CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Micro Precisión Calibration de Mexico S. de R.L. de C.V.
Calle Vidrio No. 1427 Colonia Moderna
Guadalajara Jalisco 44190, Mexico

Fulfills the requirements of

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 and

ANSI/NCSL Z540.3-2006

In the fields of

CALIBRATION and **DIMENSIONAL MEASUREMENT**

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 31 October 2022
Certificate Number: AC-1969.11

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)

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CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: **October 31, 2022** Certificate Number: **AC-1969.11**

CALIBRATION

Acoustics and Vibration

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Sound Pressure Level – Measure Equipment[1]	(74 to 114) dB (125 to 2 000) Hz 4 000 Hz	0.36 dB 0.72 dB	Comparison to Sound Level Calibrator
Sound Pressure Level – Generators	(30 to 130) dB 31.5 Hz to 8 kHz	0.32 dB 0.28 % of reading	Transfer Method to Sound Level Calibrator and Frequency Meter

Chemical Quantities

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
pH Meters	(4, 7, 10) pH	0.012 pH	Comparison to Standard Solutions
Conductivity Meters	1 µS/cm 5 µS/cm 10 µS/cm 100 µS/cm 1 015 µS/cm 1 408 µS/cm	0.48 µS/cm 0.62 µS/cm 0.62 µS/cm 2.1 µS/cm 5.9 µS/cm 7 µS/cm	Comparison to Standard Solutions
Mass Concentration - Refractometers	(0 to 70) % Brix	0.12 % Brix	Comparison to saturated solutions

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage[1] - Source	(0 to 220) mV 220 mV to 2.2 V (2.2 to 22) V (22 to 220) V 220 V to 1.1 kV	12 µV/V + 0.93 µV 9.5 µV/V + 1.2 µV 9.6 µV/V +1 µV 12 µV/V + 21 µV 14 µV/V + 0.2 mV	Multiproduct Calibrator
DC Voltage[1] - Measure	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V 100 V to 1 kV	8.2 µV/V + 0.6 µV 9 µV/V + 0.6 µV 9.3 µV/V + 0.34 µV 12 µV/V + 31 µV 12 µV/V + 37 µV	Multimeter
DC Voltage[1] - Measure High Voltage	(1to 2) kV (2 to 20) kV	0.62 mV/V + 0.4 V 0.62 mV/V + 4 V	Voltmeter
DC Current[1] – Source	(0 to 220) µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 20.5) A	19 µA/A + 1.4 nA 15 µA/A + 2.2 nA 17 µA/A 21 µA/A 50 µA/A 95 µA/A + 95 µA 0.12 % of reading	Multiproduct Calibrator
	(10 to 1 000) A	0.22 % of reading	Multiproduct Calibrator with current coil
DC Current[1] - Measure	(0 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	6.8 µA/A + 0.059 nA 2.4 µA/A + 0.063 nA 2.3 µA/A + 0.064 nA 27 µA/A + 2.5 nA 24 µA/A + 0.67 nA 10 µA/A + 0.14 µA 8.5 µA/A + 0.31 µA	Multimeter
	(0 to 100) A (100 to 300) A	1.1 mA/A + 0.67 mA 0.88 mA/A + 42 mA	Shunt Monitored with Multimeter
	(1 to 2 000) A	0.84 % of reading	Comparison to Clamp Meter
Inductance - Source Fixed Points	(0.1 to 10) kHz 1 mH 10 mH 100 mH 1 H	 0.065 % of reading 0.065 % of reading 0.031 % of reading 0.065 % of reading	Standard Inductors

