



# 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.**

**117 Jetplex Circle, Suite C-4**

**Madison, AL 35758**

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

**ISO/IEC 17025:2017**

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-2080.02

Certificate Number

  
ANAB Approval

Certificate Valid: 08/16/2018-09/20/2019

Version No. 005 Issued: 08/16/2018



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. 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 17025:2017,  
ANSI/NCSL Z540-1-1994 (R2002) AND ANSI/NCSL Z540.3-2006 (R2013)

**Technical Maintenance, Inc.**

117 Jetplex Circle, Suite C4  
Madison, AL 35758

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**CALIBRATION**

Valid to: September 20, 2019

Certificate Number: AC-2080.02

**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 <sup>1</sup>	(4, 7, & 10) pH units	0.019 pH	pH buffer solutions
Conductivity <sup>1</sup>	≈100 μS ≈1 410 μS ≈10 000 μS	0.069 μS 5.1 μS 34 μS	Conductivity solutions



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate <sup>1</sup>	0 to 220 mV	11 $\mu$ V/V + 0.4 $\mu$ V	Fluke 5730A Multiproduct Calibrator
	(0.22 to 2.2) V	5.2 $\mu$ V/V + 0.7 $\mu$ V	
	(2.2 to 11) V	3.5 $\mu$ V/V + 2.5 $\mu$ V	
	(11 to 22) V	3.5 $\mu$ V/V + 4 $\mu$ V	
	(22 to 220) V	5 $\mu$ V/V + 40 $\mu$ V	
	(220 to 1 100) V	6.5 $\mu$ V/V + 0.4 mV	
DC Voltage – Measure <sup>1</sup>	Up to 100 mV	11 $\mu$ V/V + 0.3 $\mu$ V	HP 3458A Multimeter
	(0.1 to 1) V	10 $\mu$ V/V + 0.3 $\mu$ V	
	(1 to 10) V	10 $\mu$ V/V + 0.5 $\mu$ V	
	(10 to 100) V	12 $\mu$ V/V + 30 $\mu$ V	Ross voltage dividers
	(100 to 1 000) V	12 $\mu$ V/V + 0.1 mV	
	(1 to 30) kV	0.13 % of reading	
	(30 to 150) kV	0.12 % of reading	
DC Current – Generate <sup>1</sup>	Up to 220 $\mu$ A	40 $\mu$ A/A + 6 nA	Fluke 5730A Multiproduct Calibrator
	(0.22 to 2.2) mA	35 $\mu$ A/A + 7 nA	
	(2.2 to 22) mA	36 $\mu$ A/A + 40 nA	
	(22 to 220) mA	48 $\mu$ A/A + 0.7 $\mu$ A	
	(0.22 to 2.2) A	81 $\mu$ A/A + 12 $\mu$ A	
	(2.2 to 11) A	0.059 % of reading + 0.5 mA	Fluke 5522A Multiproduct Calibrator
	(11 to 20.5) A	0.1 % of reading + 0.75 mA	
DC Current – Measure <sup>1</sup>	Up to 100 nA	31 $\mu$ A/A + 0.04 nA	HP 3458A Multimeter
	(0.1 to 100) $\mu$ A	22 $\mu$ A/A + 0.8 nA	
	100 $\mu$ A to 10 mA	23 $\mu$ A/A + 50 nA	
	(10 to 100) mA	37 $\mu$ A/A + 0.5 $\mu$ A	
	(0.1 to 1) A	0.011 % of reading + 10 $\mu$ A	
	(1 to 600) A	0.3 % of reading	Current Shunts
Electrical Calibration of Thermocouple Indicating Devices <sup>1</sup>	Type B		Fluke 7526A Process Calibrator
	(600 to 800) °C	0.27 °C	
	(800 to 1 550) °C	0.22 °C	
	(1 550 °C to 1 820) °C	0.17 °C	
	Type C		
	(0 to 1000) °C	0.13 °C	
	(1 000 to 1 800) °C	0.18 °C	
(1 800 to 2 000) °C	0.2 °C		
(2 000 to 2 316) °C	0.27 °C		



