



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

Micro Precision Calibration Pte. Ltd.

Blk 5008 Ang Mo Kio Ave 5

#07-04 TechPlace II, Singapore 569874

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-1969.15

Certificate Number


ANAB Approval

Certificate Valid: 10/21/2016-10/31/2018
Version No. 001 Issued: 10/21/2016



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, & ANSI/NCSL Z540.3-2006

Micro Precision Calibration Pte. Ltd.

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CALIBRATION

Valid to: October 31, 2018

Certificate Number: AC-1969.15

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 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V 220 V to 1.1 kV	10 μ V/V + 0.5 μ V 6 μ V/V + 0.8 μ V 4 μ V/V + 3 μ V 4 μ V/V + 4.5 μ V 4 μ V/V + 4 μ V 5 μ V/V + 5 μ V	Fluke 5720A
Fixed Values	1 V 1.018V 10 V	1.6 μ V/V 1.6 μ V/V 1.2 μ V/V	Fluke 732A
DC Voltage - Measure	Up to 100 mV 100 mV to 1 V (1 to 10) V (20 to 100) V 100 V to 1 kV (1 to 10) kV (10 to 20) kV (20 to 70) kV	6.1 μ V/V + 0.3 μ V 5.0 μ V/V + 0.3 μ V 5.0 μ V/V + 0.5 μ V 7.3 μ V/V + 30 μ V 26 μ V/V + 0.10 mV 0.3 mV/V 0.3 mV/V 0.3 mV/V	Agilent 3458A Opt 002 Vitretek 4640B With HVL-100
DC Current - Source ³	Up to 220 μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	41 μ A/A + 7 nA 34 μ A/A + 8 nA 35 μ A/A + 45 nA 46 μ A/A + 0.8 μ A 82 μ A/A + 13 μ A	Fluke 5720A



Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
DC High Current - Source ³	(2.2 to 11) A	0.17 mA/A	Fluke 5500A
	(11 to 20) A (20 to 1 000) A	1.5 mA/A + 1 mA 4.6 mA/A	Fluke 5220A with 50 turn Coil
DC Current ³ – Measure	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	35 μ A/A + 400 μ A 25 μ A/A + 40 μ A 25 μ A/A + 10 μ A 25 μ A/A + 5 μ A 25 μ A/A + 5 μ A 40 μ A/A + 5 μ A 0.12 mA/A + 10 μ A	HP 3458A
	(1 to 20) A (20 to 300) A	0.14 mA/A 3.2 mA/A	Y5020 Fluke Shunt w/ Multimeter
Inductance - Source at 1 kHz	(1 to 10) mH (10 to 100) mH 100 mH to 1 H (1 to 10) H	0.03 mH 0.15 mH 2.0 mH 11 mH	Genrad 1490-D
Resistance - Source ³ Fixed Points	1 Ω 10 k Ω 1 M Ω to 1G Ω	10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 1.5 m Ω/Ω	Fluke 742-1 Fluke 742-10k Standard Resistor
Resistance - Source ³ Fixed Points	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	91 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 37 $\mu\Omega/\Omega$ 46 $\mu\Omega/\Omega$ 0.1 m Ω/Ω	Fluke 5720A
Resistance - Measure ³	(0 to 100) Ω 100 Ω 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	14 $\mu\Omega/\Omega$ 12 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 55 $\mu\Omega/\Omega$ 0.57 m Ω/Ω + 1.1 k Ω 5.7 m Ω/Ω + 11 k Ω	Agilent 3458A

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
Electrical Simulation of Thermocouples ³ – Type E	-250 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.5 °C 0.17 °C 0.21 °C	Fluke 5500A
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.27 °C 0.17 °C 0.23 °C	
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.5 °C 0.43 °C 0.46 °C 0.46 °C	
Type S	(0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C	0.53 °C 0.41 °C 0.42 °C 0.52 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.71 °C 0.27 °C 0.18 °C 0.16 °C	
Type B	(600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C	0.50 °C 0.38 °C 0.34 °C 0.37 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C	0.45 °C 0.25 °C 0.22 °C 0.20 °C 0.31 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C	0.65 °C 0.40 °C 0.37 °C 0.45 °C	
Type C	(0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C	0.34 °C 0.29 °C 0.35 °C 0.57 °C 0.95 °C	