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance[1] - Measure	(0 to 1) Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 k Ω (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	53 μΩ/Ω + 26 μΩ 2.2 μΩ/Ω + 76 μΩ 6.7 μΩ/Ω + 32 μΩ 2.9 μΩ/Ω + 0.41 mΩ 2.9 μΩ/Ω + 0.42 mΩ 6.6 μΩ/Ω + 37 mΩ 17 μΩ/Ω +1 Ω 78 μΩ/Ω + 63 Ω 0.3 mΩ/Ω + 2.3 kΩ 2.3 mΩ/Ω + 0.2 MΩ	Multimeter
Capacitance[1] - Source 50 Hz to 1 kHz	(0.19 to 3.3) nF (3.3 to 330) nF 330 nF to 3.3 μF (3.3 to 33) μF (33 to 330) μF	5 mF/F + 0.01 nF 2.5 mF/F + 0.3 nF 2.5 mF/F + 3 nF 4 mF/F + 30 nF 4.5 mF/F + 0.3 μF	Multiproduct Calibrator
Capacitance[1] - Source 50 Hz to 300 Hz	(330 μF to 3.3 mF (3.3 to 33) mF (33 to 110) mF	4.5 mF/F + 3 μF 7.5 mF/F + 30 μF 11 mF/F + 100 μF	Multiproduct Calibrator
Capacitance[1] – Source 50 Hz to 1 kHz	10 pF to 1 nF 1 nF to 10 μF	0.6 % of reading 0.052 % of reading	Capacitance Decade Box
Resistance[1] - Source	(0 to 1.9) Ω (1.9 to19) Ω (19 to 190) Ω (0.19 to 1.9) kΩ (1.9 to 19) kΩ (19 to 190) kΩ (0.19 to 1.9) MΩ (1.9 to 19) MΩ (19 to 100) MΩ	96 μΩ/Ω + 50 μΩ 26 μΩ/Ω + 0.17 mΩ 22 μΩ/Ω + 0.24 mΩ 17 μΩ/Ω + 0.92 mΩ 18 μΩ/Ω 19 μΩ/Ω 30 μΩ/Ω 36 μΩ/Ω + 51 Ω 0.2 mΩ/Ω	Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance[1] - Source	(0 to 100) mΩ 100 mΩ to 1 Ω (1 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 (1 to 10) GΩ 10 GΩ to 100 GΩ 1.0 TΩ 10.0 TΩ	0.60 % of reading + 60 μΩ 0.064 % of reading 0.008 7 % of reading 0.003 5 % of reading 0.003 1 % of reading 0.002 8 % of reading 0.002 7 % of reading 0.006 % of reading 0.006 2 % of reading 0.009 2 % of reading 0.016 % of reading 0.016 % of reading 0.025 % of reading 0.35 % of reading 1.5 % of reading	Decade Resistor
Resistance[1] - Source Fixed Points	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.1 mΩ/Ω 39 μΩ/Ω 24 μΩ/Ω 18 μΩ/Ω 17 μΩ/Ω 19 μΩ/Ω 27 μΩ/Ω 54 μΩ/Ω 0.2 mΩ/Ω	Multiproduct Calibrator
Electrical Simulation of Thermocouple Indicators[1] Generate / Measure	Type B (600 to 800) °C (800 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C Type E (-250 to -100) ºC (-100 to 650) ºC (650 to 1 000) ºC Type J (-210 to -100) ºC (-100 to 760) ºC (760 to 1 200) ºC	 0.57 °C 0.47 °C 0.46 °C 0.37 °C 0.59 °C 0.98 °C 0.58 °C 0.19 °C 0.25 °C 0.32 °C 0.2 °C 0.27 °C	Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of Thermocouple Indicators[1] Generate / Measure	Type K		Multiproduct Calibrator
	(-200 to -100) ºC	0.39 °C	
	(-100 to 120) ºC	0.22 °C	
	(120 to 1 000) ºC	0.31 °C	
	(1 000 to 1 372) ºC	0.47 °C	
	Type L		
	(-200 to -100) °C	0.43 °C	
	(-100 to 800) °C	0.31 °C	
	(800 to 900) °C	0.21 °C	
	Type N		
	(-200 to -100) °C	0.47 °C	
	(-100 to 410) °C	0.26 °C	
	(410 to 1 300) °C	0.32 °C	
	Type R		
	(0 to 250) °C	0.68 °C	
	(250 to 1 000) °C	0.44 °C	
	(1 000 to 1 767) °C	0.49 °C	
	Type S		
	(0 to 250) ºC	0.58 °C	
	(250 to 1 400) ºC	0.47 °C	
	(1 400 to 1 767) ºC	0.57 °C	
	Type T		
	(-250 to -150) ºC	0.73 °C	
	(-150 to 0) ºC	0.28 °C	
	(0 to 400) ºC	0.2 °C	
	Type U		
	(-200 to 0) °C	0.65 °C	
	(0 to 600) °C	0.32 °C	
Electrical Simulation of RTD Indicating Systems[1] Generate / Measure	PT 385, 100 Ω		Multimeter and/or Multiproduct Calibrator
	(-200 to 800) °C	0.053 °C	
	PT 3926, 100 Ω		
	(-200 to 630) °C	0.055 °C	
	PT 3916, 100 Ω		
	(-200 to 630) °C	0.054 °C	
	PT 385, 200 Ω		
	(-200 to 630) °C	0.052 °C	
	PT 385, 500 Ω		
	(-200 to 630) °C	0.058 °C	
	PT 385, 1000 Ω		
	(-200 to 630) °C	0.054 °C	
	PTNi 385, 120 Ω		
	(-80 to 260) °C	0.044 °C	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of RTD Indicating Systems[1] Generate / Measure	CU 427, 10 Ω (-100 to 260) °C	0.071 °C	Multimeter and/or Multiproduct Calibrator