Electrical Calibration of Thermocouple Indicating Devices <sup>1</sup>	Type E		
	(-250 to -200) °C		0.19 °C
	(-200 to -100) °C		0.1 °C
	(-100 to 0) °C		0.07 °C
	(0 to 600) °C		0.07 °C
	(600 to 1 000) °C		0.08 °C
	Type J		
	(-210 to -100) °C		0.11 °C
	(-100 to 800) °C		0.07 °C
	(800 to 1 200) °C		0.08 °C
	Type K		
	(-250 to -200) °C		0.35 °C
	(-200 to -100) °C		0.13 °C
	(-100 to 800) °C		0.08 °C
	(800 to 1 372) °C		0.1 °C
	Type L		
	(-200 to -100) °C		0.08 °C
	(-100 to 900) °C		0.07 °C
	Type N		
	(-250 to -200) °C		0.56 °C
	(-200 to -100) °C		0.18 °C
	(-100 to 0) °C		0.1 °C
	(0 to 100) °C		0.09 °C
	(100 to 800) °C		0.08 °C
	(800 to 1 300) °C		0.1 °C
	Type R		
	(-50 to -25) °C		0.42 °C
	(-25 to 0) °C		0.34 °C
(0 to 100) °C		0.3 °C	
(100 to 400) °C		0.22 °C	
(400 to 600) °C		0.17 °C	
(600 to 1 000) °C		0.16 °C	
(1 000 to 1 600) °C		0.15 °C	
(1 600 to 1 767) °C		0.18 °C	
Type S			
(50 to -25) °C		0.39 °C	
(-25 to 0) °C		0.33 °C	
(0 to 100) °C		0.29 °C	
(100 to 400) °C		0.22 °C	
(400 to 600) °C		0.18 °C	
(600 to 1 600) °C		0.17 °C	
(1 600 to 1 767) °C		0.2 °C	
Type T			
(-250 to -200) °C		0.26 °C	
(-200 to -100) °C		0.13 °C	
(-100 to 0) °C		0.09 °C	
(0 to 400) °C		0.07 °C	
			Fluke 7526A Process Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices <sup>1</sup>	Type U (-200 to 0) °C (0 to 600) °C	0.13 °C 0.08 °C	Fluke 7526A Process Calibrator
Power Meters <sup>1</sup>	3 μW to 100 mW	0.25 % of reading	HP 11683A Range Calibrator
Resistance – Generate, Fixed Points <sup>1</sup>	1, 1.9 Ω 10, 19 Ω 100, 190 Ω 1, 1.9 kΩ 10, 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	0.14 mΩ/Ω 33 μΩ/Ω 35 μΩ/Ω 15 μΩ/Ω 13 μΩ/Ω 13 μΩ/Ω 15 μΩ/Ω 18 μΩ/Ω 25 μΩ/Ω 54 μΩ/Ω 66 μΩ/Ω 0.16 Ω/Ω	Fluke 5730A Multiproduct Calibrator
Resistance – Generate <sup>1</sup>	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	40 μΩ/Ω + 10 mΩ 30 μΩ/Ω + 15 mΩ 28 μΩ/Ω + 15 mΩ 28 μΩ/Ω + 0.02 Ω 29 μΩ/Ω + 0.02 Ω 29 μΩ/Ω + 0.2 Ω 29 μΩ/Ω + 0.1 Ω 29 μΩ/Ω + 1 Ω 29 μΩ/Ω + 1 Ω	Fluke 5520A Multiproduct Calibrator
Resistance – Measure <sup>1</sup>	Up to 10 Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	16 μΩ/Ω + 50 μΩ 14 μΩ/Ω + 0.5 mΩ 12 μΩ/Ω + 0.5 mΩ 12 μΩ/Ω + 5 mΩ 12 μΩ/Ω + 5 mΩ 16 μΩ/Ω + 2.0 Ω 50 μΩ/Ω + 0.1 kΩ 0.05 % of reading + 1 kΩ 0.51 % of reading + 10 kΩ	HP 3458A Multimeter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate <sup>v</sup>	(0.22 to 2.2) mV		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.36 mV/V + 5 μV	
