



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Technical Maintenance, Inc.

3248 Forest View Road

Rockford, IL 61109

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2005

and national standards

ANSI/NCSL Z540-1-1994 (R2002) AND

ANSI/NCSL Z540.3-2006 (R2013)

while demonstrating technical competence in the field of

CALIBRATION

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations to which this accreditation applies.

AC-2080.03

Certificate Number


ANAB Approval

Certificate Valid: 03/14/2018-09/20/2019

Version No. 003 Issued: 03/14/2018



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. 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 April 2017).



**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005,
ANSI/NCSL Z540-1-1994 (R2002) AND ANSI/NCSL Z540.3-2006 (R2013)**

Technical Maintenance, Inc.
3248 Forest View Road
Rockford, IL 61109
Scott Chamberlain 779-774-3877

CALIBRATION

Valid to: **September 20, 2019**

Certificate Number: **AC-2080.03**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration (7 to 200) Hz (100 to 2 500) Hz (2.5 to 10) kHz	(0.01 to 10) g	1.5 % of reading 1.2 % of reading 2.5 % of reading	Accelerometer Calibrator

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH ³	(4, 7, 10) pH	0.019 pH	Buffer Solutions
Conductivity ³	99.8 µS 998 µS 10 007 µS	0.38 µS 4.1 µS 37 µS	Conductivity Solutions



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ³	Up to 220 μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	55 μ A/A + 6 nA 50 μ A/A + 7 nA 50 μ A/A + 40 nA 60 μ A/A + 0.7 μ A 98 μ A/A + 12 μ A	Fluke 5522A
	(2.2 to 11) A	0.037% of reading + 480 μ A	Fluke 5720A/5725A
	(11 to 20.5) A	0.11 % of reading + 750 μ A	Fluke 5522A
DC Current – Generate ³ Clamp Only	(20.5 to 1000) A	0.9 % of reading	Fluke 5522A/Coil5500A
DC Current – Measure ³	Up to 100 nA 100 nA to 1 μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 10 mA (10 to 100) mA 100 mA to 1 A	36 μ A/A + 0.04 nA 24 μ A/A + 0.04 nA 24 μ A/A + 0.1 nA 24 μ A/A + 0.8 nA 25 μ A/A + 0.05 μ A 43 μ A/A + 0.5 μ A 0.14 mA/A + 10 μ A	Agilent 3458A
	(1 to 500) A	0.32 % of reading	Current Shunt
DC Voltage ³ – Generate	Up to 220 mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	11 μ V/V + 0.4 μ V 8.2 μ V/V + 0.7 μ V 7.1 μ V/V + 2.5 μ V 7.1 μ V/V + 4 μ V 8.2 μ V/V + 40 μ V 10 μ V/V + 0.4 mV	Fluke 5720A
DC Voltage ³ – Measure	Up to 100 mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1 000) V	18 μ V/V + 0.3 μ V 11 μ V/V + 0.3 μ V 11 μ V/V + 0.5 μ V 13 μ V/V + 30 μ V 13 μ V/V + 0.1 mV	Agilent 3458A
	(1 to 120) kV	0.37 % of reading	Ross VD120



