



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

Precision Repair and Calibration Inc.

9150 Isanti Street NE

Blaine MN 55449

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

ISO/IEC 17025:2005

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

while demonstrating technical competence in the fields of

CALIBRATION and TESTING

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

ACT-1177

Certificate Number


ANAB Approval

Certificate Valid: 08/01/2017-07/07/2019
Version No. 011 Issued: 08/01/2017



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 April 2017).



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

Precision Repair and Calibration Inc.

9150 Isanti Street NE
Blaine, MN 55449
Brian McDonald
763-784-1704

CALIBRATION

Valid to: **July 7, 2019**

Certificate Number: **ACT-1177**

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance - Source ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 330 kΩ 330 kΩ 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	0.58 mΩ + 31 μΩ/Ω 0.58 mΩ + 23 μΩ/Ω 0.58 Ω + 22 μΩ/Ω 0.58 Ω + 25 μΩ/Ω 5.8 Ω + 25 μΩ/Ω 5.8 Ω + 47 μΩ/Ω 58 Ω + 0.10 mΩ/Ω 58 Ω + 0.20 mΩ/Ω 0.58 kΩ + 0.39 mΩ/Ω 5.8 kΩ + 2.3 mΩ/Ω 58 kΩ + 12 mΩ/Ω	Fluke 5520A
Resistance - Measure ¹	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	58 μΩ + 10 μΩ/Ω 58 μΩ + 12 μΩ/Ω 0.58 mΩ + 10 μΩ/Ω 5.8 mΩ + 10 μΩ/Ω 57 mΩ + 10 μΩ/Ω 0.58 Ω + 10 μΩ/Ω 5.8 Ω + 50 μΩ/Ω 58 mΩ + 0.50 mΩ/Ω 0.58 Ω + 5 mΩ/Ω	HP 3458A Opt 002
DC Voltage - Source ¹	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33. to 330) V 100 V to 1 kV	1 μV + 16 μV/V 6 μV + 9 μV/V 60 μV + 10 μV/V 0.59 mV + 14 μV/V 5.9 mV + 14 μV/V	Fluke 5520A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage - Measure ¹	Up to 100 mV	1 μ V + 5 μ V/V	HP 3458A Opt 002
	100 mV to 1 V	1 μ V + 4 μ V/V	
	(1 to 10) V	2 μ V + 4 μ V/V	
	(10 to 100) V	1 μ V + 6 μ V/V	HP 3458A with Fluke 80K6 Probe
	100 V to 1 kV	58 μ V + 6 μ V/V	
	(1 to 6) kV	1 μ V + 0.1 V/V	HP 3458A with Fluke 80K40 Probe
	(6 to 40) kV	1 μ V + 0.5 V/V	
DC Current - Source ¹	Up to 330 μ A	20 nA + 0.12 mA/A	Fluke 5520A
	330 μ A to 3.3 mA	0.25 μ A + 78 μ A/A	
	(3.3 to 33) mA	0.61 μ A + 78 μ A/A	
	(33 to 330) mA	6.1 μ A + 78 μ A/A	
	330 mA to 1.1 A	66 μ A + 0.16 mA/A	
	(1.1 to 3) A	66 μ A + 0.30 mA/A	
	(3 to 11) A	0.70 mA + 0.39 mA/A	
	(11 to 20) A	0.82 mA + 0.78 mA/A	
DC Current - Measure ¹	Up to 100 nA	40 pA + 35 μ A/A	HP 3458A Opt 002
	100 nA to 1 μ A	40 pA + 25 μ A/A	
	(1 to 10) μ A	0.10 nA + 25 μ A/A	
	(10 to 100) μ A	0.80 nA + 25 μ A/A	
	100 μ A to 1 mA	5 nA + 25 μ A/A	
	(1 to 10) mA	50 nA + 25 μ A/A	
	(10 to 100) mA	0.50 μ A + 40 μ A/A	
100 mA to 1 A	10 μ A + 0.12 mA/A	HP 3458A with Current Shunts	
	(1 to 1 200) A		10 μ A + 0.10 mA/A
AC Voltage - Source ¹	(1 to 33) mV		Fluke 5520A
	(10 to 45) Hz	7.4 μ V + 0.62 mV/V	
	45 Hz to 10 kHz	7.4 μ V + 0.12 mV/V	
	(10 to 20) kHz	7.4 μ V + 0.16 mV/V	
	(20 to 50) kHz	7.4 μ V + 0.78 mV/V	
	(50 to 100) kHz	10 μ V + 2.7 mV/V	
(100 to 500) kHz	39 μ V + 6.2 mV/V		