	(20 to 40) Hz	0.12 mV/V + 4 μV	
	40 Hz to 20 kHz	0.11 mV/V + 4 μV	
	(20 to 50) kHz	0.24 mV/V + 4 μV	
	(50 to 100) kHz	0.6 mV/V + 5 μV	
	(100 to 300) kHz	1.3 mV/V + 10 μV	
	(300 to 500) kHz	1.7 mV/V + 20 μV	
	500 kHz to 1 MHz	3.2 mV/V + 20 μV	
	(2.2 to 22) mV		
	(10 to 20) Hz	0.36 mV/V + 5 μV	
	(20 to 40) Hz	0.12 mV/V + 4 μV	
	40 Hz to 20 kHz	0.11 mV/V + 4 μV	
	(20 to 50) kHz	0.24 mV/V + 4 μV	
	(50 to 100) kHz	0.6 mV/V + 5 μV	
	(100 to 300) kHz	1.3 mV/V + 10 μV	
	(300 to 500) kHz	1.7 mV/V + 20 μV	
	500 kHz to 1 MHz	3.2 mV/V + 20 μV	
	(22 to 220) mV		
	(10 to 20) Hz	0.24 mV/V + 12 μV	
	(20 to 40) Hz	0.11 mV/V + 7 μV	
	40 Hz to 20 kHz	69 μV/V + 7 μV	
	(20 to 50) kHz	0.14 mV/V + 7 μV	
	(50 to 100) kHz	0.37 mV/V + 17 μV	
(100 to 300) kHz	0.77 mV/V + 20 μV		
(300 to 500) kHz	1.7 mV /V + 25 μV		
500 kHz to 1 MHz	3.2 mV /V + 45 μV		
(0.22 to 2.2) V			
(10 to 20) Hz	0.28 mV/V + 40 μV		
(20 to 40) Hz	0.11 mV/V + 15 μV		
40 Hz to 20 kHz	50 μV/V + 8 μV		
(20 to 50) kHz	78 μV/V + 10 μV		
(50 to 100) kHz	0.1 mV/V + 30 μV		
(100 to 300) kHz	0.4 mV/V + 80 μV		
(300 to 500) kHz	1.2 mV /V + 0.2 mV		
500 kHz to 1 MHz	0.2 mV/V + 0.3 mV		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate <sup>1</sup>	(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 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.28 mV/V + 0.4 mV 0.11 mV/V + 0.15 mV 50 μV/V + 50 μV 78 μV/V + 0.1 mV 98 μV/V + 0.2 mV 0.3 mV/V + 0.6 mV 1.2 mV/V + 2 mV 1.8 mV/V + 3.2 mV	Fluke 5730A Multiproduct Calibrator
	(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	0.28 mV/V + 4 mV 0.11 mV/V + 1.5 mV 62 μV/V + 0.6 mV 93 μV/V + 1 mV 0.18 mV/V + 2.5 mV 1.1 mV/V + 16 mV 5.1 mV/V + 40 mV 9.3 mV/V + 80 mV	
AC Voltage – Generate <sup>1</sup>	(220 to 750) V (30 to 50) kHz (50 to 100) kHz (750 to 1 000) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.7 mV/V + 11 mV 2.7 mV/V + 45 mV 0.11 mV/V + 4 mV 0.2 mV/V + 6 mV 0.7 mV/V + 11 mV	Fluke 5730A Multiproduct Calibrator /5725A Amplifier
AC Voltage – Measure <sup>1</sup>	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	0.044 % 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	HP 3458A Multimeter

