

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

JOHNSON GAGE AND INSPECTION
 5920 W. 21st Street North
 Wichita, KS 67205
 Scott Porter Phone: 316-943-7532

CALIBRATION

Valid To: March 31, 2011

Certificate Number: 2820.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Bore Gages ³ –			
3 point	Up to 4 in	(90 + 3D) μin	Ring gages
2 point	Up to 12 in	(80 + 4D) μin	Gage blocks
CMM–			
Repeatability	---	32 μin	Sphere per ASME B89.4.1 Sec. 5.3.3
Linear Displacement Accuracy	Up to 160 in	(50 + 0.7L) μin	Laser per ASME B89.4.1 Sec. 5.4.3
Volumetric Performance	Up to 200 Cu. Ft.	260 μin	Ball bar per ASME B89.4.1 Sec. 5.5.2
Bi-Directional Length Measurement	Up to 4"	70 μin	Gage block per ASME B89.4.1 Sec. 5.6

Parameter/Equipment	Range	CMC ^{2,5} (\pm)	Comments
Gage Blocks	Up to 0.1 in (0.1 to 4) in (4 to 20) in	3.8 μ in (2.6 + 1.7L) μ in (3 + 1.6L) μ in	Master gage blocks & Brown & Sharpe amplifier
Micrometers ³	Up to 16 in	(80 + 5L) μ in	Gage Blocks
Micrometer Standards	(1 to 13) in (13 to 32) in	(8 + 4L) μ in (4.2L) μ in	Gage blocks, P&W Supermic
Calipers ³ – Digital Dial and Vernier	Up to 40 in Up to 40 in	(390 + 13L) μ in (650 + 8L) μ in	Gage blocks and caliper checker
Indicators, Dial and Digital ³ (For Dial, Res. = 0.2 least Grad.)	Up to 4 in	(10 + 0.6R) μ in	Gage blocks
Height Gages ³	Up to 40 in	(90 + 8L) μ in	Gage blocks
Plug/Pin Gages	Up to 10 in	(9 + 1.4D) μ in	P&W Supermic, gage blocks
Plain Rings	(0.1218 to 9) in	(8 + 2D) μ in	Internal Supermic, master gage blocks
Straight Threaded Plug Gages – Pitch Diameter Major Diameter	Up to 6 in Up to 5 in	(55 + 8D) μ in (9 + 1.4D) μ in	3 wire method P&W Supermic, gage blocks
Tapered Threaded Plug Gages – Pitch Diameter Major Diameter	Up to 4 in Up to 4.5 in	150 μ in 50 μ in	3-wire method, tapered sine block P&W Supermic, gage blocks

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Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Adjustable Threaded Ring Gages	(0.05 to 2) in diameter	(250 + 13D) μin	Setting plugs
Steel Rules ³ – Length Graduations	Up to 72 in ----	(800 + 25L) μin 0.006 in	Gage blocks Glass scale
Optical Comparators ³ – Linearity Angle	11.5 in travel Up to 360 ⁰	160 μin 1.8 min	Glass scale, plain plug gages
Surface Plates ³ – Flatness Repeat Reading	Up to 107 in diagonal ----	(10 + 1L) μin 16 μin	LDDM Repeat reading gage
Measuring Tapes – Length Graduations	Up to 180 ft ----	(0.005 + .000016L)in 0.006 in	Test frame Glass scale

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Measure ³	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V (800 to 1000) V	11 μV/V + 0.9 μV 9 μV/V + 1 μV 9.3 μV/V + 1.8 μV 12 μV/V + 35 μV 15 μV/V + 100 μV 19 μV/V + 1.2 mV 24 μV/V + 1.2 mV	HP 3458A, HP 34420A