AC Voltage[1] - Source	(0 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz 220 mV to 2.2 V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz (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 kHz to 1 MHz (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 kHz to 1 MHz (220 to 750) V (30 to 50) kHz (50 to 100) kHz 220 V to 1.1 kV (15 to 50) Hz 50 Hz to 1 kHz	 0.55 mV/V + 13 µV 0.21 mV/V + 8 µV 0.11 mV/V + 8 µV 0.37 mV/V + 8 µV 0.85 mV/V + 25 µV 3.4 mV/V + 80 µV 0.5 mV/V + 80 µV 0.16 mV/V + 25 µV 75 µV/V + 6 µV 0.12 mV/V + 16 µV 0.25 mV/V + 70 µV 2.2 mV/V + 0.85 mV 0.5 mV/V + 0.8 mV 0.16 mV/V + 0.25 mV 75 µV/V + 0.06 mV 0.12 mV/V + 0.16 mV 0.25 mV/V + 0.35 mV 3.4 mV/V + 8.5 mV 0.5 mV/V + 8 mV 0.16 mV/V + 2.5 mV 80 µV/V + 0.8 mV 0.22 mV/V + 3.5 mV 0.5 mV/V + 8 mV 16 mV/V + 0.19 V 0.6 mV/V + 11 mV 2.3 mV/V + 45 mV 0.4 mV/V + 16 mV 90 µV/V + 4 mV	Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage[1] - Measure	(0 to 100) mV		Multimeter, Synchronous Sub-Sampled Mode
	1 Hz to 1 kHz	56 µV + 6.1 µV	
	1 kHz to 20 kHz	0.16 mV/V + 4.3 µV	
	20 kHz to 100 kHz	0.40 mV/V + 55 µV	
	100 kHz to 300 kHz	1.2 mV/V + 0.48 mV	
	300 kHz to 1 MHz	11 mV/V + 32 µV	
	100 mV to 1 V		
	1 Hz to 1 kHz	0.11 mV/V + 0.14 µV	
	1 kHz to 20 kHz	0.19 mV/V + 1.2 µV	
	20 kHz to 100 kHz	0.95 mV/V + 0.16 µV	
	100 kHz to 300 kHz	3.6 mV/V + 0.20 µV	
	300 kHz to 1 MHz	12 mV/V + 0.12 µV	
	(1 to 10) V		
	1 Hz to 1 kHz	0.11 mV/V + 4.3 µV	
	1 kHz to 20 kHz	0.19 mV/V + 0.66 µV	
	20 kHz to 100 kHz	0.95 mV/V + 0.61 µV	
	100 kHz to 300 kHz	3.6 mV/V + 0.17 µV	
	300 kHz to 1 MHz	12 mV/V + 3.5 µV	
	(1 to 4) MHz	6.0 mV/V + 57 mV	
	(10 to 100) V		
	1 Hz to 1 kHz	0.27 mV/V + 1.6 mV	
	1 kHz to 20 kHz	0.26 mV/V + 0.75 mV	
	20 kHz to 50 kHz	0.44 mV/V + 0.73 mV	
	50 kHz to 100 kHz	1.5 mV/V + 1.3 mV	
	(100 to 1000) V		
	1 Hz to 1 kHz	0.52 mV/V + 27 mV	
	1 kHz to 20 kHz	0.79 mV/V + 27 mV	
AC Voltage[1] - Measure High Voltage	(50 to 60) Hz		Voltmeter
	(0.5 to 2) kV	0.89 mV/V + 1.4 V	
	(2 to 20) kV	3.3 mV/V + 6.7 V	
AC Current[1] - Source	(0 to 22) mA		Multiproduct Calibrator
	10 Hz to 1 kHz	0.23 mA/A + 15 nA	
	(1 to 10) kHz	0.28 % of reading	
	(22 to 220) mA		
	10 Hz to 1 kHz	1.4 mA/A	
	1 kHz to 10 kHz	0.17 % of reading + 21 µA	
	220 mA to 2.2 A		
	40 Hz to 1 kHz	0.38 mA/A + 0.19 mA	
	1 kHz to 10 kHz	0.65 % of reading	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current[1] - Source	(2.2 to 11) A 45 Hz to 1 kHz 1 kHz to 5 kHz (11 to 20) A 45 Hz to 1 kHz 1 kHz to 5 kHz	 2.6 mA/A 3.9 % of Reading 1.6 mA/A + 4.8 mA 3.1 % of reading	Multiproduct Calibrator
AC Current[1] - Source	(1 to 1 000) A (50 to 400) Hz	 0.29 % of reading	Multiproduct Calibrator with Fluke Coil
AC Current[1] - Measure	100 pA to 100 µA 10 Hz to 1 kHz (0.1 to 1) mA 10 Hz to 1 kHz (1 to 10) mA 10 Hz to 1 kHz (10 to 100) mA 10 Hz to 1 kHz (0.1 to 1) A 10 Hz to 1 kHz	 16 nA 74 µA/A + 3.9 nA 73 µA/A + 5.5 nA 73 µA/A + 13 nA 0.13 mA/A	Multimeter
	1 Hz to 1 kHz (0.1 to 15) A (15 to 100) A (100 to 300) A	 0.27 mA/A 1.1 m/A A 1 mA/A	Shunt monitored with Multimeter
	(1 to 2 000) A 5 Hz to 1 kHz	 1.6 % of reading	Comparison to Digital Clamp Meter
Oscilloscope[1] Level Sine Amp 50 kHz ref. Level Sine Flatness 5 mV to 5.5 V relative to 50 kHz reference Square Wave 1 MΩ, 100 Hz 50 Ω, 1 kHz Time Marker Output[2] Into 50 Ω	 5 mV to 5 V (V pp) 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 1 mV to ± 130 V ± 1 mV to ± 6.6 V 2 ns to 20 ms 50 ms to 5 s	 20 mV/V + 0.3 mV 15 mV/V + 0.3 mV 20 mV/V + 0.3 mV 40 mV/V + 0.3 mV 1 mV/V + 40 µV 2.5 mV/V + 40 µV (25 + 1 000*t*) parts in 10^6 25 parts in 10^6 s	Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Oscilloscope[1] Pulse Rise Time 5 mV to 2.5 V (p-p)	1 kHz to 10 MHz	100 ps	Multiproduct Calibrator