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ³	Up to 22 mV		Fluke 5720A
	(10 to 20) Hz	0.36 mV/V + 5 μV	
	(20 to 40) Hz	0.15 mV/V + 5 μV	
	40 Hz to 20 kHz	0.13 mV/V + 5 μV	
	(20 to 50) kHz	0.3 mV/V + 5 μV	
	(50 to 100) kHz	0.71 mV/V + 6 μV	
	(100 to 300) kHz	1.6 mV/V + 12 μV	
	(300 to 500) kHz	2 mV/V + 25 μV	
	500 kHz to 1 MHz	4 mV/V + 25 μV	
	(22 to 220) mV		
	(10 to 20) Hz	0.35 mV/V + 15 μV	
	(20 to 40) Hz	0.14 mV/V + 8 μV	
	40 Hz to 20 kHz	0.12 mV/V + 8 μV	
	(20 to 50) kHz	0.29 mV/V + 8 μV	
	(50 to 100) kHz	0.7 mV/V + 20 μV	
	(100 to 300) kHz	1.3 mV/V + 25 μV	
	(300 to 500) kHz	2 mV/V + 30 μV	
	500 kHz to 1 MHz	3.9 mV/V + 60 μV	
	220 mV to 2.2 V		
	(10 to 20) Hz	0.51 mV/V + 50 μV	
	(20 to 40) Hz	0.4 mV/V + 20 μV	
	40 Hz to 20 kHz	0.38 mV/V + 10 μV	
	(20 to 50) kHz	1.4 mV/V + 12 μV	
	(50 to 100) kHz	0.41 mV/V + 40 μV	
(100 to 300) kHz	0.69 mV/V + 0.1 mV		
(300 to 500) kHz	1.5 mV/V + 0.25 mV		
500 kHz to 1 MHz	2.4 mV/V + 0.4 mV		
(2.2 to 22) V			
(10 to 20) Hz	0.48 mV/V + 0.5 mV		
(20 to 40) Hz	0.39 mV/V + 0.2 mV		
40 Hz to 20 kHz	0.38 mV/V + 70 μV		
(20 to 50) kHz	0.39 mV/V + 0.12 mV		
(50 to 100) kHz	0.4 mV/V + 0.25 mV		
(100 to 300) kHz	0.5 mV/V + 0.8 mV		
(300 to 500) kHz	1.3 mV/V + 2.5 mV		
500 kHz to 1 MHz	1.9 mV/V + 4 mV		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ³	(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 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.51 mV/V + 5 mV 0.4 mV/V + 2 mV 0.38 mV/V + 0.7 mV 0.39 mV/V + 1.2 mV 0.43 mV/V + 3 mV 1.4 mV/V + 20 mV 6.3 mV/V + 50 mV 12 mV/V + 0.1 V	Fluke 5720A
	(220 to 1 100) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz (220 to 750) V (30 to 50) kHz (50 to 100) kHz	0.38 mV/V + 0.7 mV 0.39 mV/V + 1.2 mV 0.43 mV/V + 3 mV 0.39 mV/V + 1.2 mV 0.43 mV/V + 3 mV	Fluke 5720A/5725A
AC Voltage – Measure ³	Up to 10 mV (1 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz 10 mV 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 (1 to 2) MHz	0.044 % of reading + 0.003 mV 0.026 % of reading + 0.0011 mV 0.044 % of reading + 0.0011 mV 0.11 % of reading + 0.0011 mV 0.5 % of reading + 0.0011 mV 4 % of reading + 0.002 mV 0.019 % of reading + 0.004 mV 0.019 % of reading + 0.002 mV 0.027 % of reading + 0.002 mV 0.045 % of reading + 0.002 mV 0.09 % of reading + 0.002 mV 0.31 % of reading + 0.01 mV 1 % of reading + 0.01 mV 1.5 % of reading + 0.01 mV	Agilent 3458A