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Electrical Calibration of RTD Indicating Systems ³ – Pt 385, 100 Ω	(-200 to 0) $^{\circ}\text{C}$ (0 to 100) $^{\circ}\text{C}$ (100 to 400) $^{\circ}\text{C}$ (400 to 630) $^{\circ}\text{C}$ (630 to 800) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$ 0.07 $^{\circ}\text{C}$ 0.1 $^{\circ}\text{C}$ 0.12 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$	Fluke 5500A
Pt 3926, 100 Ω	(-200 to 0) $^{\circ}\text{C}$ (0 to 100) $^{\circ}\text{C}$ (100 to 400) $^{\circ}\text{C}$ (400 to 600) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$ 0.07 $^{\circ}\text{C}$ 0.1 $^{\circ}\text{C}$ 0.12 $^{\circ}\text{C}$	
Pt 3916, 100 Ω	(-200 to 190) $^{\circ}\text{C}$ (-190 to 0) $^{\circ}\text{C}$ (0 to 300) $^{\circ}\text{C}$ (300 to 600) $^{\circ}\text{C}$ (600 to 630) $^{\circ}\text{C}$	0.25 $^{\circ}\text{C}$ 0.05 $^{\circ}\text{C}$ 0.08 $^{\circ}\text{C}$ 0.1 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$	
Pt 385, 200 Ω	(-200 to 100) $^{\circ}\text{C}$ (100 to 260) $^{\circ}\text{C}$ (260 to 600) $^{\circ}\text{C}$ (600 to 630) $^{\circ}\text{C}$	0.04 $^{\circ}\text{C}$ 0.05 $^{\circ}\text{C}$ 0.14 $^{\circ}\text{C}$ 0.16 $^{\circ}\text{C}$	
Pt 385, 500 Ω	(-200 to 100) $^{\circ}\text{C}$ (100 to 260) $^{\circ}\text{C}$ (260 to 600) $^{\circ}\text{C}$ (600 to 630) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$ 0.06 $^{\circ}\text{C}$ 0.09 $^{\circ}\text{C}$ 0.11 $^{\circ}\text{C}$	
Pt 385, 1k Ω	(-200 to 100) $^{\circ}\text{C}$ (100 to 260) $^{\circ}\text{C}$ (260 to 600) $^{\circ}\text{C}$ (600 to 630) $^{\circ}\text{C}$	0.03 $^{\circ}\text{C}$ 0.05 $^{\circ}\text{C}$ 0.07 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$	
PtNi 385, 100 Ω	(-80 to 100) $^{\circ}\text{C}$ (100 to 260) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$ 0.14 $^{\circ}\text{C}$	
Cu 427, 10 Ω	(-100 to 260) $^{\circ}\text{C}$	0.3 $^{\circ}\text{C}$	
AC Voltage – Source ³	200 μV to 2.2 mV (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	0.55 mV/V + 4.5 μV 0.21 mV/V + 4.5 μV 0.11 mV/V + 4.5 μV 0.37 mV/V + 4.5 μV 0.85 mV/V + 7 μV 1.1 mV/V + 13 μV 1.7 mV/V + 25 μV 3.4 mV/V + 25 μV	Fluke 5720A