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Measure ^{3, 4}	Up to 20 mV (20 to 200) mV 200 mV to 2 V (2 to 20) V	3.5 μV 36 μV 320 μV 4.2 mV	Eurotherm MC2000
DC Voltage – Generate ³	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V (800 to 1000) V	13 μV/V + 1.4 μV 8.4 μV/V + 2.3 μV 9.5 μV/V + 3 μV 12 μV/V + 47 μV 15 μV/V + 200 μV 20 μV/V + 500 μV 25 μV/V + 250 μV	HP 3458A, HP 34420A, with Fluke 5100B
DC Voltage – Generate ^{3, 4}	Up to 20 mV (20 to 200) mV 200 mV to 2 V (2 to 20) V	4 μV 0.37 mV 0.037 % rdg 4.8 mV	Eurotherm MC2000
DC Current – Measure ³	Up to 1 μA (1 to 10) μA (10 to 100) μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 20) A	12 μA/A + 0.093 nA 22 μA/A + 0.14 nA 25 μA/A + 1 nA 22 μA/A + 7 nA 23 μA/A + 64 nA 40 μA/A + 0.61 μA 96 μA/A + 28 μA 0.012 % rdg	HP 3458A with current shunt
DC Current – Generate ³	Up to 1 μA 1 μA to 10 μA 10 μA to 100 μA 0.1 mA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 20 A 20 A to 32 A 32 A to 105 A 105 A to 200 A 20 A to 160 A 160 A to 525 A 525 A to 1000 A	11 μA/A + 0.11 nA 21 μA/A + 0.15 nA 21 μA/A + 1.3 nA 21 μA/A + 8.8 nA 22 μA/A + 72 nA 40 μA/A + 0.61 μA 96 μA/A + 28 μA 0.012 % rdg 0.23% rdg + 7 mA 0.24% rdg + 7 mA 0.24% rdg + 21 mA 0.24% rdg + 7 mA 0.24% rdg + 19 mA 0.24% rdg + 95 mA	HP3458A with HP3245A and amplifier with current shunt Wavetek 9100 with Option 200, 10 turn coil Wavetek 9100 with Option 200, 50 turn coil

Parameter/Equipment	Range	CMC ² (±)	Comments
Resistance – Generate and Measure ³	(0 to 1) Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	0.012 % rdg + 3 μΩ 50 μΩ/Ω + 40 μΩ 14 μΩ/Ω + 0.7 mΩ 10 μΩ/Ω + 6 mΩ 10 μΩ/Ω + 55 mΩ 8 μΩ/Ω + 0.9 Ω 80 μΩ/Ω + 5 Ω 57 μΩ/Ω + 120 Ω 58 μΩ/Ω + 1 kΩ 0.58 % rdg	HP34420A, HP3458A
Capacitance – Measuring Equipment (Stim repetition rate: ≤350Hz) (Stim repetition rate: 350Hz to 1.5kHz)	(0.5 to 4.0) nF (4.0 to 40.0) nF (40.0 to 400.0) nF (0.4 to 4.0) μF (4.0 to 40.0) μF (40.0 to 400.0) μF (0.4 to 4.0) mF (4.0 to 40.0) mF (0.5 to 4.0) nF (4.0 to 40.0) nF (40.0 to 400.0) nF (0.4 to 4.0) μF (4.0 to 40.0) μF (40.0 to 400.0) μF (0.4 to 4.0) mF (4.0 to 40.0) mF	0.35 % rdg + 18 pF 0.35 % rdg + 36 pF 0.35 % rdg + 200 pF 0.46 % rdg + 2 nF 0.58 % rdg + 21 nF 0.57 % rdg + 230 nF 0.57 % rdg + 2.4 μF 1.2 % rdg + 72 μF 0.7 % rdg + 35 pF 0.7 % rdg + 70 pF 0.7 % rdg + 380 pF 0.9 % rdg + 5 nF 1.2 % rdg + 40 nF 1.2 % rdg + 400 nF 1.2 % rdg + 4 μF 2.3 % rdg + 150 μF	Wavetek 9100
Electrical Calibration of Thermocouple Indicators & Indicating Systems ³ – Type B Type E Type J Type K	1100 °F to 1500 °F 1500 °F to 2800 °F 2800 °F to 3300 °F -454 °F to -150 °F -150 °F to 1832 °F -340 °F to -150 °F -150 °F to 2192 °F -440 °F to -150 °F -150 °F to 2500 °F	0.64 °F 0.45 °F 0.36 °F 1.2 °F 0.22 °F 0.28 °F 0.22 °F 0.3 °F 0.22 °F	HP 3458A, HP 34420A, Fluke 8842A, with HP 3245A