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ³	100 mV to 1 V		Agilent 3458A
	(1 to 40) Hz	0.019 % of reading + 0.04 mV	
	40 Hz to 1 kHz	0.019 % of reading + 0.02 mV	
	(1 to 20) kHz	0.027 % of reading + 0.02 mV	
	(20 to 50) kHz	0.045 % of reading + 0.02 mV	
	(50 to 100) kHz	0.09 % of reading + 0.02 mV	
	(100 to 300) kHz	0.31 % of reading + 0.1 mV	
	300 kHz to 1 MHz	1 % of reading + 0.1 mV	
	(1 to 2) MHz	1.5 % of reading + 0.1 mV	
	1 V to 10 V		
	(1 to 40) Hz	0.019 % of reading + 0.0004 V	
	40 Hz to 1 kHz	0.019 % of reading + 0.0002 V	
	(1 to 20) kHz	0.027 % of reading + 0.0002 V	
	(20 to 50) kHz	0.045 % of reading + 0.0002 V	
	(50 to 100) kHz	0.09 % of reading + 0.0002 V	
	(100 to 300) kHz	0.31 % of reading + 0.001 V	
	300 kHz to 1 MHz	1 % of reading + 0.001 V	
	(1 to 2) MHz	1.5 % of reading + 0.001 V	
	(10 to 100) V		
	(1 to 40) Hz	0.026 % of reading + 0.002 V	
40 Hz to 1 kHz	0.041 % of reading + 0.002 V		
(1 to 20) kHz	0.038 % of reading + 0.002 V		
(20 to 50) kHz	0.048 % of reading + 0.002 V		
(50 to 100) kHz	0.13 % of reading + 0.002 V		
(100 to 300) kHz	0.4 % of reading + 0.01 V		
300 kHz to 1 MHz	1.5 % of reading + 0.01 V		
(100 to 700) V			
(1 to 40) Hz	0.05 % of reading + 0.04 V		
40 Hz to 1 kHz	0.05 % of reading + 0.02 V		
(1 to 20) kHz	0.07 % of reading + 0.02 V		
(20 to 50) kHz	0.13 % of reading + 0.02 V		
(50 to 100) kHz	0.3 % of reading + 0.02 V		
(1 to 85) kV		0.62 % of reading	Ross VD120 w/34401A
(50, 60) Hz			



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Current – Generate ³	Up to 200 μ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.36 mA/A + 20 nA 0.25 mA/A + 12 nA 0.19 mA/A + 10 nA 0.42 mA/A + 15 nA 1.6 mA/A + 80 nA	Fluke 5720A		
	(0.2 to 2.2) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.36 mA/A + 50 nA 0.25 mA/A + 40 nA 0.18 mA/A + 40 nA 0.3 mA/A + 0.18 μ A 1.6 mA/A + 0.8 μ A			
	(2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.26 mA/A + 0.5 μ A 0.24 mA/A + 0.4 μ A 0.18 mA/A + 0.4 μ A 0.3 mA/A + 0.7 μ A 1.6 mA/A + 6 μ A			
	(22 to 200) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.36 mA/A + 5 μ A 0.24 mA/A + 4 μ A 0.18 mA/A + 3 μ A 0.3 mA/A + 4 μ A 1.6 mA/A + 12 μ A			
	(0.2 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz	0.28 mA/A + 40 μ A 0.6 mA/A + 0.1 mA			
	(5 to 10) kHz	9.3 mA/A + 0.2 mA			
	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz	0.81 mA/A + 0.17 mA 1.3 mA/A + 0.38 mA		Fluke 5720A/5725A	
	(5 to 10) kHz	4.3 mA/A + 0.75 mA			
	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 Hz to 5) kHz	0.1 % of reading + 2 mA 0.12 % of reading + 5 mA 2.28 % of reading + 5 mA		Fluke 5522A	
	AC Current – Generate ³ Clamp Only	(20.5 to 1 000) A (45 to 440) Hz		1.5 % of reading + 0.9 A	Fluke 5520A/coil



