



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

Garber Metrology
Weighing Solutions & Precision Calibration
 1842 William Penn Way, Lancaster, PA 17601
 Vasant Amin Phone: 717 393 1708

CALIBRATION

Valid to: January 26, 2011

Certificate Number: AC-1255

I. Electromagnetic DC/Low Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage - Source	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1.02 kV	60 µV/V + 3 µV 50 µV/V + 5 µV 50 µV/V + 50 µV 55 µV/V + 500 µV 55 µV/V + 1.5 mV	Fluke 5500A	OEM & GIDEP Sourced Procedures
DC Current - Source	Up to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 11) A	130 µA/A + 50 nA 100 µA/A + 250 nA 100 µA/A + 3.3 µA 300 µA/A + 44 µA 600 µA/A + 330 µA		
Resistance - Source	Up to 11 Ω (11 to 33) Ω (33 to 330) Ω 330 Ω to 3.3 kΩ (3.3 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 3.3 MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	120 µΩ/Ω + 8 mΩ 120 µΩ/Ω + 15 mΩ 90 µΩ/Ω + 15 mΩ 90 µΩ/Ω + 60 mΩ 90 µΩ/Ω + 600 mΩ 110 µΩ/Ω + 6 Ω 120 Ω/Ω + 6 Ω 150 Ω/Ω + 55 Ω 600 µΩ/Ω + 550 Ω 1 mΩ/Ω + 550 Ω 5 mΩ/Ω + 5.5 kΩ 5 mΩ/Ω + 16.5 kΩ		
Capacitance - Source	330 pF to 11 nF (11 to 110) nF (110 to 330) nF 330 nF to 1.1 µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF 330 µF to 1.1 mF	5 mF/F + 10 pF 2.5 mF/F + 100 pF 2.5 mF/F + 300 pF 2.5 mF/F + 1 nF 3.5 mF/F + 3 nF 3.5 mF/F + 10 nF 4 mF/F + 30 nF 5 mF/F + 100 nF 7 mF/F + 300 nF 10 mF/F + 300 nF		



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source	<p>(1 to 33) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz</p> <p>(33 to 330) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz</p> <p>330 mV to 3.3 V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz</p> <p>(3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz</p> <p>(33 to 330) V 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz</p> <p>330 V to 1.02 kV 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz</p>	<p>3.5 mV/V + 20 μV 1.5 mV/V + 20 μV 2 mV/V + 20 μV 2.5 mV/V + 20 μV 3.5 mV/V + 33 μV 10 mV/V + 60 μV</p> <p>2.5 mV/V + 50 μV 500 μV/V + 20 μV 1 mV/V + 20 μV 1.6 mV/V + 40 μV 2.4 mV/V + 170 μV 7 mV/V + 330 μV</p> <p>1.5 mV/V + 250 μV 300 μV/V + 60 μV 800 μV/V + 60 μV 1.4 mV/V + 300 μV 2.4 mV/V + 1.7 mV 5 mV/V + 3.3 mV</p> <p>1.5 mV/V + 2.5 mV 400 μV/V + 600 μV 800 μV/V + 2.6 mV 1.9 mV/V + 5 mV 2.4 mV/V + 17 mV</p> <p>500 μV/V + 6.6 mV 800 μV/V + 15 mV 900 μV/V + 33 mV</p> <p>500 μV/V + 80 mV 2 mV/V + 100 mV 2 mV/V + 500 mV</p>	Fluke 5500A	OEM & GIDEP Sourced Procedures
AC Current - Source	<p>(29 to 330) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz</p> <p>330 μA to 3.3 mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz</p>	<p>2.5 mA/A + 150 nA 1.25 mA/A + 150 nA 1.25 mA/A + 250 nA 4 mA/A + 150 nA 12.5 mA/A + 150 nA</p> <p>2 mA/A + 300 nA 1 mA/A + 300 nA 1 mA/A + 300 nA 2 mA/A + 300 nA 6 mA/A + 300 nA</p>		