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage - Source ¹	(33 to 330) mV (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	8.5 μV + 0.39 mV/V 8.5 μV + 0.11 mV/V 8.5 μV + 0.13 mV/V 8.5 μV + 0.27 mV/V 26 μV + 0.62 mV/V 55 μV + 1.5 mV/V	Fluke 5520A
	330 mV to 3.3 V (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	3.4 mV + 0.23 mV/V 4.1 mV + 0.12 mV/V 0.18 mV + 0.15 mV/V 0.18 mV + 0.23 mV/V 0.20 mV + 0.55 mV/V 0.50 mV + 1.9 mV/V	
	(3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.77 mV + 0.23 mV/V 0.74 mV + 0.12 mV/V 0.74 mV + 0.19 mV/V 0.74 mV + 0.27 mV/V 1.4 mV + 0.70 mV/V	
	(33 to 330) V 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	6.0 mV + 0.15 mV/V 7.4 mV + 0.16 mV/V 7.4 mV + 0.20 mV/V 7.4 mV + 0.23 mV/V 39 mV + 1.6 mV/V	
	330 V to 1 kV 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	58 mV + 0.23 mV/V 58 μV + 0.20 mV/V 59 mV + 0.23 mV/V	
AC Voltage - Measure ¹	(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	10 μV + 32 μV/V 10 μV + 32 μV/V 10 μV + 32 μV/V 10 μV + 32 μV/V 10 μV + 32 μV/V 10 μV + 32 μV/V	HP 3458A Opt 002



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment	
AC Voltage - Measure ¹	(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	10 μ V + 32 μ V/V 10 μ V + 32 μ V/V 10 μ V + 32 μ V/V 10 μ V + 32 μ V/V 10 μ V + 32 μ V/V 10 μ V + 32 μ V/V 10 μ V + 32 μ V/V 10 μ V + 32 μ V/V	HP 3458A Opt 002	
	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	12 μ V + 32 μ V/V 12 μ V + 32 μ V/V 12 μ V + 32 μ V/V 12 μ V + 32 μ V/V 12 μ V + 32 μ V/V 12 μ V + 32 μ V/V 12 μ V + 32 μ V/V 12 μ V + 32 μ V/V		
	(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	57 μ V + 32 μ V/V 57 μ V + 32 μ V/V 57 μ V + 32 μ V/V 57 μ V + 32 μ V/V 57 μ V + 32 μ V/V 57 μ V + 32 μ V/V 57 μ V + 32 μ V/V 57 μ V + 32 μ V/V		
	(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	0.58 mV + 32 μ V/V 0.58 mV + 32 μ V/V 0.58 mV + 32 μ V/V 0.58 mV + 32 μ V/V 0.58 mV + 32 μ V/V 0.58 mV + 32 μ V/V 0.58 mV + 32 μ V/V		
	100 V to 1 kV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	11 μ V + 32 μ V/V 11 μ V + 32 μ V/V 11 μ V + 32 μ V/V 11 μ V + 32 μ V/V 11 μ V + 32 μ V/V		HP 3458A with Fluke 80K6 Probe



