



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

**Garber Scale and Calibration**

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**CALIBRATION**

Valid to: January 26, 2011

Certificate Number: AC-1255

**I. Dimensional**

PARAMETER/ EQUIPMENT	RANGE	BEST 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	



PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Calipers – Dial, Vernier, & Digital	Up to 6 in (6 to 12) in (12 to 48) in	602 µin 1 181 µin 1 225 µin	Grade 2 Gage Blocks	OEM & GIDEP Sourced Procedures
Indicator Calibrators	Up to 1 in	61 µin		
Height gages	Up to 12 in (12 to 48) in	630 µin 642 µin		
Indicators – Dial and Digital	Up to 6 in (0.001 in resolution)	288 µin	Grade 2 Gage Blocks, Indicator Calibrator	
	Up to 0.5 in (0.0001 in resolution)	133.7 µin		
	Up to 0.05 in (0.00005 in resolution)	61.9 µin		
	Up to 0.02 in (0.00002 in resolution)	36.4 µin		
	Up to 0.01 in (0.00001 in resolution)	20.1 µin		
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	39 µin	Pratt & Whitney LMU-2130, Grade 1 Gage Blocks, Electronic Height Gage	
	(1 to 4) in	64 µin		
	(4 to 10) in	120 µin		
	(10 to 24) in	271 µin		
Parallels	Up to 4 in	52.2 µin	Pratt & Whitney LMU-2130, Grade 1 Gage Blocks	
Optical Comparators	X Up to 6 in	1.73R	Glass Scale Standard, Check Balls	
	Y Up to 6 in	1.73R		

## II. Mechanical

PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pressure/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	Precision Pressure Calibrator, Dead Weight Tester, Ametek R-110-1	OEM & GIDEP Sourced Procedures
		1.23 psi		
		2.04 psi		
		2.64 psi		
		3.26 psi		
Torque	Up to 100 in·oz Up to 250 ft·lb	0.87 in·oz	Torque Calibrator CDI Suretest 5000-ST	
		1.91 ft·lb		
Durometers	Up to 100 duro	1.16 % of Full Scale	Triple Beam Balance	

Balances	Up to 200 g	0.22 mg	Class 0 Weights	NIST Handbook 44
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PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Balances	Up to 600 g	19.2 mg	Class 1 or Class S Weights	NIST Handbook 44
Balances and Scales	Up to 1 200 g (0.1 g resolution)	0.18 g		
	Up to 2 000 g (0.2 g resolution)	0.26 g		
	Up to 5 kg (0.5 g resolution)	0.58 g		
Balances and Scales	Up to 30 kg (1 g resolution)	1.21 g	Class F Weights	NIST Handbook 44
	Up to 2 lb (0.0002 lb resolution)	0.0004 lb		
	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			
Mass	Up to 50 lb	0.001 lb	Standard Weights	NIST Handbook 105-1



