



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

Rothe Enterprises, Inc. Metrology Services Division
1100 Hercules Ave, Suite 230
Houston, TX 77058

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

ISO/IEC 17025:2005

and national standards

ANSI/NCSL Z540-1-1994 AND
ANSI/NCSL Z540.3-2006

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-1440

Certificate Number


ANAB Approval

Certificate Valid: 02/15/2017-03/11/2019
Version No. 005 Issued: 02/15/2017



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 January 2009).



ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005; ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid to: March 11, 2019

Certificate Number: AC-1440

I. Electromagnetic - DC/Low Frequency

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
DC Voltage – Source ³	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1 kV	16 μ V/V + 1.2 μ V 8.5 μ V/V + 2.3 μ V 9.3 μ V/V + 23 μ V 14 μ V/V + 0.18 mV 14 μ V/V + 1.8 mV	Fluke 5520A SC1100
DC Voltage – Measure ³	(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100V to 1 kV (1 to 15) kV Up to 150 kV	13 μ V/V + 0.36 μ V 12 μ V/V + 0.68 μ V 12 μ V/V + 5.8 μ V 14 μ V/V + 68 μ V 14 μ V/V + 0.59 mV 1.2 mV/V + 1.2 V 6.4 mV/V + 19 V	HP 3458A Ross VD-15-8.3-A-LB-AL with HP 3458A Ross VD-150-10Y-AK-LB-AL with HP 3458A
DC Current - Source ³	Up to 330 μ A 330 μ A to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1A (1.1 to 3) A (3 to 11) A (11 to 20.5) A (25 to 120) A (20 to 50) A (50 to 150) A (150 to 550) A (550 to 1 k) A	0.13 mA/A + 23 nA 90 μ A/A + 58 nA 86 μ A/A + 0.29 μ A 89 μ A/A + 2.9 μ A 0.22 mA/A + 74 μ A 0.34 mA/A + 74 μ A 0.46 mA/A + 0.58 mA 0.80 mA/A + 0.87 mA 4.7 mA + 85 μ A/A 5.2 mA/A + 0.14 A 5.4 mA/A + 0.14 A 5.5 mA/A + 0.53 A 6 mA/A + 0.54 A	Fluke 5520A SC1100 52120A Fluke 5520A SC1100 with 5500A Coil



Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
DC Current - Measure ³	(10 to 100) nA 100 nA to 1 μA (1 to 10) μA (10 to 100) μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A 1 mΩ (15 to 150) μA (1.5 to 150) mA (1.5 to 15) A 10 mΩ (1 to 100) A 100 mΩ (1 to 100) A 100 μΩ (5 to 200) A	1.8 mA/A + 0.58 nA 0.17 mA/A + 0.58 nA 32 μA/A + 0.59 nA 30 μA/A + 1.1 nA 46 μA/A + 82 nA 0.13 mA/A + 0.13 μA 0.13 mA/A + 1.3 μA 0.14 mA/A + 13 μA 0.68 mA/A + 5.4 μA 0.13 mA/A + 15 μA 0.13 mA 11 mA/A 9 mA/A 8.7 mA/A	HP 3458A HP 3458A with Honeywell 2759 with Rubicon 100 with Deltec MSA101 with Deltec MKBC408
AC Voltage - Source ⁴	Up to 33 mV (10 to 45) Hz 45 to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (33 to 330) mV (10 to 45) Hz 45 to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz 330 mV to 3.3 V (10 to 45) Hz 45 to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (3.3 to 33) V (10 to 45) Hz 45 to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.62 mV/V + 6.9 μV 0.12 mV/V + 6.9 μV 0.16 mV/V + 6.9 μV 0.78 mV/V + 6.9 μV 2.7 mV/V + 14 μV 6.2 mV/V + 58 μV 0.23mV/V + 9.2 μV 0.11mV/V + 9.2 μV 0.12mV/V + 9.2 μV 0.27 mV/V + 9.2 μV 0.62 mV/V + 37 μV 1.6 mV/V + 81 μV 0.23 mV/V + 58 μV 0.12 mV/V + 69 μV 0.15 mV/V + 69 μV 0.23 mV/V + 58 μV 0.54 mV/V + 0.14 mV 1.9 mV/V + 0.69 mV 0.23 mV/V + 0.75 mV 0.12 mV/V + 0.69 mV 0.19 mV/V + 0.69 mV 0.27 mV/V + 0.69 mV 0.70 mV/V + 1.8 mV	Fluke 5520A SC1100