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage - Measure ¹	(1 to 6) kV 1 Hz to 1 kHz	12 μ V + 32 μ V/V	HP 3458A with Fluke 80K40 Probe
	(6 to 40) kV 1 Hz to 1 kHz	11 μ V + 32 μ V/V	
AC Current – Source ¹	(29 to 330) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	5.2 μ A + 2 nA/A 5.2 μ A + 1 nA/A 0.10 μ A + 1 nA/A 0.90 μ A + 2 nA/A 1.1 μ A + 4 nA/A 2.1 μ A + 12 nA/A	Fluke 5520A
	330 μA to 3.3 mA (10 to 20) Hz 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.78 μ A + 2 nA/A 0.78 μ A + 1 nA/A 1.0 μ A + 2 nA/A 1.6 μ A + 4 nA/A 3.1 μ A + 8 nA/A	
	(3.3 to 33) mA (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	10 μ A + 1 nA/A 10 μ A + 0.40 nA/A 10 μ A + 1 nA/A 16 μ A + 1 nA/A 16 μ A + 3 nA/A	
	(33 to 330) mA (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	17 μ A + 1 nA/A 17 μ A + 0.40 nA/A 39 μ A + 1 nA/A 78 μ A + 1 nA/A 0.31 mA + 0.40 nA/A	
	330 mA to 3 A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	87 μ A + 1 nA/A 87 μ A + 0.40 nA/A 0.78 mA + 0.40 nA/A 3.9 mA + 2 nA/A	
	(3 to 11) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	16 μ A + 0.40 nA/A 16 μ A + 1 nA/A 16 μ A + 20 nA/A	Fluke 5520A-600
	(11 to 20.5) A 45 Hz to 1 kHz (1 to 5) kHz	39 μ A + 1 nA/A 39 μ A + 20 nA/A	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current – Source ¹ (cont.)	(20 to 150) A (45 to 100) Hz	87 μ A + 5 mA/A	Fluke 5520A-600 with S-ACA Coil
	(150 to 550) A 45 Hz to 1 kHz	1.6 mA + 5 mA/A	
	(550 to 1 000) A 45 Hz to 1 kHz	3.9 mA + 5 mA/A	
AC Current - Measure ¹	Up to 100 μA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	20 nA + 5 μ A/A 20 nA + 5 μ A/A 20 nA + 5 μ A/A 20 nA + 5 μ A/A	HP 3458A Opt 002
	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	20 nA + 5 μ A/A 20 nA + 5 μ A/A 20 nA + 5 μ A/A 20 nA + 5 μ A/A 20 nA + 5 μ A/A 40 nA + 5 μ A/A 0.15 μ A + 5 μ A/A	
	(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	60 nA + 5 μ A/A 60 nA + 5 μ A/A 60 nA + 5 μ A/A 60 nA + 5 μ A/A 60 nA + 5 μ A/A 70 nA + 5 μ A/A 0.16 μ A + 5 μ A/A	
	(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	0.58 μ A + 5 μ A/A 0.58 μ A + 5 μ A/A 0.58 μ A + 5 μ A/A 0.58 μ A + 5 μ A/A 0.58 μ A + 5 μ A/A 0.58 μ A + 5 μ A/A 0.60 μ A + 5 μ A/A	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current - Measure ¹	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	5.8 μ A + 5 μ A/A 5.8 μ A + 5 μ A/A 5.8 μ A + 5 μ A/A 5.8 μ A + 5 μ A/A 5.8 μ A + 5 μ A/A 5.8 μ A + 5 μ A/A	HP 3458A Opt 002
	(1 to 1 200) A 1 Hz to 2 MHz	10 μ A + 0.11 mA/A	HP 3458A Opt 002 with Current Shunts
DC Power - Source ¹	33 mV to 1 kV 330 μ A to 330 mA 330 mA to 11 A (11 to 20.5) A	5.8 μ W + 0.20 nW/W 0.58 mW + 1 nW/W 0.58 mW + 1 nW/W	Fluke 5520A
AC Power - Source ¹	(33 to 330) mV (3.3 to 330) mA 330 mA to 20.5 A 330 mV to 1 kV (3.3 to 90) mA (90 to 330) mA (0.33 to 0.9) A 900 mA to 11 A (11 to 20.5) A	5.8 μ W + 1 nW/W 0.58 mW + 1 nW/W 5.8 μ W + 1 nW/W 5.8 μ W + 20 pW/W 0.58 mW + 1 nW/W 0.58 mW + 1 nW/W 0.58 mW + 0.10 nW/W	Fluke 5520A
Capacitance – Source ¹	190 pF to 3.3 nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF 330 nF to 1.1 μ F (1.1 to 3.3) μ F (3.3 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F 330 μ F to 3.3 mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	10 pF + 0.40 nF/F 10 pF + 0.20 nF/F 80 pF + 0.20 nF/F 0.20 nF + 0.20 nF/F 0.80 nF + 0.20 nF/F 2.3 nF + 0.20 nF/F 7.8 nF + 0.20 nF/F 23 nF + 0.30 nF/F 78 nF + 0.35 nF/F 0.23 μ F + 0.35 nF/F 58 nF + 0.35 nF/F 0.58 μ F + 0.35 nF/F 0.58 μ F + 0.58 nF/F 5.8 μ F + 0.85 nF/F	Fluke 5520A