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
AC Voltage – Source ³ (cont.)	(2.2 to 22) mV		Fluke 5720A
	(10 to 20) Hz	0.55 mV/V + 5 µV	
	(20 to 40) Hz	0.21 mV/V + 5 µV	
	40 Hz to 20 kHz	0.11 mV/V + 5 µV	
	(20 to 50) kHz	0.37 mV/V + 5 µV	
	(50 to 100) kHz	0.85 mV/V + 7 µV	
	(100 to 300) kHz	1.1 mV/V + 12 µV	
	(300 to 500) kHz	1.7 mV/V + 25 µV	
	500 kHz to 1 MHz	3.4 mV/V + 25 µV	
	(22 to 220) mV		
	(10 to 20) Hz	0.55 mV/V + 13 µV	
	(20 to 40) Hz	0.21 mV/V + 8 µV	
	40 Hz to 20 kHz	0.11 mV/V + 8 µV	
	(20 to 50) kHz	0.32 mV/V + 8 µV	
	(50 to 100) kHz	0.85 mV/V + 25 µV	
	(100 to 300) kHz	1.1 mV/V + 25 µV	
	(300 to 500) kHz	1.7 mV/V + 35 µV	
	500 kHz to 1 MHz	3.4 mV/V + 80 µV	
	220 mV to 2.2 V		
	(10 to 20) Hz	0.5 mV/V + 80 µV	
	(20 to 40) Hz	0.16 mV/V + 25 µV	
	40 Hz to 20 kHz	0.16 mV/V + 6 µV	
	(20 to 50) kHz	0.12 mV/V + 16 µV	
	(50 to 100) kHz	0.25 mV/V + 70 µV	
	(100 to 300) kHz	0.43 mV/V + 130 µV	
	(300 to 500) kHz	1.1 mV/V + 350 µV	
	500 kHz to 1 MHz	2.2 mV/V + 850 µV	
	(2.2 to 220) V		
	(10 to 20) Hz	0.5 mV/V + 8 mV	
	(20 to 40) Hz	0.16 mV/V + 2.5 mV	
	40 Hz to 20 kHz	0.16 mV/V + 0.8 mV	
	(20 to 50) kHz	0.22 mV/V + 3.5 mV	
	(50 to 100) kHz	0.5 mV/V + 8 mV	
	(100 to 300) kHz	1.5 mV/V + 90 mV	
	(300 to 500) kHz	4.7 mV/V + 90 mV	
	500 kHz to 1 MHz	12 mV/V + 190 mV	
	(220 to 1 100) V		
	(15 to 50) Hz	0.4 mV/V + 16 mV	
	50 Hz to 1 kHz	0.5 mV/V + 4 mV	

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
AC Current – Source ³	(9 to 220) μA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.71 mA/A + 25 nA 0.36 mA/A + 20 nA 0.15 mA/A + 16 nA 0.65 mA/A + 40 nA 1.7 mA/A + 80 nA	Fluke 5720A
	220 μA 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	0.71 mA/A + 40 nA 0.36 mA/A + 35 nA 0.15 mA/A + 35 nA 0.65 mA/A + 0.4 μ A 1.7 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	0.71 mA/A + 0.4 μ A 0.36 mA/A + 0.35 μ A 0.15 mA/A + 0.35 μ A 0.65 mA/A + 4 μ A 1.7 mA/A + 8 μ A	
	(22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.71 mA/A + 4 μ A 0.36 mA/A + 3.5 μ A 0.15 mA/A + 3.5 μ A 0.65 mA/A + 40 μ A 1.7 mA/A + 80 μ A	
	220 mA to 2.2 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.7 mA/A + 35 μ A 0.76 mA/A + 80 μ A 8.6 mA/A + 0.16 mA	
	(2.2 to 20.5) A 50 Hz to 1 kHz (1 to 5) kHz	0.51 mA/A + 1 mA 0.5 mA/A + 5.8 mA	Agilent 5220A
	(20 to 1 000) A (45 to 440) Hz	5.9 mA/A + 40 mA	Fluke 5500A with 50 Turn Coil
AC Current – Measure ³ (5 to 100) μ A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	4.6 mA/A + 0.03 μ A 1.7 mA/A + 0.03 μ A 0.7 mA/A + 0.03 μ A 0.7 mA/A + 0.03 μ A	HP 3458A synchronous sub-sampled mode
100 μ A to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	5.0 mA/A + 0.2 μ A 1.7 mA/A + 0.2 μ A 0.7 mA/A + 0.2 μ A 0.4 mA/A + 0.2 μ A	
(1 to 10) mA	10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	4.6 mA/A + 2 μ A 1.7 mA/A + 2 μ A 0.7 mA/A + 2 μ A 0.4 mA/A + 2 μ A	