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
AC Voltage - Source ³ (cont.)	(33 to 330) V (10 to 45) Hz 45 to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz 330 V to 1.02 kV 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.15 mV/V + 2.3 mV 0.16 mV/V + 6.9 mV 0.19 mV/V + 6.9 mV 0.23 mV/V + 6.9 mV 1.6 mV/V + 58 mV 0.23 mV/V + 12 mV 0.19 mV/V + 12 mV 0.23 mV/V + 12 mV	Fluke 5520A SC1100
AC Voltage - Measure ³	(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 (100 to 300) kHz 300 kHz to 1MHz (1 to 4) MHz (4 to 8) MHz (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 (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz 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 (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.37 mV/V + 3.5 μ V 0.27 mV/V + 1.3 μ V 0.36 mV/V + 1.3 μ V 1.2 mV/V + 1.3 μ V 5.8 mV/V + 1.3 μ V 40 mV/V + 2.3 μ V 14 mV/V + 5.8 μ V 81 mV/V + 1.2 μ V 0.23 V/V + 9.2 μ V 86 μ V/V + 4.7 μ V 95 μ V/V + 2.4 μ V 0.17 mV/V + 2.4 μ V 0.35 mV/V + 2.4 μ V 0.93 mV/V + 2.4 μ V 3.5 mV/V + 12 μ V 12 mV/V + 12 μ V 17 mV/V + 12 μ V 46 mV/V + 81 μ V 46 mV/V + 92 μ V 0.17 V/V + 0.10 mV 86 μ V/V + 47 μ V 91 μ V/V + 24 μ V 0.17 mV/V + 24 μ V 0.35 mV/V + 24 μ V 0.93 mV/V + 24 μ V 3.5 mV/V + 0.12 mV 12 mV/V + 0.12mV 17 mV/V + 0.12 mV 46 mV/V + 0.81 mV 46 mV/V + 0.92 mV 0.17 V/V + 1.2 mV	HP 3458A

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
AC Current - Source ³ (cont.)	(3.3 to 33) mA		Fluke 5520A SC1100
	(10 to 20) Hz	1.4 mA/A + 2.3 μ A	
	(20 to 45) Hz	0.70 mA/A + 2.3 μ A	
	45 Hz to 1 kHz	0.31 mA/A + 2.3 μ A	
	(1 to 5) kHz	0.78 mA/A + 2.3 μ A	
	(5 to 10) kHz	1.6 mA/A + 3.5 μ A	
	(10 to 30) kHz	3.1 mA/A + 4.6 μ A	
	(33 to 330) mA		
	(10 to 20) Hz	1.4 mA/A + 23 μ A	
	(20 to 45) Hz	0.70 mA/A + 23 μ A	
	45 Hz to 1 kHz	0.31mA/A + 23 μ A	
	(1 to 5) kHz	0.78 mA/A + 58 μ A	
	(5 to 10) kHz	1.6 mA/A + 0.12 mA	
	(10 to 30) kHz	3.1 mA/A + 0.23 mA	
	330 mA to 1.1 A		
	(10 to 45) Hz	1.5 mA/A + 0.12 mA	
	45 Hz to 1 kHz	0.39 mA/A + 0.12 mA	
	(1 to 5) kHz	4.7 mA/A + 1.2 mA	
	(5 to 10) kHz	19 mA/A + 1.2 mA	
	(1.1 to 3) A		
45 Hz to 1 kHz	1.7 mA/A + 0.12 mA		
(3 to 11) A			
(40 to 100) Hz	1.2mA/A + 1.4mA		
(11 to 20.5) A			
(40 to 100) Hz	1.2mA/A + 1.4mA		
(25 to 120) A			
60 Hz	13 mA/A + 19 mA		
400 Hz	0.78 mA/A + 94 mA		
(20 to 50) A		52120A	
(45 to 65) Hz	3.3 mA/A + 30 mA		
(65 to 440) Hz	8.4 mA/A + 32 mA		
(50 to 150) A		Fluke 5520A - SC1100 With 5500 Coil	
(45 to 65) Hz	3.4 mA/A + 30 mA		
(65 to 440) Hz	8.5 mA/A + 32 mA		
(150 to 500) A			
(45 to 65) Hz	3.4 mA/A + 0.19 A		
(65 to 440) Hz	8.9 mA/A + 0.20 A		
(500 to 1 000) A			
(45 to 65) Hz	4 mA/A + 0.28 A		
(65 to 440) Hz	9.4 mA/A + 0.35 A		
(500 to 3 000) A		52120A with 25 turn Coil	
60 Hz	7.3 mA/A + 0.56 mA		
400 Hz	7.3 mA/A + 0.50 mA		
(3 000 to 6 000) A		52120A with 50 turn Coil	
60 Hz	7.5 mA/A + 780 mA		
400 Hz	7.5 mA/A + 780 mA		