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of Thermocouples ¹ Type B	(600 to 800) °C	0.34 °C	Fluke 5520A
	(800 to 1 000) °C	0.26 °C	
	(1 000 to 1 550) °C	0.26 °C	
	(1 550 to 1 820) °C	0.20 °C	
Type C	(0 to 150) °C	0.23 °C	
	(150 to 650) °C	0.20 °C	
	(650 to 1 000) °C	0.24 °C	
	(1 000 to 1 800) °C	0.39 °C	
	(1 800 to 2 316) °C	0.65 °C	
Type E	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	
Type J	(-210 to -100) °C	0.21 °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	0.18 °C	
Type K	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 120) °C	0.12 °C	
	(120 to 1 000) °C	0.20 °C	
	(1 000 to 1 372) °C	0.31 °C	
Type L	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.20 °C	
	(800 to 900) °C	0.13 °C	
Type N	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.17 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °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	0.31 °C	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Type S	(0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C	0.37 °C 0.28 °C 0.29 °C 0.36 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.49 °C 0.19 °C 0.12 °C 0.11 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.43 °C 0.21 °C	Fluke 5520A-600
Electrical Simulation of RTDs ¹ Pt 395 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.04 °C 0.04 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C	
Pt 3926 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.04 °C 0.04 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C	
Pt 3916 100 Ω	(-200 to -190) °C (-180 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.20 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.06 °C 0.07 °C 0.08 °C 0.18 °C	Fluke 5520A
Pt 385 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.03 °C 0.03 °C 0.03 °C 0.04 °C 0.09 °C 0.10 °C 0.11 °C 0.13 °C	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Pt 385 500 Ω	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
Pt 385 1000 Ω	(-200 to -80) °C	0.03 °C	Fluke 5520A
	(-80 to 0) °C	0.03 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.05 °C	
	(300 to 400) °C	0.06 °C	
	(400 to 600) °C	0.06 °C	
PtNi 385 120 Ω	(-80 to 0) °C	0.06 °C	Fluke 5520A
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.11 °C	
Cu 427 10 Ω	(-100 to 260) °C	0.23 °C	
Oscilloscopes ¹			Fluke 5520A SC600
Square Wave Signal Into 50 Ω at 1 kHz Into 1 MΩ at 1 kHz	1 mV to 1.1 kV 1 mV to 1.1 kV	2.0 mV/V + 30 μV 0.76 mV/V + 30 mV	
Leveled Sine Wave Amplitude	50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	16 mV/V + 0.23 mV 27 mV/V + 0.23mV 31 mV/V + 0.23 mV 47 mV/V + 0.23 mV	
Leveled Sine Wave Flatness (relative to 50 kHz)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	12 mV/V + 78 μV 16 mV/V + 78 μV 31 mV/V + 78 μV	
Time Marker 50 Ω Source and Period	5 s to 50 ms 20 ms to 2 ns	19 μs/s + 54 μs 1.9 μs/s	
Rise Time	≤ 300 ps	(+ 0 / - 78) ps	



Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Calipers ¹	Up to 60 in	(420 + 28L) μin	Grade 2 Gage Blocks
Caliper Masters	Up to 12 in	100 μin	Grade 2 Gage Blocks, Electronic Indicator, Surface Plate
CMMs ¹			
Linear Displacement	Up to 120 in length	(5 + 4L) μin	Laser System
Linear Displacement	Up to 28 in length	(14 + 7L) μin	Check Master
Volumetric	Up to 27 in	110 μin	Ball Bar
Electronic Indicator	Up to 0.05 in	23 μin	Grade 2 Gage Blocks
Gage Blocks	Up to 20 in	(1.4 + 1.9L) μin	Laser Ruler, Grade 1 Master Gage Block Set
Height Gages ¹	Up to 40 in	(47 + 9L) μin	Grade 2 Gage Blocks, Surface Plate
Height Masters	Up to 18 in	(98 + 5L) μin	Electronic Indicator, Gage Blocks, Surface Plate
Indicators ¹	Up to 5 in	(32 + 55L) μin	Grade 2 Gage Blocks, Micrometer Head
Ring Gages Inside Dimension	Up to 11 in	25 μin	Universal Measuring Machine, Master Rings
Laser Micrometer ¹	Up to 2 in	20 μin	Master Pin Gages
Length Standards	Up to 36 in	(39 + 6L) μin	Universal Measuring Machine, Gage Blocks, Bench Micrometer
Micrometers, OD ¹	Up to 36 in	(53 + 7L) μin	Grade 2 Gage Blocks
Micrometers, ID ¹	Up to 40 in	(290 + 2L) μin	Gage Blocks, Bench Micrometer, Universal Measuring Machine



Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Micrometers, Depth ¹	Up to 12 in	(530 + 1L) μin	Mike Master, Gage Blocks
Micrometer Heads	Up to 2 in	50 μin	Gage Blocks, Electronic Indicator, Optical Flat, Universal Measuring Machine
Mike Masters	Up to 6 in	61 μin	Gage Blocks, Surface Plate, Electronic Indicator
Pin Gages (OD) ¹	Up to 1 in	21 μin	Master Pin Gage, Laser Micrometer
Plug Gages (OD)	Up to 20 in	(8 + 7.1L) μin	Universal Measuring Machine, Grade 2 Gage Blocks
Bore Gages ¹	Up to 12 in	(220 + 19L) μin	Gage Blocks, Gage Block Accessory, Master Ring Gages
Optical Comparators ¹	Up to 12 in Linearity Magnification	110 μin 53 μin	Glass Scales, Precision Balls
Microscopes ¹	Up to 12 in Linearity Magnification	110 μin 53 μin	Gage Blocks, Glass Scales
VMMs ¹	Up to 12 in Linearity Magnification	110 μin 180 μin	Glass Scales, Laser
Master Setting Disc	Up to 20 in	(8 + 7L) μin	Gage Blocks, Universal Measuring Machine
Precision Balls	Up to 2 in	22 μin	Universal Measuring Machine
Snap Gages ¹	Up to 4 in	98 μin	Gage Blocks, Optical Flat
Surface Plates ¹ - Flatness - Repeatability	Up to 16 ft diagonal Up to 16 ft diagonal	57 μin 32 μin	Precision Levels, Repeat-o-Meter
Thread Plug Gages ¹ Thread Set Plugs	Up to 10 in	88 μin	Bench Micrometer, Grade 2 Gage Blocks, Thread Measuring Wires
Thread Ring Gages	Up to 10 in	110 μin	Thread Set Plug Masters

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Tapered Thread Plug Gages	Up to 7 in	520 μin Basic 190 μin PD	Thread Measuring Wires, Bench Micrometer, O.D. Micrometer
Tapered Thread Ring Gages, Crest Check	Up to 7 in	360 μin Basic 630 μin Standoff	Master Tapered Thread Plugs, O.D. Micrometer
Rulers	Up to 72 in	(1 919 + 1.5L) μin	Microscope, Gage Blocks
Rulers ¹	Up to 72 in	(18 000 + 0.6L) μin	Gage Blocks
Tape Measures ¹	Up to 600 in	37 000 μin	Gage Blocks
Angle Blocks	Up to 45 deg	64 μin	Gage Blocks, Sine Bar, Indicator, Surface Plate
Angle Leaf	Up to 12 in	(250 + 2L) μin	VMM
1-2-3 Blocks	Up to 6 in	35 μin	Gage Blocks, Surface Plate, Indicator
Radius Gages	Up to 12 in	(250 + 2L) μin	VMM
V-Blocks	Up to 6 in	110 μin	Pin Gages, Surface Plate, Indicator
Parallels and Straight Edges ¹	Up to 48 in	61 μin	Gage Blocks, Indicator Surface Plate
Steel Squares	Up to 18 in	(37 + 6L) μin	Surface Plate, Indicator, Master Square
Feeler Gages	Up to 0.5 in	95 μin	Gage Blocks, Super Micrometer
Comptor Gage Indicators	Up to 0.04 in	130 μin	Comptor Master
Roundness Testers ¹ Roundness Flatness Squareness	Up to 12 in	4.8 μin 9.3 μin 45 μin	Cylindrical Square, Master Flat, Master Ball
Profilometers ¹	Up to 250 μin	6.4 μin	Profilometer Standard
Protractors	(0 to 360) deg	0.16 deg	Angle Blocks, Surface Plate, Master Square
Chamfer Gages ¹	Up to 3 in	1 200 μin	Chamfer Checker Gage