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ³	Up to 100 μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.41 % of reading + 0.03 pA 0.16 % of reading + 0.03 pA 0.07 % of reading + 0.03 pA	Agilent 3458A
	(1 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	0.41 % of reading + 20 μ A 0.16 % of reading + 20 μ A 0.069 % of reading + 20 μ A 0.038 % of reading + 20 μ A 0.069 % of reading + 20 μ A 0.41 % of reading + 40 μ A 0.56 % of reading + 0.15 mA	
	(0.1 to 1) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 Hz (5 to 20) kHz (20 to 50) kHz	0.41 % of reading + 0.2 mA 0.17 % of reading + 0.2 mA 0.087 % of reading + 0.2 mA 0.11 % of reading + 0.2 mA 0.31 % of reading + 0.2 mA 1 % of reading + 0.4 mA	
	(2 to 30) A Up to 1 kHz (1 to 5) kHz	0.36 % of reading 5.8 % of reading	Current Shunt
Resistance ³ – Fixed Points	1 Ω , 1.9 Ω 10 Ω , 19 Ω 100 Ω , 190 Ω 1 k Ω , 1.9 k Ω 10 k Ω , 19 k Ω 100 k Ω , 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	0.12 m Ω / Ω 31 $\mu\Omega$ / Ω 23 $\mu\Omega$ / Ω 12 $\mu\Omega$ / Ω 13 $\mu\Omega$ / Ω 14 $\mu\Omega$ / Ω 24 $\mu\Omega$ / Ω 26 $\mu\Omega$ / Ω 50 $\mu\Omega$ / Ω 59 $\mu\Omega$ / Ω 0.14 m Ω / Ω	Fluke 5720A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ³	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω 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 MΩ 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 330 MΩ to 1.1 GΩ	51 μΩ/Ω + 0.01 Ω 42μΩ/Ω + 0.015 Ω 33 μΩ/Ω + 0.015 Ω 33 μΩ/Ω + 0.02 Ω 33 μΩ/Ω + 0.02 Ω 34 μΩ/Ω + 0.2 Ω 34 μΩ/Ω + 0.1 Ω 34 μΩ/Ω + 1 Ω 33 μΩ/Ω + 1 Ω 40 μΩ/Ω + 10 Ω 38μΩ/Ω + 10 Ω 70 μΩ/Ω + 0.15 kΩ 0.15 mΩ/Ω + 0.25 kΩ 0.3 mΩ/Ω + 2.5 kΩ 0.61 mΩ/Ω + 3 kΩ 3.5 mΩ/Ω + 0.1 MΩ 17 mΩ/Ω + 0.5 MΩ	Fluke 5522A
Resistance – Measure ³	Up 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	18 μΩ/Ω + 50 μΩ 16 μΩ/Ω + 0.5 mΩ 13 μΩ/Ω + 0.5 mΩ 14 μΩ/Ω + 5 mΩ 13 μΩ/Ω + 50 mΩ 18 μΩ/Ω + 2 Ω 58 μΩ/Ω + 100 Ω 0.58 mΩ/Ω + 1 kΩ 0.59 % of reading + 10 kΩ	Agilent 3458A
Capacitance – Generate ³ Fixed Points	1 pF 10 pF 100 pF 1 000 pF	0.41 % of reading 017 % of reading 0.13 % of reading 0.32 % of reading	Agilent 16380A
Capacitance – Generate ³	(220 to 400) pF (0.4 to 3.3) nF (3.3 to 33) nF (33 to 330) nF (0.33 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF	1.9 % of reading + 0.01 nF 0.85 % of reading + 0.01 nF 0.37 % of reading + 0.01 nF 0.32 % of reading + 0.3 nF 0.32 % of reading + 3 nF 0.32 % of reading + 3 nF 0.48 % of reading + 30 nF 0.55 % of reading + 0.1 μF	Fluke 5522A



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ³	(110 to 329.999) μ F (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.53 % of reading + 0.3 μ F 0.53 % of reading + 1 μ F 0.53 % of reading + 3 μ F 0.53 % of reading + 10 μ F 0.88 % of reading + 30 μ F 1.3 % of reading + 0.1 mF	Fluke 5522A
Capacitance – Measure ³ 50Hz – 100kHz	0.1 pF to 1 μ F (1 to 10) μ F 10 μ F to 10 mF	0.7 % of reading 1.3 % of reading 12 % of reading	Fluke PM 6304C
Electrical Calibration of Thermocouple Indicating Devices ³ –	Type B (600 to 1 820) °C Type C (0 to 2 316) °C Type E (-250 to 1 000) °C Type J (-210 to 1 200) °C Type K (-200 to 1 372) °C Type L (-200 to 900) °C Type N (-200 to 1 300) °C Type R (0 to 1 767) °C Type S (0 to 1 767) °C Type T (-250 to -200) °C (-200 to 400) °C Type U (-200 to 600) °C	0.41 °C 0.38 °C 0.29 °C 0.19 °C 0.21 °C 0.12 °C 0.26 °C 0.45 °C 0.44 °C 0.41 °C 0.2 °C 0.19 °C	Fluke 7526A
Inductance – Measure ³ Up to 1 kHz	10 μ H to 637 kH	0.07 % of reading	Fluke PM 6304C