AC Voltage – Measure <sup>1</sup>	10 mV to 100 mV		
	(1 to 40) Hz	0.019 % of reading + 0.004 mV	
	40 Hz to 1 kHz	0.019 % of reading + 0.002 mV	
	(1 to 20) kHz	0.027 % of reading + 0.002 mV	
	(20 to 50) kHz	0.045 % of reading + 0.002 mV	
	(50 to 100) kHz	0.09 % of reading + 0.002 mV	
	(100 to 300) kHz	0.31 % of reading + 0.01 mV	
	300 kHz to 1 MHz	1 % of reading + 0.01 mV	
	(1 to 2) MHz	1.5 % of reading + 0.01 mV	
	100 mV to 1 V		
	(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 21) kV			
Up to 400 Hz	0.59 % of reading		Ross voltage dividers
(21 to 100) kV			
Up to 400 Hz	0.62 % of reading		





Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate <sup>1</sup>	(9 to 220) $\mu$ A		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.31 mA/A + 16 nA	
	(20 to 40) Hz	0.21 mA/A + 10 nA	
	40 Hz to 1 kHz	0.15 mA/A + 8 nA	
	(1 to 5) kHz	0.35 mA/A + 12 nA	
	(5 to 10) kHz	1.3 mA/A + 65 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	0.3 mA/A + 40 nA	
	(20 to 40) Hz	0.16 mA/A + 35 nA	
	40 Hz to 1 kHz	0.14 mA/A + 35 nA	
	(1 to 5) kHz	0.25 mA/A + 0.11 $\mu$ A	
	(5 to 10) kHz	1.3 mA/A + 0.65 $\mu$ A	
	(2.2 to 22) mA		
	(10 to 20) Hz	0.31 mA/A + 0.4 $\mu$ A	
	(20 to 40) Hz	0.2 mA/A + 0.35 $\mu$ A	
	40 Hz to 1 kHz	0.14 mA/A + 0.35 $\mu$ A	
	(1 to 5) kHz	0.26 mA/A + 0.55 $\mu$ A	
	(5 to 10) kHz	1.4 mA/A + 5 $\mu$ A	
(22 to 220) mA			
(10 to 20) Hz	0.3 mA/A + 4 $\mu$ A		
(20 to 40) Hz	0.2 mA/A + 3.5 $\mu$ A		
40 Hz to 1 kHz	0.14 mA/A + 2.5 $\mu$ A		
(1 to 5) kHz	0.26 mA/A + 3.5 $\mu$ A		
(5 to 10) kHz	1.4 mA/A + 10 $\mu$ A		
(0.22 to 2.2) A			
20 Hz to 1 kHz	0.3 mA/A + 35 $\mu$ A		
(1 to 5) kHz	0.54 mA/A + 80 $\mu$ A		
(5 to 10) kHz	8.2 mA/A + 0.16 mA		
AC Current – Generate <sup>1</sup>	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.56 mA/A + 0.17 mA 1.2 mA/A + 0.38 mA 4.3 mA/A + 0.75 mA	Fluke 5730A Multiproduct Calibrator /5725A Amplifier
AC Current – Generate <sup>1</sup>	(11 to 20.5) A 45 Hz to 100 Hz 100 Hz to 1 kHz (1 to 5) kHz	0.19 % of reading + 5 mA 0.24 % of reading + 5 mA 4.6 % of reading + 5 mA	Fluke 5522A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure <sup>1</sup>	Up to 100 $\mu$ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (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 (0.1 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 + 0.03 pA 0.16 % of reading + 0.03 pA 0.07 % of reading + 0.03 pA 0.41 % of reading + 20 $\mu$ A 0.16 % of reading + 20 $\mu$ A 0.069 % of reading + 20 $\mu$ A 0.038 % of reading + 20 $\mu$ A 0.069 % of reading + 20 $\mu$ A 0.41 % of reading + 40 $\mu$ A 0.56 % of reading + 0.15 mA 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	HP 3458A Multimeter
AC Current – Measure <sup>1</sup>	(1 to 600) A 30 Hz to 10 kHz	3.5 % of reading	Current Clamp
Capacitance <sup>1</sup> – Generate 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	(0.19 to 0.1099) nF (1.1 to 3.2999) nF (3.3 to 329.999) nF (0.33 to 1.09999) $\mu$ F (1.1 to 3.29999) $\mu$ F (3.3 to 10.9999) $\mu$ F (11 to 32.999) $\mu$ F (33 to 109.999) $\mu$ F (110 to 329.999) $\mu$ F (0.33 to 1.09999) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	1.2 % of reading + 0.01 nF 1.2 % of reading + 0.01 nF 0.39 % of reading + 0.3 nF 0.38 % of reading + 3 nF 0.37 % of reading + 3 nF 0.38 % of reading + 10 nF 0.53 % of reading + 30 nF 0.58 % of reading + 0.1 $\mu$ F 0.58 % of reading + 0.3 $\mu$ F 0.57 % of reading + 1 $\mu$ F 0.58 % of reading + 3 $\mu$ F 0.59 % of reading + 10 $\mu$ F 0.65 % of reading + 30 $\mu$ F 1.3 % of reading + 0.1 mF	Fluke 5522A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1</sup> – Amplitude – Square Wave 50 Ω 1 MΩ  Rise Time  Flatness (50 kHz reference)  Time Marker <sup>2</sup>	1 mVpp to 6.6 Vpp 1 mVpp to 130 Vpp  <350 ps  5 mV to 5.5 V 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1 100) MHz  1 ns to 20 ms 50 ms to 5 s	1.3 % of reading + 40 μV 1.3 % of reading + 40 μV  + 13 ps / -0.11 ps  2.5 % of reading + 0.1 mV 3.4 % of reading + 0.1 mV 5.5 % of reading + 0.1 mV 6.9 of reading % + 0.1 mV  2.7 parts in 10 <sup>6</sup> s (25 + 1 000t) parts in 10 <sup>6</sup> s	Fluke 5522A /SC1100 Multiproduct Calibrator
Low Frequency Power – Generate <sup>1</sup>  (45 to 65) Hz 1 PF  DC	Up to 20 kW	0.25 % of reading  0.21 % of reading	Fluke 5522A Multiproduct Calibrator

