin $(35 + 7D) \mu\text{in}$	
Ring Gauges, Cylindrical & Tapered	(0.02 to 12) in	$(11 + 1.5L) \mu\text{in}$	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 4) in (4 to 8) in (8 to 12) in	24 μin 28 μin 29 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	$(55 + 15L) \mu\text{in}$ $(34 + 15L) \mu\text{in}$	Mitutoyo gage blocks, optical flat, monochromic light source

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Parameter/Equipment	Range	CMC ^{2, 6} (±)	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 + 10L) 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 1 V (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
High Voltage	(1 to 70) kV	0.10 % of rdg	Vitrek 4670B
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
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 μA/A + 5 μA 60 μA/A + 5 μA 0.013 % + 10 μA	HP 3458A

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Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
High DC Current ⁷	(1 to 500) A	1.3 %	Fluke 5500A w/current coil hall effect
	(1 to 50) A	0.16 % of rdg	Current shunt monitored w/ 3458A
	(50 to 100) A	0.20 % of rdg	
	(100 to 1000) A (1000 to 3000) A	0.27 % of rdg 0.27 % of rdg	
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 kΩ	Fluke 5500A
	Fixed Points	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 %
Resistance – Measure ³	(0 to 10) Ω (10 to 100) Ω 100 Ω to 100 kΩ 100 kΩ 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

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Parameter/Equipment	Range	CMC ^{2,4} (±)	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 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.5 °C 0.16 °C 0.21 °C	Fluke 5500A
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.27 °C 0.17 °C 0.23 °C	
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.33 °C 0.18 °C 0.26 °C 0.04 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.47 °C 0.37 °C 0.46 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.63 °C 0.24 °C 0.16 °C	

Parameter/Equipment	Range	CMC ^{2,4} (±)	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} (±)	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	0.024 % + 12 μV 90 μV/V + 7 μV 80 μV/V + 15 μV 0.02 % + 7 μV 0.046 % + 17 μV 0.27 % + 45 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	0.024 % + 40 μV 90 μV/V + 15 μV 45 μV/V + 8 μV 75 μV/V + 10 μV 0.11 % + 30 μV 0.17 % + 300 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	
(1 to 50) kV	(50 to 60) Hz	0.32 % of rdg	Vitrek 4670B
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

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

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ² (\pm)	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, HP11793A, HP 11792A
RF Absolute Power ³ – Generate Connector Type N			
50 MHz to 26.5 GHz	(-70 to -30) dB (-30 to -20) dB (-20 to 10) dB (10 to 20) dB	0.64 dB 0.06 dB 0.068 dB 1.2 dB	HP 438A, 8484A, 8485A

Parameter/Range	Frequency	CMC ^{2,7} (±)	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	CMC ² (±)	Comments
Torque - Measure	(0 to 2) NM (1 to 25) NM (8 to 150) NM (30 to 1500) NM	0.92 % of rdg 0.71 % of rdg 0.68 % of rdg 0.72 % of rdg	Norbar Torque system
Scales and Balances ³	1 mg to 30 kg (10 to 660) lb	1.0 LSVD 0.30 lb	Verification with class 1 weights Class F weights

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Parameter/Range	Frequency	CMC ² (±)	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 10 kg	3 µg 4 µg 5 µg 8 µg 10 µg 23 µg 36 µg 44 µg 3 mg	Class 1 with balance Class 4 with balance
Pressure ³	Up to 100 psi UP to 1500 psi Up to 15000 psi (Up to 12000) psi (Up to 25000) psi (Up to 40000) psi	0.065 % of rdg 0.066 % of rdg 0.070 % of rdg 0.026 % of rdg 0.037 % of rdg 0.053 % of rdg	Druck PM 620 RUSKA Model:7615
Pressure	Up to 800 psi Up to 16000 psi	0.017 % of rdg 0.021% of rdg	GE Pressurements Model: P3125-1 dead weight pressure standard
Force ³ – Measure			
Compression	Up to 200 kN (200 to 5000) kN	0.29 % of rdg 1.3 % of rdg	Comparison to Morehouse standard load cell
Tension	Up to 200 kN (200 to 1700) kN	0.29 % of rdg 1.3 % of rdg	

VI. Optical Quantities

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Optical Power ³ – Measure			
850 nm	(6 to -60) dB	4.9 % of rdg	Agilent 81554SM, 81689A, 8156A, 81532A
1310 nm	(10 to -110) dB	4.9 % of rdg	
1550 nm	(10 to -110) dB	4.7 % of reading	
Optical Wavelength ³ – Measure	(700 to 1650) nm	3.9 % of rdg	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	(-196 to 420) °C (100 to 1200) °C	0.42 °C 1.5 °C	FTM-100 & PRT probe Type S thermocouple

VIII. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measure Fixed Point	1 MHz 10 MHz	5 x 10 ⁻¹² Hz 5 x 10 ⁻¹² Hz	Agilent 58503A GPS

IX. Vibration

Parameter/Equipment	Range	CMC ² (±)	Comments
Vibration and Frequency Meters Frequency Response	(5 to 10) Hz 10 Hz to 10 kHz	6 % of FS 3.6 % of FS	GTI model 4000 accelerometer system

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.

⁷ In the statement of CMC, the value is defined as the percentage of reading.



World Class Accreditation

The American Association for Laboratory 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 February 28, 2012
Revised November 29, 2011

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