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
AC Current - Measure ³ (cont.)	(5 to 100) μA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	4.6 mA/A + 35 nA 1.7 mA/A + 35 nA 1.2 mA/A + 35 nA 1.2 mA/A + 35 nA 0.70 mA + 35 nA	HP 3458A
	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 (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 (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 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 (1 to 10) A 60 Hz to 400 Hz	4.6 mA/A + 0.24 μA 1.9 mA/A + 0.24 μA 1.9 mA/A + 0.24 μA 0.36 mA/A + 0.24 μA 0.70 mA/A + 0.24 μA 4.6 mA/A + 0.47 μA 6.4 mA/A + 1.7 μA 4.6 mA/A + 2.4 μA 1.7 mA/A + 2.4 μA 0.70 mA/A + 2.4 μA 0.35 mA/A + 2.4 μA 0.70 mA/A + 2.3 μA 4.6 mA/A + 4.6 μA 6.4 mA/A + 17 μA 4.6 mA/A + 23 μA 1.7 mA/A + 23 μA 0.70 mA/A + 23 μA 0.36 mA/A + 23 μA 1.1 mA/A + 23 μA 4.7 mA/A + 46 μA 6.4 mA/A + 0.17 mA 4.6 mA/A + 0.23 mA 1.8 mA/A + 0.23 mA 0.93 mA/A + 0.23 mA 1.2 mA/A + 0.23 mA 3.5 mA/A + 0.23 mA 10 mA/A + 0.40 mA 2.46 mA/A + 1.2 mA	Keysight 34461A

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
Resistance - Source ³	Up to 11 Ω (11 to 33) Ω (33 to 111) Ω (110 to 330) Ω 330 Ω to 1.1k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω 330 k Ω to 1.19 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω 330 M Ω to 1.1 G Ω	0.12 m Ω / Ω + 1.2 m Ω 0.12 m Ω / Ω + 1.7 m Ω 27 $\mu\Omega$ / Ω + 1.6 m Ω 24 $\mu\Omega$ / Ω + 2.3 m Ω 25 $\mu\Omega$ / Ω + 2.3 m Ω 26 $\mu\Omega$ / Ω + 2.3 m Ω 25 $\mu\Omega$ / Ω + 2.3 m Ω 23 $\mu\Omega$ / Ω + 0.23 Ω 23 $\mu\Omega$ / Ω + 0.23 Ω 26 $\mu\Omega$ / Ω + 2.3 Ω 35 $\mu\Omega$ / Ω + 2.3 Ω 48 $\mu\Omega$ / Ω + 35 Ω 0.12 m Ω / Ω + 58 Ω 0.28 m Ω / Ω + 2.9 k Ω 0.47 m Ω / Ω + 3.5 k Ω 2.3 $\mu\Omega$ / Ω + 0.12 M Ω 12 $\mu\Omega$ / Ω + 0.50 M Ω	Fluke 5520A SC1100
Resistance - Measure ³	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	23 $\mu\Omega$ / Ω + 86 $\mu\Omega$ 17 $\mu\Omega$ / Ω + 0.64 m Ω 15 $\mu\Omega$ / Ω + 0.86 m Ω 15 $\mu\Omega$ / Ω + 8.6 $\mu\Omega$ 15 $\mu\Omega$ / Ω + 86 $\mu\Omega$ 21 $\mu\Omega$ / Ω + 2.4 Ω 61 $\mu\Omega$ / Ω + 0.12 k Ω 0.58 m Ω / Ω + 3.5 k Ω 5.8 m Ω / Ω + 0.33 M Ω	HP 3458A
Electrical Simulation of Thermocouple Indicators - Source and Measure ³ Type B	(600 to 800) $^{\circ}\text{C}$ (800 to 1 000) $^{\circ}\text{C}$ (1 000 to 1 550) $^{\circ}\text{C}$ (1 550 to 1 820) $^{\circ}\text{C}$	0.34 $^{\circ}\text{C}$ 0.26 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$ 0.26 $^{\circ}\text{C}$	Fluke 5520A SC1100
Type C	(0 to 150) $^{\circ}\text{C}$ (150 to 650) $^{\circ}\text{C}$ (650 to 1 000) $^{\circ}\text{C}$ (1 000 to 1 800) $^{\circ}\text{C}$ (1 800 to 2 316) $^{\circ}\text{C}$	0.23 $^{\circ}\text{C}$ 0.20 $^{\circ}\text{C}$ 0.24 $^{\circ}\text{C}$ 0.39 $^{\circ}\text{C}$ 0.65 $^{\circ}\text{C}$	
Type E	(-250 to -100) $^{\circ}\text{C}$ (-100 to -25) $^{\circ}\text{C}$ (-25 to 350) $^{\circ}\text{C}$ (350 to 650) $^{\circ}\text{C}$ (650 to 1 000) $^{\circ}\text{C}$	0.39 $^{\circ}\text{C}$ 0.12 $^{\circ}\text{C}$ 0.11 $^{\circ}\text{C}$ 0.12 $^{\circ}\text{C}$ 0.16 $^{\circ}\text{C}$	