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
AC Current – Measure ³ (Cont.) (10 to 100) mA 100 mA to 1 A (0.001 to 5) A (5 to 20) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz 10 Hz to 50 kHz 10 Hz to 50 kHz	4.6 mA/A + 20 μ A 1.7 mA/A + 20 μ A 0.7 mA/A + 20 μ A 0.4 mA/A + 20 μ A 4.6 mA/A + 200 μ A 1.8 mA/A + 200 μ A 0.9 mA/A + 200 μ A 1.2 mA/A + 200 μ A 0.3 mA/A 0.4 mA/A	HP 3458A synchronous sub-sampled mode Fluke Y5020A
AC Resistance ³ – Generate 100 Hz to 100 kHz	0 Ω 0.1 Ω 1.0 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω	0.13 m Ω 0.022 m Ω 0.05 m Ω 0.49 m Ω 15 m Ω 0.1 Ω 1.5 Ω 4.7 Ω	HP 16074A
Capacitance ³ - Source at 1kHz Fixed Values	(330 to 500) pF 500 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F 330 μ F to 1.1 mF (1.1 to 3.3) mF (1, 10, 100, 1 000) pF (1 to 5) MHz (5 to 13) MHz	33 mF/F 14 mF/F 7.3 mF/F 5.1 mF/F 5.4 mF/F 3.2 mF/F 3.2 mF/F 2.9 mF/F 3.7 mF/F 1.1 mF/F 3 mF/F	Fluke 5500A 16380A Capacitance Set
Oscilloscope ³ – Rise/Fall Time Sq Wave 50 Ω or 1 M Ω Load impedance – <10 kHz Horizontal Deflection (Time) Vertical Deflection (Amplitude)	(10 to 90) % (40 μ V _{p-p} to 1mV) μ V _{p-p} 1 mV to 5 V _{p-p} 180.10 ps to 55.00 s $\pm$ (1 mV to 200 V)	1.6 ps 2.5 % 0.13 % 0.4 parts in 10 ⁶ s 0.05 %	Wavetek 9530 Wavetek9500B-3200 Wavetek 9500B-3200 Wavetek 9500B-3200 Agilent/HP 3458A

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Oscilloscope ³ – (Cont.) Bandwidth	100 mHz to 300 MHz (300 to 500) MHz 550 MHz to 3 GHz (3 to 26.5) GHz (26.5 to 50) GHz	2.4 % 3 % 4.1 % 5.8 % 7 %	Wavetek 9500B-3200 Wavetek 9530 8485A, 8487A

II. Electromagnetic – RF/Microwave

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Pulse – Measure ³	33 MHz to 3.0 GHz	1.4 % + 5 ps	HP 86100
RF Power Sensors – Calibration Factors	100 kHz to 100 MHz 100 MHz to 5 GHz (5 to 10) GHz (10 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	0.14 % 0.97 % 1.3 % 1.4 % 2.1 % 2.3 % 4.1 %	Coaxial Thermistor, Power Sensors
Tuned RF Power, Relative ³ – Measure (0.0 to -3) dB (-3 to -10) dB (-10 to -40) dB (-40 to -50) dB (-50 to -80) dB (-80 to -90) dB (-90 to -110) dB (-110 to -127) dB	2.5 MHz to 26.5 GHz	0.06 dB 0.08 dB 0.11 dB 0.14 dB 0.2 dB 0.31 dB 0.34 dB 0.4 dB	HP 8902A, HP 11722A, HP 11793A, HP 11792A
RF Power – Absolute ³ Measure 100 kHz to 50 GHz	(-70 to -30) dBm (-30 to -20) dBm (-20 to 0) dBm (0 to 20) dBm	0.64 dBm 0.06 dBm 0.068 dBm 1.2 %	HP 438A, HP 8902A, E4419A, HP 11722A, HP 8482A, HP 8484A, HP 8481A, HP 8485A, HP 8487A
RF Power - Source ³ (-127 to 13) dBm	10 kHz to 20 MHz	1.2 dB	HP 8663A
(-110 to 10) dBm	20 MHz to 2 GHz (2 to 20) GHz (20 to 40) GHz (40 to 50) GHz	1.2 dB 1.3 dB 1.9 dB 2.8 dB	HP 83650L