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Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators & Indicating Systems ³ (cont) –			
Type N	-150 °F to 250 °F 250 °F to 2372° F	0.25 °F 0.22 °F	HP 3458A, HP 34420A, Fluke 8842A, with HP 3245A
Type R	32 °F to 500 °F 500 °F to 750 °F 750 °F to 3214 °F	0.74 °F 0.45 °F 0.4 F	
Type S	32 °F to 200 °F 200 °F to 500 °F 500 °F to 1850 °F 1850 °F to 3214 °F	0.74 °F 0.54 °F 0.45 °F 0.37 °F	
Type T	-400 °F to -250 °F -250 °F to 752 F	0.45 °F 0.25° F	
Electrical Calibration of Thermocouple Indicators & Indicating Systems ^{3, 4} –			
Type B	1100 °F to 1500 °F 1500 °F to 3200 °F	0.73 °F 0.53 °F	Eurotherm MC2000
Type E	-150 °F to 50 °F 50 °F to 1832 °F	0.42 °F 0.36 °F	
Type J	-200 °F to 1500 °F	0.36 °F	
Type K	-200 °F to 0 °F 0 °F to 2400 °F	0.64 °F 0.51 °F	
Type N	32 °F to 250 °F 250 °F to 770 °F 770 °F to 2100 °F	0.62 °F 0.55 °F 0.48 °F	
Type R	32 °F to 200 °F 200 °F to 500 °F 500 °F to 1850 °F 1850 °F to 3214 °F	2.9 °F 2.2 °F 1.7 °F 1.3 °F	
Type S	32 °F to 200 °F 200 °F to 500 °F 500 °F to 1850 °F 1850 °F to 3214 °F	2.9 °F 2.2 °F 1.7 °F 1.5 °F	

Peter Mlynar

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators & Indicating Systems (cont) ^{3, 4} – Type T	-328 °F to -250 °F -250 °F to 32 °F 32 °F to 250 °F 250 °F to 752 °F	1.1 °F 0.74 °F 0.46 °F 0.4 °F	Eurotherm MC2000

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure ³ (1 to 10 mV) (10 to 100) mV 100 mV to 1 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 (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 (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	7 μV 4 μV 4 μV 0.11 % rdg + 2 μV 0.57 % rdg + 2.5 μV 4.6 % rdg + 4 μV 90 μV/V + 4.6 μV 80 μV/V + 2.6 μV 0.017 % rdg + 2.3 μV 0.035 % rdg + 2.5 μV 0.093 % rdg + 2.5 μV 0.35 % rdg + 12 μV 1.2 % rdg + 12 μV 1.8 % rdg + 11 μV 80 μV/V + 48 μV 80 μV/V + 25 μV 0.016 % rdg + 25 μV 0.035 % rdg + 23 μV 0.093 % rdg + 23 μV 0.35 % rdg + 120 μV 1.2 % rdg + 120 μV 1.8 % rdg + 110 μV	HP 3458A

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure ³ (cont.)			
(1 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 + 0.47 mV 80 μV/V + 0.25 mV 0.016 % rdg + 0.25 mV 0.035 % rdg + 0.23 mV 0.093 % rdg + 0.25 mV 0.35 % rdg + 1.2 mV 1.2 % rdg + 1.1 mV 1.8 % rdg + 1.1 mV	HP 3458A
(10 to 100) 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	0.023 % rdg + 4.7 mV 0.023 % rdg + 2.4 mV 0.023 % rdg + 2.4 mV 0.04 % rdg + 3 mV 0.14 % rdg + 3 mV 0.46 % rdg + 14 mV 1.8 % rdg + 15 mV	
(100 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.046 % rdg + 48 mV 0.046 % rdg + 25 mV 0.07 % rdg + 23 mV 0.14 % rdg + 22 mV 0.35 % rdg + 20 mV	
AC Voltage – Generate			
(1 to 10) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	8.5 μV 6 μV 5 μV 0.1 % rdg + 3 μV 0.56 % rdg + 3.5 μV	HP3458A with HP3245A and Wavetek 9100