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment	
Electrical Simulation of Thermocouple Indicators - Source and Measure ³ (cont.)	Type B	(600 to 800) °C	Fluke 5520A SC1100	
		(800 to 1 000) °C		
		(1 000 to 1 550) °C		
		(1 550 to 1 820) °C		
	Type C	(0 to 150) °C		0.34 °C
		(150 to 650) °C		0.26 °C
		(650 to 1 000) °C		0.23 °C
		(1 000 to 1 800) °C		0.26 °C
		(1 800 to 2 316) °C		0.23 °C
	Type E	(-25 to 350) °C		0.20 °C
		(350 to 650) °C		0.24 °C
		(650 to 1 000) °C		0.39 °C
		(1 000 to 1 800) °C		0.12 °C
		(1 800 to 2 316) °C		0.11 °C
	Type J	(-250 to -100) °C		0.12 °C
		(-100 to -25) °C		0.16 °C
		(-210 to -100) °C		0.39 °C
		(-100 to -30) °C		0.12 °C
		(-30 to 150) °C		0.11 °C
		(150 to 760) °C		0.13 °C
		(760 to 1 200) °C		0.13 °C
	Type K	(-200 to -100) °C		0.18 °C
		(-100 to -25) °C		0.26 °C
		(-25 to 120) °C		0.14 °C
	(120 to 1 000) °C	0.13 °C		
	(1 000 to 1 372) °C	0.20 °C		
Type L	(-200 to -100) °C	0.31 °C		
	(-100 to 800) °C	0.29 °C		
	(800 to 900) °C	0.20 °C		
Type N	(-200 to -100) °C	0.13 °C		
	(-100 to -25) °C	0.29 °C		
	(-25 to 120) °C	0.17 °C		
	(120 to 410) °C	0.15 °C		
	(410 to 1 300) °C	0.14 °C		
	(410 to 1 300) °C	0.21 °C		
Type R	(0 to 250) °C	0.44 °C		
	(250 to 400) °C	0.27 °C		
	(400 to 1 000) °C	0.26 °C		
	(1 000 to 1 767) °C	0.26 °C		
	(1 000 to 1 767) °C	0.31 °C		



Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment	
Electrical Simulation of Thermocouple Indicators ³ (cont.) Type R Thermocouple Probe Type S	(660 to 1 000) °C	(0.7 + 0.0025Y) °C	Fluke 5520A SC1100	
	(0 to 250) °C	0.47 °C		
	(250 to 1 000) °C	0.36 °C		
	(1 000 to 1 400) °C	0.37 °C		
	(1 400 to 1 767) °C	0.46 °C		
Type T	(-250 to -150) °C	0.49 °C		
	(-150 to 0) °C	0.19 °C		
	(0 to 120) °C	0.12 °C		
	(120 to 400) °C	0.11 °C		
Type U	(-200 to 0) °C	0.56 °C		
	(0 to 600) °C	0.27 °C		
Electrical Simulation of RTDs ³ Pt 385 (100 Ω)	(-200 to 0) °C	0.04 °C	Fluke 5520A SC1100	
	(0 to 100) °C	0.06 °C		
	(100 to 300) °C	0.07 °C		
	(300 to 400) °C	0.08 °C		
	(400 to 630) °C	0.10 °C		
	(630 to 800) °C	0.18 °C		
DC Power - Source ³ (1 to 1 000) V	1.5 W	0.06 % of Watts Output		Fluke 5520A SC1100
	6 W	0.05 % of Watts Output		
	12 W	0.07 % of Watts Output		
	20 W	0.06 % of Watts Output		
	30 W	0.10 % of Watts Output		
	60 W	0.08 % of Watts Output		
	120 W	0.05 % of Watts Output		
	500 W	0.07 % of Watts Output		
	1.5 kW	0.07 % of Watts Output		
	6 kW	0.10 % of Watts Output		
	30 kW	0.09 % of Watts Output		
	50 kW	0.09 % of Watts Output		
AC Power - Source ³ (45 to 65) Hz P=1 (1 to 1 000) V	1.5 W	0.07 % of Watts Output	Fluke 5520A SC1100	
	6 W	0.07 % of Watts Output		
	12 W	0.07 % of Watts Output		
	20 W	0.07 % of Watts Output		
	30 W	0.07 % of Watts Output		
	60 W	0.07 % of Watts Output		
	120 W	0.07 % of Watts Output		
	500 W	0.11 % of Watts Output		
	1500 W	0.08 % of Watts Output		
	6 kW	0.11 % of Watts Output		
	30 kW	0.11 % of Watts Output		
	50 kW	0.01 % of Watts Output		

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
Capacitance - Source³ (4.7 to 470) nF 1 µF to 1.1 mF	10Hz to 1kHz (10 to 300) Hz	3.9pF/nF + 42 pF 4.5nF/uF + 2.0 nF	Fluke 5520A SC1100
Oscilloscopes³ DC Signal into 50 Ω Load into 1 MΩ Load	(-6.6 to 6.6) V (-130 to 130) V	1.9 mV/V + 46 µV 0.39 mV/V + 46 µV	
Square Wave 50 Ω Load	1 mV to 6.6 V p-p 10 Hz to 10 kHz	1.9 mV/V + 46 µV	
1 MΩ Load	1 mV to 130 V p-p 10 Hz to 10 kHz	1.2 mV/V + 46 µV	
Leveled Sine Wave - Flatness Relative to 50 kHz [5 mV to 5.5 V] [5mV to 3.5V]	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1 100) MHz	12 mV/V + 0.12 mV 16 mV/V + 0.12 mV 31 mV/V + 0.12 mV 39 mV/V + 0.12 mV	
Time Marker into 50 Ω Load-Source ⁴	5 s to 50 ms 20 ms to 100 ns (50 to 20) ns 10 ns (5 to 1) ns	(25 + t x 1 000) ⁷ parts in 10 ⁶ 2.5 parts in 10 ⁶ 2.5 parts in 10 ⁶ 2.5 parts in 10 ⁶ 2.5 parts in 10 ⁶	
Edge Specs into 50 Ω Load - Source Rise Time Amplitude Frequency	≤ 300 ps 5 mV to 2.5V 1 kHz to 10 MHz	0 ps /-120ps 16 mV/V + 0.23 mV 1.9 parts in 10 ⁶ of setting	
Wave Generator - Source³ Amplitude (10 Hz to 10 kHz) Square, Sine, Triangle into 1 MΩ Square, Sine, Triangle into 50 Ω Frequency ³	(1.8 mV to 55 V) p-p (1.8 mV to 2.5 V) p-p 10 Hz to 100 kHz	30 mV/V + 0.10 mV 30 mV/V + 0.10 mV 25 parts in 10 ⁶ Hz + 15 mHz	

II. Time & Frequency

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
Frequency - Source ³	0.01 Hz to 2 MHz 10 MHz	2 μ Hz/Hz + 8 μ Hz 1 part in 10^{-11} Hz	Fluke 5520A SC1100 Spectracom 8194
Stopwatches /Timers ³	Up to 24 hours	5.8 ms	Fluke 5520A SC1100 with Spectracom 8194 and Fluke PM6680B
Tachometers ³	(60 to 99,999) rpm	0.58 rpm	Fluke 5520A SC1100 with Spectracom 8194