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Current – Source (cont.)	(3.3 to 33) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (33 to 330) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 330 mA to 2.2 A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (2.2 to 11) A (45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	2 mA/A + 3 μA 1 mA/A + 3 μA 900 uA/A + 3 μA 2 mA/A + 3 μA 6 mA/A + 3 μA 2 mA/A + 30 μA 1 mA/A + 30 μA 900 uA/A + 30 μA 2 mA/A + 30 μA 6 mA/A + 30 μA 2 mA/A + 300 μA 1 mA/A + 300 μA 7.5 mA/A + 300 μA 600 μA/A + 2 mA 1 mA/A + 2 mA 3.3 mA/A + 2 mA	Fluke 5500A	OEM & GIDEP Sourced Procedures
Oscilloscopes - Amplitude	0 VDC - 50 Ω load 6 VDC - 50 Ω load 0 VDC - 1 MΩ load 66 VDC - 1 MΩ load 130 VDC - 1 MΩ load	11.6 mV 20.9 mV 11.6 mV 39.9 mV 76.1 mV		
Oscilloscopes - Flatness	50 kHz ref to 10 mV p-p 50 kHz ref to 5 V p-p 100 kHz to 30 mV 100 kHz to 5.5 V 300 MHz to 30 mV 300 MHz to 5.5 V 600 MHz to 30 mV 600 MHz to 5.5 V	580 μV 117 mV 1.05 mV 131 mV 1.05 mV 128 mV 990 μV 124 mV		
Oscilloscopes – Rise Time (V p-p)	400 ps 1 MHz, 1 V 400 ps 10 MHz, 0.5 V 400 ps 10 MHz, 1 V	1.15 ps 1.15 ps 115.61 ps		
Oscilloscopes - Square Wave 1 MΩ Load	100 mV to 100 MHz 1 V to 100 MHz	700 μV 6.01 mV		
Square Wave 50 Ω Load	100 mV to 1 kHz 1 V to 1 kHz 5 V to 1 kHz	700 μV 6.01 mV 31.23 mV		

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Oscilloscopes – Time Markers	2 ns 20 ms 50 ms 5 s	28.9 μs/s 28.9 μs/s 28.9 μs/s 2.98 μs/s	Fluke 5500A	
Electrical Simulation of Thermocouples				
Type E	-100 °C 0 °C 500 °C 1 000 °C	0.08 °C 0.02 °C 0.02 °C 0.03 °C		
Type J	-150 °C 0 °C 375 °C 750 °C	0.04 °C 0.01 °C 0.02 °C 0.03 °C		
Type K	-180 °C 0 °C 800 °C 1 300 °C	0.04 °C 0.13 °C 0.14 °C 0.17 °C		
Type T	-100 °C 0 °C 200 °C 400 °C	0.12 °C 0.04 °C 0.01 °C 0.02 °C	Fluke 744	OEM & GIDEP Sourced Procedures
Type E	-100 °C 0 °C 500 °C 1 000 °C	0.13 °C 0.02 °C 0.02 °C 0.03 °C		
Type J	-150 °C 0 °C 375 °C 750 °C	0.19 °C 0.02 °C 0.02 °C 0.03 °C		
Type K	-180 °C 0 °C 800 °C 1 300 °C	0.07 °C 0.02 °C 0.05 °C 0.1 °C		
Type T	-100 °C 0 °C 200 °C 400 °C	0.12 °C 0.04 °C 0.02 °C 0.01 °C		

II. Thermodynamic

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Temperature	(0 to 260) °C (-5 to 140) °C	0.26 °C 0.14 °C	Hart Microbath 9131 Hart Scientific 9105 Drywell	OEM & GIDEP Sourced Procedures
Microbath and Drywell Calibrators	(-200 to 660) °C	0.02 °C	HP 3458A and RTD Probe	
RTD and Thermocouple Probes	(-5 to 700) °C	0.03 °C	RTD Probe, 9105 Drywell Calibrator, 9173 Drywell Calibrator, 6102 Microbath, HP 3458A	

III. Mechanical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pressure and Vacuum	Up to 30 in Hg Up to 100 psi (100 to 150) psi (150 to 1 000) psi (1 000 to 10 000) psi	1.09 in Hg 1.23 psi 2.04 psi 2.64 psi 3.26 psi	Precision Pressure Calibrator, Dead Weight Tester, Ametek R-110-1	OEM & GIDEP Sourced Procedures
Torque	Up to 100 in·oz Up to 250 ft·lb	0.87 in·oz 1.91 ft·lb	Torque Calibrator CDI Suretest 5000-ST	
Durometers	Up to 100 duro	1.16 % of Full Scale	Triple Beam Balance	
Pipettes	(2 to 20) µL (20 to 100) µL (100 to 1 250) µL (2 000 to 9 000) µL (9 000 to 10 000) µL	0.011 µL 0.14 µL (0.67 + 0.00051 M) µL (1.53 + 0.0004 M) µL 6.71 µL	Balance, Class 1 Weights	
Mass	Up to 50 lb	0.001 lb	Standard Weights	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Balances	Up to 200 g (200 to 600) g	0.22 mg 19.2 mg	Class 0, Class 1. or Class S Weights	NIST Handbook 44
Balances and Scales	Up to 1.2 kg (0.1 g resolution) (1.2 to 2) kg (0.2 g resolution) (2 to 5) kg (0.5 g resolution) (5 to 30) kg (1 g resolution)	0.18 g 0.26 g 0.58 g 1.21 g		
Balances and Scales	Up to 2 lb (0.0002 lb resolution)	0.0004 lb	Class F Weights	
	Up to 5 lb (0.0005 lb resolution)	0.0008 lb		
	Up to 10 lb (0.001 lb resolution)	0.0016 lb		
	Up to 20 lb (0.005 lb resolution)	0.008 lb		
	Up to 25 lb (0.002 lb resolution)	0.003 lb		
	Up to 50 lb (0.005 lb resolution)	0.01 lb		
	Up to 100 lb (0.01 lb resolution)	0.011 lb		
	Up to 150 lb (0.05 lb resolution)	0.084 lb		
	Up to 500 lb (0.05 lb resolution)	0.095 lb		
	Up to 1 000 lb (0.2 lb resolution)	0.35 lb		
Up to 2 000 lb (0.5 lb resolution)	0.86 lb			
Up to 5 000 lb (1 lb resolution)	1.7 lb			
Up to 20 000 lb (2 lb resolution)	3.5 lb			
Up to 200 000 lb (20 lb resolution)	36 lb			