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate (cont)			
(10 to 100) 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 300 kHz to 1 MHz	90 μV/V + 5.3 μV 80 μV/V + 2.8 μV 0.017 % rdg + 2.5 μV 0.035 % rdg + 3 μV 0.093 % rdg + 3 μV 0.35 % rdg + 12 μV 1.2 % rdg + 13 μV	HP3458A with HP3245A and Wavetek 9100
100 mV to 1 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	80 μV/V + 48 μV 80 μV/V + 25 μV 0.016 % rdg + 25 μV 0.035 % rdg + 24 μV 0.093 % rdg + 24 μV 0.35 % rdg + 120 μV 1.2 % rdg + 120 μV	
(1 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	80 μV/V + 0.48 mV 80 μV/V + 0.25 mV 0.016 % rdg + 0.25 mV 0.035 % rdg + 0.23 mV 0.093 % rdg + 0.3 mV 0.35 % rdg + 1.2 mV 1.2 % rdg + 1.2 mV	
(10 to 50) 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	0.023 % rdg + 4.7 mV 0.023 % rdg + 2.4 mV 0.023 % rdg + 2.4 mV 0.04 % rdg + 2.5 mV 0.14 % rdg + 2.2 mV 0.47 % rdg + 11 mV	
(50 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.023 % rdg + 4.7 mV 0.023 % rdg + 2.6 mV 0.023 % rdg + 2.6 mV 0.041 % rdg + 2 mV 0.14 % rdg + 5 mV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate (cont)			
(100 to 350) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.047 % rdg + 23 mV 0.07 % rdg + 23 mV 0.14 % rdg + 22 mV	HP3458A with HP3245A and Wavetek 9100
(350 to 700) V	40 Hz to 1 kHz (1 to 15) kHz	0.047 % rdg + 21 mV 0.07 % rdg + 21 mV	
(700 to 1000) V	40 Hz to 1 kHz (1 to 3) kHz (3 to 10) kHz	0.059 % rdg + 140 mV 0.094 % rdg + 140 mV 0.094 % rdg + 240 mV	Wavetek 9100 only
AC Current – Measure ³			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	0.46 % rdg + 0.035 µA 0.17 % rdg + 0.035 µA 0.07 % rdg + 0.035 µA	HP3458A
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % rdg + 0.23 µA 0.17 % rdg + 0.23 µA 0.07 % rdg + 0.23 µA 0.035 % rdg + 0.23 µA 0.07 % rdg + 0.23 µA 0.46 % rdg + 0.46 µA 0.63 % rdg + 1.8 µA	
(1 to 10) mA	(10 Hz to 20) Hz (20 Hz to 45) Hz (45 Hz to 100) Hz 100 Hz to 5 kHz (5 kHz to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % rdg + 2.3 µA 0.17 % rdg + 2.3 µA 0.07 % rdg + 2.3 µA 0.035 % rdg + 2.3 µA 0.07 % rdg + 2.3 µA 0.46 % rdg + 4.6 µA 0.63 % rdg + 17.3 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % rdg + 23 µA 0.17 % rdg + 23 µA 0.07 % rdg + 23 µA 0.035 % rdg + 23 µA 0.07 % rdg + 23 µA 0.46 % rdg + 46 µA 0.63 % rdg + 0.17 mA	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Measure ³ (cont)			
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.46 % rdg + 0.24 mA 0.18 % rdg + 0.24 mA 0.09 % rdg + 0.23 mA 0.12 % rdg + 0.23 mA 0.35 % rdg + 0.23 mA 1.2 % rdg + 0.46 mA	HP3458A
(1 to 10) A	(1 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	75 µA/A + 0.56 mA 80 µA/A + 0.23 mA 0.014 % rdg + 0.59 mA	HP3458A with current shunt
(10 to 20) A	(1 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	90 µA/A + 5.4 mA 90 µA/A + 3.2 mA 0.017 % rdg + 4 mA	
AC Current – Generate ³			
Up to 100µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	0.47 % rdg + 0.035 µA 0.20 % rdg + 0.034 µA 0.09 % rdg + 0.033 µA	HP3458A with HP3245A
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 100) Hz (100 to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % rdg + 0.24 µA 0.17 % rdg + 0.24 µA 0.07 % rdg + 0.24 µA 0.034 % rdg + 0.24 µA 0.069 % rdg + 0.24 µA 0.46 % rdg + 0.47 µA 0.64 % rdg + 1.8 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % rdg + 2.4 µA 0.17 % rdg + 2.4 µA 0.07 % rdg + 2.4 µA 0.034 % rdg + 2.4 µA 0.069 % rdg + 2.4 µA 0.46 % rdg + 4.7 µA 0.64 % rdg + 18 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % rdg + 24 µA 0.17 % rdg + 24 µA 0.07 % rdg + 24 µA 0.034 % rdg + 24 µA 0.069 % rdg + 24 µA 0.46 % rdg + 47 µA 0.64 % rdg + 0.17 mA	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Generate ³			
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 30) kHz	0.46 % rdg + 0.24 mA 0.18 % rdg + 0.24 mA 0.09 % rdg + 0.24 mA 0.12 % rdg + 0.24 mA 0.35 % rdg + 0.23 mA 1.2 % rdg + 0.47 mA	HP3458A with HP3245A and Wavetek 9100
(1 to 10) A	(10 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	71 µA/A + 0.86 mA 94 µA/A + 0.28 mA 0.011% rdg + 1.2 mA	HP3458A with Wavetek 9100 and current shunt
(10 to 20) A	(10 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	97 µA/A + 4.6 mA 98 µA/A + 2.7 mA 0.016% rdg + 3.2 mA	HP3458A with Fluke 5100B, Fluke 5220A and current shunt
AC Current - Generate			
(0.32 to 3.2) mA	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.08 % rdg + 0.37 µA 0.12 % rdg + 0.7 µA 0.23 % rdg + 2.4 µA 0.29 % rdg + 3.5 µA	Wavetek 9100
(3.2 to 32) mA	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.081 % rdg + 3.7 µA 0.12 % rdg + 7.6 µA 0.23 % rdg + 16 µA 0.29 % rdg + 26 µA	
(32 to 320) mA	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.093 % rdg + 37 µA 0.12 % rdg + 57 µA 0.23 % rdg + 77 µA 0.29 % rdg + 120 µA	
320 mA to 3.2 A	10 Hz to 3 kHz (3 to 10) kHz	0.12 % rdg + 0.57 mA 0.29 % rdg + 3.0 mA	
(3.2 A to 10.5) A	10 Hz to 3 kHz (3 to 10) kHz	0.23 % rdg + 3.7 mA 0.58 % rdg + 12 mA	
(10.5 to 20) A	10 Hz to 3 kHz (3 to 10) kHz	0.23 % rdg + 8.3 mA 0.58 % rdg + 27 mA	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Generate (cont)			
(3.2 to 32) A	(10 to 100) Hz (100 to 440) Hz	0.32% rdg + 8.4 mA 0.93% rdg + 32 mA	Wavetek 9100 with Option 200, 10 turn coil
(32 to 200) A	(10 to 100) Hz (100 to 440) Hz	0.33% rdg + 91 mA 0.81% rdg + 290 mA	
(16 to 160) A	(10 to 100) Hz	0.33% rdg + 27 mA	Wavetek 9100 with Option 200, 50 turn coil
(160 to 1000) A	(10 to 65) Hz	0.33% rdg + 460 mA	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Torque Wrenches	(0.5 to 21) in·oz (1.375 to 5) in·lb (5 to 1000) in·lb (25 to 250) ft·lb	(0.006 + 0.6 % setting) in·oz 0.038 in·lb 0.33 % setting (0.04 + 0.33 % setting) ft·lb	Torque arm and deadweights CDI torque calibrator
Scales and Balances ³	(0 to 200) g (0 to 200) g (200 to 1000) g (1 to 7) kg (0.1 to 150) lbs, ((0.044 to 68) kg)	(0.11 + 0.00015W) mg (0.9 + 0.01W) mg (8 + 0.011W) mg (17 + 0.011W) mg (90 + 0.02W) mg	Ultra Class Weights Class "F" and "6" weights