Electrical - RF/Microwave

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Tuned RF Power Absolute - Measure	(-127 to 0) dBm 150 kHz to 1.3 GHz (-20 to 30) dBm 100 kHz to 2.6 GHz	 0.23 dB 0.13 dB	Measuring Receiver and Sensor Module
RF Power Absolute – Source	(-70 to -20) dBm 50 MHz to 50 GHz (-30 to 20) dBm 100 kHz to 4.2 GHz 10 MHz to 18 GHz 50 MHz to 26.5 GHz 50 MHz to 50 GHz (-10 to 35) dBm 100 kHz to 4.2 GHz	 0.43 dB 0.21 dB 0.26 dB 0.42 dB 0.42 dB 0.21 dB	Generator Monitored with Power Sensor
RF Power Absolute - Measure	(-70 to -20) dBm 50 MHz to 50 GHz (-30 to 20) dBm 100 kHz to 4.2 GHz 10 MHz to 18 GHz 50 MHz to 26.5 GHz 50 MHz to 50 GHz (-10 to 35) dBm 100 kHz to 4.2 GHz	 0.16 dB 0.06 dB 0.083 dB 0.12 dB 0.13 dB 0.064 dB	Power Sensor with Power Meter
Amplitude Modulation - Measure 50 Hz to 10 kHz 20 Hz to 100 kHz 50 Hz to 50 kHz 20 Hz to 100 kHz	 Rate: 150 kHz to 10 MHz Depth: (5 to 99) % Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	 0.65 % Modulation 0.65 % Modulation 0.65 % Modulation 0.65 % Modulation	Measuring Receiver, Sensor Module