IV. Dimensional

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Gage Blocks	Up to 1 in (1 to 4) in (4 to 12) in	4.1 µin 4.9 µin 6.9 µin	Pratt & Whitney LMU-2130 Grade 1 Gage Blocks	OEM & GIDEP Sourced Procedures
Thread Measuring Wires	(4 to 120) tpi	13 µin (0.0003 mm)		
Plain Plugs and Pins	(0.004 to 1) in (1 to 4) in (4 to 12) in	11.4 µin 11.6 µin 12.6 µin		
Thread Plugs	Up to 12 in	126 µin	Pratt & Whitney LMU-2130, Grade 1 Gage Blocks, Thread Measuring Wires	
Thread Rings	(0.112 to 8) in	136 µin	Pratt & Whitney LMU-2130, Class XXX Plain Rings	
Plain Rings	(0.04 to 1) in (1 to 4) in (4 to 12) in	11 µin 19.5 µin 32.5 µin		
Micrometers, OD	Up to 1 in (1 to 10) in (10 to 48) in	94 µin 138 µin 1 159 in	Grade 2 Gage Blocks, Optical Flat	
Micrometers, ID	Up to 1 in (1 to 10) in (10 to 48) in	94 µin 138 µin 1 159 µin		
Micrometers, Bore	Up to 1 in (1 to 10) in (10 to 48) in	94 µin 138 µin 1 159 µin		
Micrometers, Depth	Up to 1 in (1 to 10) in (10 to 48) in	94 µin 138 µin 1 159 µin	Grade 2 Gage Blocks	
Calipers – Dial, Vernier, & Digital	Up to 6 in (6 to 12) in (12 to 48) in	602 µin 1 181 µin 1 225 µin		
Indicator Calibrators	Up to 1 in	61 µin		
Height Gages	Up to 12 in (12 to 48) in	630 µin 642 µin		

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Indicators – Dial and Digital	Up to 6 in (0.001 in resolution) Up to 0.5 in (0.0001 in resolution) Up to 0.05 in (0.00005 in resolution) Up to 0.02 in (0.00002 in resolution) Up to 0.01 in (0.00001 in resolution)	288 µin 133.7 µin 61.9 µin 36.4 µin 20.1 µin	Grade 2 Gage Blocks, Indicator Calibrator	OEM & GIDEP Sourced Procedures
Surface Plates - Flatness	To (36 x 48) in To (72 x 144) in	(25 + 10D) µin (50 + 30D) µin	Planeators, Straight Indicators	
Length Standards	Up to 1 in (1 to 4) in (4 to 10) in (10 to 24) in	39 µin 64 µin 120 µin 271 µin	Pratt & Whitney LMU-2130, Grade 1 Gage Blocks, Electronic Height Gage	
Parallels	Up to 4 in	52.2 µin	Pratt & Whitney LMU-2130, Grade 1 Gage Blocks	
Optical Comparators	X Up to 6 in Y Up to 6 in	1.73R 1.73R	Glass Scale Standard, Check Balls	

Notes:

1. Calibration and Measurement Capabilities (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of $k=2$.
2. This laboratory offers calibrations in its laboratory and on-site at customer-designated locations. Since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
3. The use of (R) signifies the Resolution of the unit under test in inches.
4. The use of (D) signifies the diagonal measurement of the surface plate in inches.
5. The term (M) refers to the applied Measured value in micro-liters.
6. This scope is part of and must be included with the Certificate of Accreditation No. AC - 1255



Vice President