Mass

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ³	Reference Standard, Method and/or Equipment
Force Gage ¹	Up to 10 lb (10 to 110) lb (110 to 500) lb	0.05 lb 0.15 lb 0.46 lb	Test Weights
Laboratory Balance ¹	Up to 6 000 g	(0.01 + 0.000 000 14W) mg	Weight Kit
Industrial Scales ¹	Up to 500 lb	0.012 lb	Weight Kit
Pipettes ¹	0.5 µL to 10 mL	(0.61 + 0.002 4) µL	Laboratory Balances
Pressure Gages ¹	Up to 10 000 psig	0.035 % of Full Scale	Dead Weight Tester
Pressure Gages ¹	(-15 to 300) psig (300 to 10 000) psig	0.042 % of Full Scale 0.035 % of Full Scale	Pressure Monitor
Hardness Testers ¹	Rockwell		Test Blocks
	(High) HRC	1.3 HRC	
	(Medium) HRC	1.2 HRC	
	(Low) HRC	1.2 HRC	
	(High) HRB	1.5 HRBw	
	(Medium) HRB	1.6 HRBw	
	(Low) HRB	2.3 HRBw	
	(High) HR15N	1.2 HR15N	
	(Medium) HR15N	1.2 HR15N	
	(Low) HR15N	1 HR15N	
	(High) HR30N	1.2 HR30N	
	(Medium) HR30N	1.3 HR30N	
	(Low) HR30N	1.5 HR30N	
	(High) HR45N	1.4 HR45N	
	(Medium) HR45N	1.7 HR45N	
	(Low) HR45N	1.7 HR45N	
(High) HR15T	1.1 HR15T		
(Medium) HR15T	1.1 HR15T		
(20 to 79) HR15T	1.3 HR15T		
(57 to 85) HR30T	1.1 HR30T		
(50 to 56) HR30T	1.1 HR30T		
(20 to 49) HR30T	1.4 HR30T		

Mass

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ³	Reference Standard, Method and/or Equipment
	Brinnell (100 to 240) HBW (240 to 600) HBW Above 600 HBW	1 HBW 1.9 HBW 5.1 HBW	
	Vickers (170 to 200) HV (200 to 400) HV (400 to 700) HV	1.6 HV 5 HV 13 HV	
	Knoop (170 to 200) HK (200 to 400) HK (400 to 700) HK	1 HK 2.4 HK 5.5 HK	
Torque Transducers Torque Watches	Up to 10 ozf·in (10 ozf·in to 50 ozf·in) (50 ozf·in to 10 lbf·in) (10 lbf·in to 50 lbf·in) (50 lbf·in to 100 lbf·in) (100 lbf·in to 250 lbf·in) (250 lbf·in to 600 lbf·in)	0.023 ozf·in 0.05 ozf·in 0.005 lbf·in 0.013 lbf·in 0.053 lbf·in 0.08 lbf·in 0.16 lbf·in	Dead Weights, Torque Arms and Wheels
Torque Wrenches ¹	Up to 26 oz·in (26 ozf·in to 50 lbf·in) (50 lbf·in to 500 lbf·in) (500 lbf·in to 150 lbf·ft) (150 lbf·ft to 250 lbf·ft) (250 lbf·ft to 600 lbf·ft) (600 lbf·ft to 1 000 lbf·ft)	0.24 ozf·in 0.23 lbf·in 0.95 lbf·in 0.38 lbf·in 0.40 lbf·in 3.70 lbf·in 3.80 lbf·in	Torque Transducer System

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature - Measure	(-180 to 0) °C (0 to 100) °C (100 to 200) °C (200 to 400) °C (400 to 600) °C	0.01 °C 0.02 °C 0.02 °C 0.02 °C 0.03 °C	Fluke 1524



Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Humidity ¹ - Measure	(0 to 90) % RH (90 to 100) % RH	1 % RH 2 % RH	Vaisala HMI41, HMP46

Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Frequency – Source ¹	DC to 600 MHz 600 MHz to 40 GHz	5 μHz/Hz 1 μHz/Hz	Fluke 5520A, Agilent E8257D
Frequency - Measure ¹	DC to 12.4 GHz	2.31 X 10 ¹⁰	Phillips PM6681R, Agilent 53131A Frequency Counters
Timers and Stopwatches ¹	1 s to 24 h	0.02 s	Phillips PM6681R Frequency Counter Stop Watch Calibrator

TESTING

Testing – Dimensional Testing/Measurement

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Dimensional Measurement	Up to 6 in Up to 20 in Up to 18 in Up to 1 in Up to 12 in Up to 35 in	(420 + 28L) μin (39 + 6L) μin (9 + 7L) μin (53 + 7L) μin (250 + 2L) μin (150 + 6L) μin	Caliper Bench Micrometer Indicator Micrometer VMM CMM

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. The term (L) indicates Length in inches.
3. The use of (W) signifies applied Weight in milligrams.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1177.



Vice President