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Amplitude Modulation – Source Rate: 50 Hz to 100 kHz Depths: 5 % to 95 %	10 kHz to 13.5 MHz	0.6 %	HP 11715A
Rate: 50 Hz to 100 kHz Depths: 95 % to 99 %	10 kHz to 13.5 MHz	0.6 %	
Amplitude Modulation ³ – Measure Rate: 150 kHz to 10 MHz Depth: (5 to 99) %	50 Hz to 10 kHz 20 Hz to 10 kHz	2.5 % IV 3.6 % IV	HP 8902A
Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	50 Hz to 10 kHz 20 Hz to 10 kHz	1.6 % IV 3.6 % IV	
Depth: (5 to 99) % 1.3 GHz to 26.5 GHz	50 Hz to 50 kHz 20 Hz to 100 kHz	3.6 % 3.2 %	HP 8902A with HP 11793A
Frequency Modulation – Source Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	10 kHz to 432 MHz	0.6 %	HP 11715A
Harmonic Measurements ³	30 Hz to 50 GHz	1.5 dB	HP 8565E
Phase Modulation ³ – Rate: 10 MHz to 1.3 GHz Rate: (1.3 to 26.5) GHz	200 Hz to 20 kHz 200 Hz to 20 kHz	3.6 % IV 4.7 %	HP 8902A, HP 8902A with HP 11793A
Distortion ³ – Measure (0 to 99.9) dB: 20 Hz to 20 kHz (20 to 100) kHz	(50 to 500) kHz (50 to 500) kHz	1.3 dB 2.4 dB	Agilent 8903A

III. Optical Radiation

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Optical Power ³ – Measure (800 to 1 000) nm (1 000 to 1 310) nm (1 310 to 1 700) nm	(10 to -90) dB (10 to -110) dB (10 to -110) dB	2.9 % 2.9 % 2.9 %	Agilent Optical Test System

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Optical Power ³ – Measure	(0.01 to 10) W	2.0 %	Molelectron PM2/PM10
Optical Wavelength ³ - Measure	(700 to 1 650) nm	0.007 nm	Agilent 86120B
Fiber Optic Wavelength – Source ³	(1 510 to 1 540) nm	1.5 parts in 10 ⁶ m	NIST SRM 2519, 2517
Illuminance	(0 to 500) fc	1.8 %	Comparison to Standard Light Meter

IV. Time & Frequency

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Frequency ³ - Source	0.01 Hz to 10 MHz	5.7×10^{-11} Hz/Hz	GPS, HP 58503B, HP 3325B
	10 MHz to 50.0 GHz	1.1×10^{-11} Hz/Hz	GPS, HP 58503B Agilent 83650L
Frequency ³ – Measure	0.1 Hz to 3 GHz 500 MHz to 26.5 GHz	2.3×10^{-11} Hz/Hz 1.4×10^{-11} Hz/Hz	GPS, HP 53132A GPS, HP 5351B
Fixed Point	10 MHz	6×10^{-12} Hz/Hz	HP 58503B GPS
Time Interval ³ – Measure	25 ps to 1 s	1.2 % + 5 ps	Agilent 86100
Photo Tachometer	(0 to 100 000) rpm	0.0016 rpm + 0.00017 %	Generator with Lamp

V. Thermodynamics

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Relative Humidity ³	(11 to 95) % RH	1.7 %RH	Vaisala HMI41, HMP46 w/ Humidity Generator
Infrared Thermometers	(30 to 300) °C	1.9 °C	Black Body Calibrator
Temperature ³	(-40 to 400) °C	0.07 °C	Guideline 9540A Tinsley 5187

VI. Acoustical

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Sound ³ (125 to 2000) Hz	(74 to 114) dB SPL	0.34 dB	Sound calibrator Sound meter
4000 Hz	(74 to 114) dB SPL	0.45 dB	Electronic counter