### III. Electromagnetic DC/Low Frequency

PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage - Source	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1 020) V	60 $\mu$ V/V + 3 $\mu$ V 50 $\mu$ V/V + 5 $\mu$ V 50 $\mu$ V/V + 50 $\mu$ V 55 $\mu$ V/V + 500 $\mu$ V 55 $\mu$ V/V + 1.5 mV	Fluke 5500A	OEM & GIDEP Sourced Procedures
DC Current - Source	(0 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 $\mu$ A/A + 50 nA 100 $\mu$ A/A + 250 nA 100 $\mu$ A/A + 3.3 $\mu$ A 300 $\mu$ A/A + 44 $\mu$ A 600 $\mu$ A/A + 330 $\mu$ A		
Resistance - Source	Up to 11 $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ (110 to 330) $\Omega$ 330 $\Omega$ to 1.1 k $\Omega$ (1.1 to 3.3) k $\Omega$ (3.3 to 11) k $\Omega$ (11 to 33) k $\Omega$ (33 to 110) k $\Omega$ (110 to 330) k $\Omega$ 330 k $\Omega$ to 1.1 M $\Omega$ (1.1 to 3.3) M $\Omega$ (3.3 to 11) M $\Omega$ (11 to 33) M $\Omega$ (33 to 110) M $\Omega$ (110 to 330) M $\Omega$	120 $\mu\Omega/\Omega$ + 8 m $\Omega$ 120 $\mu\Omega/\Omega$ + 15 m $\Omega$ 90 $\mu\Omega/\Omega$ + 15 m $\Omega$ 90 $\mu\Omega/\Omega$ + 15 m $\Omega$ 90 $\mu\Omega/\Omega$ + 60 m $\Omega$ 90 $\mu\Omega/\Omega$ + 60 m $\Omega$ 90 $\mu\Omega/\Omega$ + 600 m $\Omega$ 90 $\mu\Omega/\Omega$ + 600 m $\Omega$ 110 $\mu\Omega/\Omega$ + 6 $\Omega$ 120 $\Omega/\Omega$ + 6 $\Omega$ 150 $\Omega/\Omega$ + 55 $\Omega$ 150 $\Omega/\Omega$ + 55 $\Omega$ 600 $\mu\Omega/\Omega$ + 550 $\Omega$ 1 m $\Omega/\Omega$ + 550 $\Omega$ 5 m $\Omega/\Omega$ + 5.5 k $\Omega$ 5 m $\Omega/\Omega$ + 16.5 k $\Omega$		
Capacitance - Source	(330 to 500) pF 500 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF 330 nF to 1.1 $\mu$ F (1.1 to 3.3) $\mu$ F (3.3 to 11) $\mu$ F (11 to 33) $\mu$ F (33 to 110) $\mu$ F (110 to 330) $\mu$ F 330 $\mu$ F to 1.1 mF	5 mF/F + 10 pF 5 mF/F + 10 pF 5 mF/F + 10 pF 5 mF/F + 10 pF 2.5 mF/F + 100 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	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source	<b>(1 to 33) mV</b> (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 <b>(33 to 330) mV</b> (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 <b>330 mV to 3.3 V</b> (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 <b>(3.3 to 33) V</b> (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz <b>(33 to 330) V</b> 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz <b>(330 to 1 020) V</b> 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	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  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  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  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  500 μV/V + 6.6 mV 800 μV/V + 15 mV 900 μV/V + 33 mV  500 μV/V + 80 mV 2 mV/V + 100 mV 2 mV/V + 500 mV	Fluke 5500A Calibrator	OEM & GIDEP Sourced Procedures

PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Current -- Source	<b>(30 to 330) µA</b> (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz <b>330 µA to 3.3 mA</b> (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz <b>(3.3 to 33) mA</b> (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz <b>(33 to 330) mA</b> (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz <b>330 mA to 2.2 A</b> (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz <b>(2.2 to 11) A</b> (45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	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  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  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 1mA/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		



PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
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	Fluke 5500A	OEM & GIDEP Sourced Procedures
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		
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		
Electrical Simulation of Thermocouples – Source	<b>Type E</b> -100 °C 0 °C 500 °C 1 000 °C <b>Type J</b> -150 °C 0 °C 375 °C 750 °C <b>Type K</b> -180 °C 0 °C 800 °C 1 300 °C <b>Type T</b> -100 °C 0 °C 200 °C 400 °C	0.08 °C 0.02 °C 0.02 °C 0.03 °C 0.04 °C 0.01 °C 0.02 °C 0.03 °C 0.04 °C 0.13 °C 0.14 °C 0.17 °C 0.12 °C 0.04 °C 0.01 °C 0.02 °C	Fluke 744	

PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Electrical Simulation of Thermocouples – Measure	<b>Type E</b> -100 °C 0 °C 500 °C 1 000 °C <b>Type J</b> -150 °C 0 °C 375 °C 750 °C <b>Type K</b> -180 °C 0 °C 800 °C 1 300 °C <b>Type T</b> -100 °C 0 °C 200 °C 400 °C	0.13 °C 0.02 °C 0.02 °C 0.03 °C 0.19 °C 0.02 °C 0.02 °C 0.03 °C 0.07 °C 0.02 °C 0.05 °C 0.1 °C 0.12 °C 0.04 °C 0.02 °C 0.01 °C	Fluke 744	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	

### V. Thermodynamic

Temperature Measurement	(0 to 260) °C	0.26 °C	Hart Microbath 9131	OEM & GIDEP Sourced Procedures
Temperature Measurement	(-5 to 140) °C	0.14 °C	Hart Scientific 9105 Drywell	

*Notes:*

1. *Best Measurement Uncertainties (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of k=2.*
2. *This laboratory's capabilities include commercial and field (on-site) calibration services. 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. *This scope is part of and must be included with the Certificate of Accreditation No. AC - 1255*

*Karl Greenway*

Vice President