III. Thermodynamic

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
Temperature - Source	(-45 to 155) °C	0.05 °C	Ametek RTC 157B, PRT STS 200 B915
Temperature - Measure ³	(-250 to 660) °C Ambient	(0.03 + 0.00042Y) °C 0.3 °C	Advanced Sensing Products WSP660 PRT and HP 3458A Rotronic Hygropalm
IR Temperature - Source ³	(122 to 932) °F	17 °F	Hart 9132
Humidity	11 % 33 % 75 % Ambient	1.2 % 1.2 % 1.6 % 1.8 %	Saturated Salt Solutions LiCl MgCl NaCl Rotronic Hygropalm

IV. Mechanical

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
Torque Wrenches ^{3,6}	5 to 50) lbf-in (40 to 400) lbf-in (100 to 1 000) lbf-in (25 to 250) lbf-ft	(0.25 + 0.026T) lbf-in (2.1 + 0.0053T) lbf-in (3.8 + 0.0015T) lbf-in (0.7 + 0.023T) lbf-ft	CDI 5000ST and 2000-400-02
Pressure Gages, Transducers - Measure ^{3,7}	(3 to 30) psi (20 to 100) psi (100 to 500) psi (200 to 1 000) psi (1 000 to 5 000) psi (2 000 to 10 000) psi	(0.0086 + 0.00092P) psi (0.038 + 0.00087P) psi (0.04 + 0.0011P) psi (0.076 + 0.0011P) psi (0.40 + 0.0011P) psi (0.69 + 0.0011P) psi	Crystal 30PSIXP2I Crystal 100PSIXP2I Crystal 500PSIXP2I Crystal 1KPSIXP2I Crystal 5KPSIXP2I Crystal 10KPSIXP2I
Pressure Gages, Transducers – Measure ⁷	(-15 to 0) psi (0 to 30) psi (0 to 100) psi	(0.006 - 0.00072P) psi (0.0036 + 0.000048P) psi (0.0042 + 0.00011P) psi	GE Druck Pace 1002
	(100 to 1 500) psi (1 500 to 15 000) psi	(0.0049 + 0.000076P) psi (0.000075 + 0.000086P) psi	Mensor CPB5000

V. Dimensional

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(\pm)]	Reference Standard or Equipment
Micrometers ³	Up to 1 in (2 to 12) in (12 to 24) in	37 μ in 150 μ in 610 μ in	Grade 2 Gage Blocks
Calipers ^{3,5}	Up to 6 in (6 to 12) in (12 to 24) in	(290 + 0.51L) μ in 300 μ in 350 μ in	
Indicators	Up to 1 in	140 μ in	P&W Model C Supermicrometer
Plain Plug and Pin Gages	Up to 1 in	51 μ in	P&W Model C Supermicrometer, Grade 2 Gage Blocks

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
Gage Blocks ⁵	Up to 4 in (5 to 20) in	(3.7 uin + 0.97L) uin (4.7 uin + 2.8L) uin	P&W LMU 1000A Grade 2 Gage Blocks
Setting Standards ⁵	Up to 40 in	81 uin	P&W LMU1000A Grade 2 Gage Blocks
Steel Tapes and Rules	Up to 25 ft	(590 +29.3L) uin	P&W LMU1000A Grade 2 Gage Blocks
Surface Plates Flatness	Diagonal up to 5 ft	61 uin	Mahr Federal EMD-832P-48-W2 Electronic Levels
Thread Plugs Pitch Diameter Major Diameter	Up to 5 in Up to 5 in	11 μin 51 μin	P&W Model C Supermicrometer, Grade 2 Gage Blocks, Thread Wires

Notes:

1. Calibration and Measurement Uncertainties (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of k=2, unless otherwise indicated.
2. This laboratory's capabilities include both in-laboratory and 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. On-site calibration service is available for this parameter.
4. The use of (t) signifies Time in seconds.
5. (L) stands for the nominal value of Length being measured in inches.
6. (T) refers to the nominal value of Torque being measured in lbf·in or lbf·ft.
7. (P) is the nominal value of Pressure being measured in psi.
8. (Y) stands for the nominal value of Temperature being measured in °C.



 Vice President