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscope Calibration – Vertical Deflection ³ 50 Ω, 1 kHz square wave 1 MΩ, 1 kHz square wave Flatness – Leveled Sine Wave 5 mV to 5.5 V ref @ 50 kHz BANDWIDTH Rise Time Time Interval ²	1 mV to 6.6 V 1 mV to 130 V 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz <300 ps (1 to 20) ms 50 ms to 5 s	0.64 % of reading + 40 μV 0.79 % of reading + 40 μV 2.5 % of reading + 0.1 mV 2.2 % of reading + 0.1 mV 4.6 % of reading + 0.1 mV 6.4 % of reading + 0.1 mV + 33 ps / -120 ps 3 μs/s (25 + 1 000t) μs/s	Fluke 5522A/SC1100
Flatness – Measure	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 (1 to 2) MHz (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	0.027 % of reading + 0.04 mV 0.013 % of reading + 0.02 mV 0.019 % of reading + 0.02 mV 0.036 % of reading + 0.02 mV 0.94 % of reading + 0.02 mV 0.35 % of reading + 0.1 mV 1.2 % of reading + 0.1 mV 1.7 % of reading + 0.1 mV 0.027 % of reading + 0.4 mV 0.013 % of reading + 0.2 mV 0.019 % of reading + 0.2 mV 0.036 % of reading + 0.2 mV 0.94 % of reading + 0.2 mV 0.35 % of reading + 1 mV 1.2 % of reading + 1 mV 1.7 % of reading + 1 mV	Fluke 3458A
Power Meter Range Calibration ³	3 μW to 100 mW	0.3 % of reading	HP 11683A



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation ³ – Measure			
10 kHz to 10 MHz	(5 to 99) %Depth	1 %Depth	Agilent E4440A
10 MHz to 3 GHz	(5 to 20) %Depth (20 to 99) %Depth	2.9 %Depth 0.8 %Depth	
(3 to 26.5) GHz	(5 to 20) %Depth (20 to 99) %Depth	5.2 %Depth 1.8 %Depth	
Frequency Modulation ³ – Measure			
250 kHz to 10 MHz	250 Hz to 10 kHz	3.1 % of reading	Agilent E4440A
10 MHz to 6.6 GHz (6.6 to 13.2) GHz (13.2 to 26.5) GHz	50 Hz to 200 kHz	3.1 % of reading 3.8 % of reading 5 % of reading	
Attenuation ³ – Measure			
10 MHz to 26.5 GHz	(-10 to 0) dB (-20 to -11) dB (-30 to -21) dB (-40 to -31) dB (-50 to -41) dB (-60 to -51) dB (-70 to -61) dB (-80 to -71) dB (-90 to -81) dB (-100 to -91) dB (-110 to -101) dB (-120 to -111) dB	0.039 dB 0.039 dB 0.039 dB 0.039 dB 0.039 dB 0.05 dB 0.05 dB 0.05 dB 0.05 dB 0.05 dB 0.059 dB 0.059 dB	Agilent E4440A w/ N5532B Sensor
Flatness – Measure			
	(0.1 to 1) V 300 kHz to 26.5 GHz	5.4 % of reading + 0.1 mV	HP 8482A/8485A
	(1 to 10) V 300 kHz to 26.5 GHz		
AM Distortion ³ – Measure	(0.3to 10) MHz 10 MHz to 26.5 GHz	1.2 % of reading 1.5 % of reading	Agilent E4440A
FM Distortion ³ – Measure	1 MHz to 50 GHz	0.5 % of reading	Agilent E4440A



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power ³ – Measure			
100 kHz to 4.2 GHz	(-10 to 20) dBm	4.9 % of reading	HP 8482A
10 MHz to 26.5 GHz		5.4 % of reading	HP 8485A
Phase Noise ³ – SSB Measure	1 MHz to 50 GHz	0.45 dB	Agilent E4440A
AM/FM Distortion ³	400 Hz to 1 kHz	1.2 dB	HP 8903B
Harmonic Distortion ³	20 Hz to 20 kHz 20 kHz to 26.5 GHz	1.6 dB 1.7 dB	Agilent E4440A