Parameter/Equipment	Range	CMC ² (±)	Comments
Indirect Verification of Rockwell hardness Testers ³	HRA		Indirect verification per ASTM E 18
	Low	0.7 HRA	
	Middle	0.62 HRA	
	High	0.36 HRA	
	HRBW		
	Low	1 HRBW	
	Middle	0.72 HRBW	
	High	0.68 HRBW	
	HRC		
	Low	0.84 HRC	
	Middle	0.74 HRC	
	High	0.51 HRC	
	HREW		
	Low	0.79 HREW	
	Middle	0.76 HREW	
	High	0.72 HREW	
	HRFW		
	Low	0.84 HRFW	
	Middle	0.76 HRFW	
	High	0.71 HRFW	
	HR15N		
Low	0.87 HR15N		
Middle	0.67 HR15N		
High	0.48 HR15N		
HR30N			
Low	0.78 HR30N		
Middle	0.67 HR30N		
High	0.55 HR30N		
HR15TW			
Low	0.93 HR15TW		
Middle	0.83 HR15TW		
High	0.66 HR15TW		
HR30TW			
Low	0.8 HR30TW		
Middle	0.8 HR30TW		
High	0.75 HR30TW		
HR45TW			
Low	0.8 HR45TW		
Middle	0.77 HR45TW		
High	0.62 HR45TW		