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation <sup>1</sup> – Measure	100 kHz to 50 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	0.019 dB 0.022 dB 0.027 dB 0.032 dB 0.037 dB 0.055 dB 0.06 dB 0.064 dB 0.069 dB	Agilent N5531S Measuring Receiver



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation <sup>1</sup> – Measure	100 kHz to 31.15 GHz (-100 to -91) dB 100 kHz to 26.5 GHz (-110 to -101) dB (-120 to -111) dB	0.074 dB 0.086 dB 0.091 dB	Agilent N5531S Measuring Receiver
RF Power <sup>1</sup> – Measure 50 MHz	1 mW	0.003 2 mW	HP 432A Power Meter & 8478B Power Sensor
RF Power – Generate	250 kHz to 20 GHz (-10 to 10) dBm (-70 to -10) dBm (-90 to -70) dBm (20 to 50) GHz (-10 to 10) dBm (-70 to -10) dBm (-90 to -70) dBm	1.5 dB 1.6 dB 1.7 dB 1.6 dB 1.7 dB 2.6 dB	Agilent E8257D Signal Generator
Amplitude Modulation <sup>1</sup> – Measure	100 kHz to 10 MHz (5 to 99) % Depth 10 MHz to 3 GHz (5 to 20) % Depth (20 to 99) % Depth (3 to 26.5) GHz (5 to 20) % Depth (20 to 99) % Depth (26.5 to 31.5) GHz (5 to 20) % Depth (20 to 99) % Depth (31.5 to 50) GHz (5 to 20) % Depth (20 to 99) % Depth	1 % Depth 2.9 % Depth 0.8 % Depth 5.2 % Depth 1.8 % Depth 7.9 % Depth 2.3 % Depth 30 % Depth 7 % Depth	Agilent N5531S Measuring Receiver
Frequency Modulation <sup>1</sup> – Measure	20 Hz to 10 kHz 250 kHz to 10 MHz (50 to 200) Hz 10 MHz to 6.6 GHz (6.6 to 13.2) GHz (13.2 to 31.15) GHz (31.15 to 50) GHz	3.1 % of reading 3.1 % of reading 3.8 % of reading 5 % of reading 11 % of reading	Agilent N5531S Measuring Receiver
Phase Modulation <sup>1</sup> – Measure	100 kHz to 50 GHz	9.7 % of reading	Agilent N5531S Measuring Receiver



**Electrical – RF/Microwave**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power <sup>1</sup> – 100 kHz to 2.6 GHz (0.1 to 26.5) GHz	(0.01 to 30) dBm	2 % of reading 3.4 % of reading	HP 8902A Measuring Receiver /HP 11722A, HP 11792A Power Sensors
AM Distortion <sup>1</sup> – Measure	(0.1 to 10) MHz 10 MHz to 26.5 GHz (26.5 to 50) GHz	0.8 % of reading 1 % of reading 6.2 % of reading	Agilent N5531S Measuring Receiver
FM Distortion <sup>1</sup> – Measure	1 MHz to 50 GHz	0.3 % of reading	Agilent N5531S Measuring Receiver

**Length – Dimensional metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers <sup>1,2</sup>	Up to 46 in	(26 + 10L) μin	Gage blocks (Grade 2)
Micrometers <sup>1,2</sup>	Up to 46 in	(30 + 6L) μin	
Height Gages <sup>1,2</sup>	Up to 46 in	(200 + 3L) μin	
Dial Indicators <sup>1,2</sup>	Up to 10 in	(5 + 57L) μin	
Rulers <sup>1</sup>	Up to 46 in	0.009 1 in	
Metal Tapes and Rules <sup>1,2</sup>	Up to 100 ft	(0.000 023L + 0.023) in	Standard rule
Feeler Gages <sup>1</sup>	Up to 1 in	73 μin	Mitutoyo 293-369 Micrometer
Cylindrical gages <sup>1,2</sup> – Plain Pins, Plugs Rings	Up to 1 in (1 to 10) in Up to 14 in	11 μin (7 + 4D) μin (8.0 + 2D) μin	P&W LabMaster gage blocks (grade 1)
Surface Plates <sup>1</sup> – Overall Flatness	(18 × 18) in to (6 × 6) ft	95 μin	Rahn Planekator
Local Area Flatness	Up to (18 × 18) in	74 μin	Repeat-o-meter
Gage Blocks <sup>2</sup>	Up to 10 in	(2.9 + 2.2L) μin	Universal measuring machine, master gage block set