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 14 in	(4.4 + 1.2L) μin	Master gage blocks, P&W universal measuring machine
Micrometers ^{2,3}	Up to 46 in	(30 + 4L) μin	Gage blocks (Grade 0)
Calipers ^{2,3}	Up to 46 in	(58 + 7L) μin	Gage blocks (Grade 0)
Dial Indicators ^{2,3}	Up to 10 in	(120 + 42L) μin	716 Starrett Calibrator, gage blocks (Grade 0)
Micrometer Rods	Up to 40 in	(250 + 4L) μin	Gage blocks (grade 0)
Height Gages ^{2,3}	Up to 40 in	(190 + 3L) μin	Gage blocks (grade 0)
Cylindrical Gages ²			
Ring Gages	(0.04 to 14) in	(4 + 3D) μin	Master gage blocks, P&W universal measuring machine
Plain Plugs/Pins	Up to 13 in	(7 + 2D) μin	
Thread Plugs –			
Major Diameter	Up to 12 in	130 μin	P & W Model C, Van Keuren thread wire set
Pitch Diameter	Up to 12 in	160 μin	
Thread Rings	Up to 12 in	54 μin	Thread setting plug gages



Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates ^{2,3}			
Overall Flatness	Up to 10 ft × 10 ft	72 μin + 1.2DL	Mahr federal level system
Local Area Flatness	± 0.002 in	69 μin	Repeat-O-Meter
Rulers ³	Up to 46 in	0.009 in	Gage blocks (grade 0)
Feeler Gage ³	Up to 1 in	74 μin	Pratt & Whitney Model C
Optical Comparators ³ –			
Linearity	Up to 20 in (20 to 40) in	590 μin 790 μin	Gage blocks, SI Industries glass scales
Magnification	10x to 100x	590 μin	

Mass

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{2,3}	(2 to 10) g (10 to 50) g (50 to 200) g (200 to 500) g (0.5 to 2) kg Up to 500 lb	0.06 mg + 0.6R 0.09 mg + 0.6R 0.41 mg + 0.6R 10 mg + 0.6R 13 mg + 0.6R 27 g + 0.6R	Class F weights
Pressure ³	(-11 to 15) psi (15 to 100) psi (100 to 300) psi (10 to 16 000) psi	0.005 3 psi 0.036 psi 0.094 psi 0.04 % of reading	Pressure transducers 2700G-BG100K, 2700G-BG700K, 2700G-BG2M Mdl P3125
Force – Tension and Compression ³	(0.01 to 500) lbf	0.001 3 % of reading	Class F weights
	(200 to 10 000) lbf	0.11 % of reading	Morehouse Press with Load Cells
Torque ³	4 lbf-in to 1 000 lbf-ft	0.5 % of reading	CDI 5000 ST torque tester
Torque Analyzers	0.4 ozf-in to 1 000 lbf-ft	0.13 % of reading	Class F weights and arm



Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Generate	(10 to 95) %RH	0.51 %RH	Thunder Scientific 1200
Relative Humidity – Measure	(0 to 90) %RH	1.7 %RH	Vaisala HM141/HMP46
Temperature – Measuring Equipment ³	(-25 to 140) °C	0.13 °C	1502A with 5615 SPRT and dry block
Temperature – Measure ³	(-200 to 420) °C	0.04 °C	Hart 1502A/5615 SPRT

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure	10 MHz	1×10^{-11} Hz/Hz	58503A/B GPS
Frequency – Measure ³	10 Hz to 225 MHz 225 MHz to 26.5 GHz	3×10^{-9} Hz/Hz 2×10^{-7} Hz/Hz	HP 53131A, E4440A

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ($k=2$), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, 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.
2. L = length in inches, D = diameter in inches, R = resolution of device under test, t = time in seconds, DL = diagonal length in inches.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2080.03.



Vice President