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Parameter/Equipment	Range	CMC ² (±)	Comments
Pressure ³ – Inches H ₂ O Absolute Pressure Pressure, psi Pressure, psi	(Up to 20) in·H ₂ O (0 to 900) mm·Hg (0 to 30) psi (30 to 300) psi	0.06 in·H ₂ O + 0.3 % rdg 0.3 mm·Hg 0.06 psi + 0.2 % rdg 0.07 psi + 0.12 % rdg	Meriam D0020IW Meriam 355-AI0900 30PSIXP21 300PSIXP21
Vacuum ³ – Inches Hg	(0 to 30) in·Hg	0.12 in Hg + 0.07% rdg	Grade 3A Gages

IV. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency –Measure	1 Hz to 40 Hz 40 Hz to 1 MHz	0.1 mHz + 0.06% rdg 0.012% rdg	HP3458A, HP 3425A
Frequency – Measuring Equipment	0.5 Hz to 10 MHz	0.8 μHz/Hz	Wavetek 9100 w/Opt 100

V. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Liquid in Glass and Bi-Metal Thermometers	-50 °F to 32 °F 32 °F to 212 °F 212 °F to 392 °F	0.11 °F 0.12 °F 0.13 °F	PRT with HP 34420A and fluid bath or dry well
RTD and Thermistor Thermometers	-50 °F to 32 °F 32 °F to 212 °F 212 °F to 392 °F 392 °F to 752 °F	0.09 °F 0.12 °F 0.13 °F 0.15 °F	PRT with HP 34420A and fluid bath or dry well

Parameter/Equipment	Range	CMC ² (±)	Comments
Thermocouples –			
Type B	1100 °F to 2000 °F 2000 °F to 2200 °F	0.97 °F 1.5 °F	Type "S" platinum standard T/C, PRT, HP 3458A, HP 34420A
Type E	-50 °F to 752 °F 752 °F to 1832 °F	0.26 °F 0.91 °F	
Type J	-50 °F to 752 °F 752 °F to 2000 °F 2000 °F to 2192 °F	0.27 °F 0.93 °F 1.5 °F	
Type K	-50 °F to 752 °F 752 °F to 2000 °F 2000 °F to 2200 °F	0.3 °F 0.93 °F 1.5 °F	
Type N	-50 °F to 752 °F 752 °F to 2000 °F 2000 °F to 2200 °F	0.3 °F 0.96 °F 1.6 °F	
Type R	32 °F to 752 °F 752 °F to 2000 °F 2000 °F to 2200 °F	0.49 °F 1.1 °F 1.6 °F	
Type S	32 °F to 752 °F 752 °F to 2000 °F 2000 °F to 2200 °F	0.54 °F 1.2 °F 1.7 °F	
Type T	-50 °F to 752 °F	0.27 °F	
Temperature Uniformity Survey ^{3, 4} (per AMS 2750D)	-50 °F to 752 °F 752 °F to 2000 °F	2.2 °F 2.5 °F	IoTech DaqBook, DaqLog, with expendable and non-expendable thermocouples

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature Probe ^{3, 4} ("SAT" per AMS 2750D) –			
In liquid	(-50 to 752) °F (752 to 1060) °F	0.48 °F 1 °F	Eurotherm MC2000, expendable and non-expendable thermocouples
In atmosphere and vacuum	(-50 to 752) °F (752 to 2000) °F	0.58 °F 1.2 °F	In atmosphere and vacuum
Relative Humidity – Measuring Equipment	(10 to 95) % RH	1.0 % RH	EdgeTech Chilled Mirror Hygrometer
Relative Humidity – Measuring Equipment	(10 to 95) % RH	1.5 % RH	Vaisala HMI41

¹ This laboratory offers commercial calibration 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. Calibration and Measurement Capabilities 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 CMC is stated for calibrations performed in the field only.

⁵ In the statement of the CMC, L is the numerical value of the nominal length of the device measured in inches. In the statement of best uncertainty, D is the numerical value of the nominal diameter of the device measured in inches. W is numerical value of the nominal applied mass in grams.



THE AMERICAN ASSOCIATION FOR
LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

JOHNSON GAGE AND INSPECTION

Wichita, KS

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 January 2009*).

Presented this 3rd day of March 2009.

A handwritten signature in cursive script, reading "Peter Abney", positioned above a horizontal line.

President
For the Accreditation Council
Certificate Number 2820.01
Valid to March 31, 2011



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