VII. Mechanical

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty(±)]	Reference Standard or Equipment
Pressure ³	(-15 to 100) psi (0 to 5) psi (0 to 1 000) psi 0 up to 10 000 psi	0.052 % of FS 0.13 % of FS 0.053 % of FS 0.085 % of FS	Fluke 700P06 Fluke 700P03 Fluke 700P08 Fluke 700P31
Scales & Balances ³	(1 to 200) mg (0 to 200) gm (Up to 1) kg (Up to 5) kg (Up to 30) kg (Up to 100) kg Up to 1000 lb	0.001 mg 0.07 mg 0.8 mg 2.0 mg 4.0 mg 19 mg 0.32 lb	Verification w/Class E1, E2 and F1 weights Verification with class F weights
Mass	(1 to 5) mg	0.009 mg	Class 1 and balance
Fixed Points	10 mg	0.011 mg	
	20 mg	0.013 mg	
	50 mg	0.015 mg	
	100 mg	0.019 mg	
	200 mg	0.024 mg	
	500 mg	0.029 mg	
	1 g	0.036 mg	
	2 g	0.048 mg	
	5 g	0.059 mg	
	10 g	0.072 mg	
	20 g	0.095 mg	
	50 g	0.12 mg	
	100 g	0.18 mg	
	200 g	0.35 mg	
	500 g	1.1 mg	
	1 kg	2 mg	
	2 kg	3.6 mg	
	5 kg	10 mg	
10 kg	20 mg		

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Air Velocity	Up to 80.0 MPH	2.3 % of rdg	Wind Tunnel
Torque Testers ³	(15 to 200) in·oz (4 to 150) in·lb (2.5 to 250) ft·lb	0.12 % 0.12 % 0.12 %	Torque Wheel, Torque Standard, Calibration Arms, Weights
Torque ³	(Up to 40) N·m (Up to 1500) N·m	0.55 % 0.72 %	Norbar Torque System

VIII. Dimensional

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Calipers ³	Up to 6 in (6 to 12) in (12 to 24) in (24 to 48) in	(300 + 2.4L) μ in (360 + 2.4L) μ in (450 + 2.4L) μ in (510 + 2.4L) μ in	Gage Blocks
Height Gages ³	(0.10 to 48) in	(48 μ in + 10L) μ in	
Gage Blocks	(0.5 to 10) mm (>10 to 50) mm (>50 to 100) mm	0.12 μ m 0.13 μ m 0.14 μ m	Gage Blocks, Measuring machine (Mechanical comparison)
Cylindrical Plug and Pin Gages	Up to 12 in	26 μ in	Measuring Machine
Pin Gages, Diameter	(0.02 to 2.00) in	(12 + 3.2L) μ in	Measuring Machine
Indicators ³ Resolution: 20 μ in 50 μ in 100 μ in	(0.1 to 4) in	14 μ in 30 μ in 74 μ in	Gage Blocks
Micrometers - 100 μ in resolution 50 μ in resolution	(0.1 to 48) in	(66 + 10L) μ in (32 + 10L) μ in	Gage Blocks
Rules and Tape Measures	Up to 72 in (12 to 72) in	(17+2L) μ in (5 800 + 0.05L) μ in	Gage Blocks

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Length Standards	Up to 12 in	(120+2.5L) μ in	Measuring machine
Optical Comparators and Vision Systems ³ X Axis Y Axis Z Axis	Up to 300 mm Up to 300 mm Up to 300 mm	(3 + 0.002L) μ m (3 + 0.002L) μ m (3 + 0.002L) μ m	Glass Scales, gage blocks, precision square, dial test indicator

IX. Chemical

Parameter/ Equipment	Range	Calibration and Measurement Capability [Expressed as Uncertainty($\pm$)]	Reference Standard or Equipment
Conductivity Meters ³	1015.6 μ S 1408.8 μ S 111.32 mS	3.4 μ S 3.9 μ S 0.4 mS	Standard Conductivity Solutions
pH Meters ³	(4, 7, 10) pH units	0.019 pH unit	Standard pH Solutions

Notes:

1. Calibration and Measurement Capabilities (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of k=2.
2. This laboratory provides calibration services in its laboratory and on-site at customer-designated locations. 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 scope of accreditation.
3. On-site calibration is offered for this parameter.
4. The use of (L) stands for Length in inches.
6. The use of (t) is an expression of Time in seconds.
8. This scope is formatted as part of a single document including the Certificate of Accreditation No. AC-1969.15


 Vice President