**Length – Dimensional metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plugs – Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	40 μin 91 μin	Gage blocks, P&W universal measuring machine, Van Keuren thread wire set
Optical Comparators <sup>1</sup> – Linearity  Magnification	Up to 20 in (20 to 40) in  10x to 100x	590 μin 790 μin  670 μin	Precision balls, Starrett Webber 81pc Gage Block Set, SI Industries glass scales
Protractors <sup>1</sup>	(0 to 360) °	0.019 °	Angle blocks
Coating Thickness Gages <sup>1</sup> – Eddy Current & Magnetic Induction, Fixed Point	(0.48 to 38.9) mils	89 μin	Calibration foils, P&W Supermicrometer
Coating Thickness Shims <sup>1</sup>	(0 to 243) mils	80 μin	P&W Supermicrometer

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances <sup>1,2</sup>	(1 to 200) g	0.29 mg + 0.6R	Class 1 weights
	(0.022 to 2 000) lb	0.01 % of reading + 0.6R	Class F weights
Pressure <sup>1</sup>	(-14 to 5) psi	0.071 psi	Fluke 700PD6 Pressure Module
	(5 to 10 000) psi	0.12 % of reading	Ametek R-100 Deadweight Tester
	(0 to 30) psia	0.019 psi	Fluke 700GA5 Pressure Gage
	(0 to 100) cmH <sub>2</sub> O	0.071 cmH <sub>2</sub> O	Heise 710B Pressure Indicator
	(0 to 20) inH <sub>2</sub> O	0.0018 inH <sub>2</sub> O	Additel 681-DP20 Pressure Gage



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure <sup>1</sup>	(20 to 150) inH <sub>2</sub> O	0.11 inH <sub>2</sub> O	Additel 681-DP150 Pressure Gage
Vacuum	(0 to 30) inHg	0.12 inHg	Fluke 700PD6 Pressure Module
Torque Wrenches <sup>1</sup>	(5 to 1 000) lbf-in (25 to 250) lbf-ft (250 to 2 000) lbf-ft	0.35 % of reading 0.43 % of reading 0.49 % of reading	CDI torque system
Torque Analyzers	(5 to 80) ozf-in (5 to 600) lbf-in (50 to 2 000) lbf-ft	0.17 % of reading 0.15 % of reading 0.14 % of reading	Weights and Wheel
Mass	(1 to 10) lb	0.048 g	Master balance
Force – Tension <sup>1</sup>	(10 to 200) mgrf (0.2 to 1) grf (1 to 10) grf (10 to 500) grf (1 to 540) lbf	0.63 mgrf 1 mgrf 0.038 % of reading 0.025 % of reading 0.026 % of reading	Class F weights

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measuring Equipment <sup>1</sup>	(50 to 600) °C	0.11 °C	Hart 1502A Indicator w/5626 PRT and dry block
Temperature – Measure <sup>1</sup>	(-25 to 600) °C	0.026 °C	Hart 1502 Indicator with 5626 PRT
Relative Humidity – Measure <sup>1</sup>	(0 to 90) % RH	1.6 %RH	Vaisala HM141/HMP46 Humidity Indicator and Probe
IR Thermometry <sup>1</sup>	(20 to 100) °C (100 to 300) °C (300 to 500) °C	0.51 °C 0.61 °C 0.8 °C	Fluke 9132 Infrared Calibrator ε= 0.95, λ = (8 to 14) μm

**Time and Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure <sup>1</sup>	10 MHz	1 part in 10 <sup>11</sup> Hz/Hz	GPS Receiver 58503A/B
	10 Hz to 500 MHz	5 parts in 10 <sup>7</sup> Hz/Hz	HP 5345A Counter
Frequency – Measure <sup>1</sup>	500 MHz to 26.5 GHz (26.5 to 40) GHz	1.7 parts in 10 <sup>9</sup> Hz/Hz 1 parts in 10 <sup>7</sup> Hz/Hz	HP 5343A Counter

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,  $t$  = time in seconds,  $R$  = resolution of device under test.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2080.02.



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Vice President