Electrical - RF/Microwave

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Frequency Modulation - Measure 20 Hz to 10 kHz 20 Hz to 200 kHz 50 Hz to 100 kHz	Rate: 250 kHz to 10 MHz Dev: ≤ 40 kHz Rate: 10 MHz to 1.3 GHz Dev: ≤ 400 kHz	1.7 % Modulation 1.7 % Modulation 1.7 % Modulation	Measuring Receiver, Sensor Module
Phase Modulation - Measure 200 Hz to 20 kHz	Rate: 10 MHz to 1.3 GHz	0.36 % Modulation	

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Height Gages[2]	(0 to 40) in	(23 + 3.2*L*) µin	Gage Blocks, Check Master
Calipers[1,2]	(0 to 40) in	(310 + 4.1*L*) µin	Gage Blocks, Check Master
Micrometers[2] (Internal, External, Depth, Bore)	(0 to 8) in (8 to 24) in	(33 + 1.4*L*) µin (19 + 5.2*L*) µin	Gage Blocks, Rods Set, Ring Gauges
Indicators[2] (Dial, Digital, Test and LVDTs)	(0 to 4) in	(3.4 + 3*L*) µin	Super Micrometer, Master Gauge Blocks
Optical Comparators and Visual Systems[1] Length	(0 to 12) in (1 to 24) in	(50 + 0.19L) µin (79 + 6.4L) µin	Glass Scale and Gauge Blocks
Optical Comparators and Visual Systems[1] Angle	30 ° 45 ° 60 ° 90 °	0.036 °	Angle Blocks
Rulers and Tapes	(0 to 40) in (0 to 164) ft	(75 + 15*L*) µin (138 + 19*L*) µin	Standard Rule, Optical Comparator
Supermicrometers Length Parallelism Force Measuring	(0 to 1) in (0 to 100) µin (0 to 48) ozf	(4.8 +3.4*L*) µin 15 µin 2 ozf	Gauge Blocks, Optical Parallel, Force Gage
Angle Meters	(0 to 90) °	0.008 5°	Sine Bar and Gauge Blocks

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Thread Plug Gages[2] - Pitch Diameter Major Diameter	Major Diameter (0 to 12) in Pitch Diameter (0 to 12) in	(65 + 1.2*L*) µin (78 + 1.2*L*) µin	Supermicrometer, Thread Measuring Wires, Gauge Blocks
Cylindrical Plug Gages & Pin Gages	(0 to 12) in	60 µin	Supermicrometer, Gauge Blocks
Surface Finish Testers Ra Ry	3 µm (108 µin) 9.5 µm (374 µin)	0.07 µm (2.4 µin) 0.22 µm (2.4 µin)	Roughness Specimen
Coating Thickness[1,3] - Measuring Equipment	(0 to 100) µm (0 to 4) mils (100 to 1 500) µm (4 to 60) mils	2.5 µm 0.09 mils 1.5 µm 0.18 mils	Coating Thickness Standards
Feeler and Taper Gages	(0 to 0.500) in	20 µin	Supermicrometer, Master Gauge Blocks, Test Indicator
Fixture Gages Radius Gages	(0 to 12) in (0 to 1) in	300 µin	Hand Tools, Optical Comparator
Surface Plates[2] – Overall Flatness Local Area Flatness (Repeat Reading)	(0 to 2 000) arcsec (-1 000 to 1 000) µin	0.23 % of reading + 0.25 arcsec 16 µin	Wyler Surface Plate Kit Repeat-o-Meter
CMM – Verification Volumetric Length	(0 to 10) in (10 to 20) in (20 to 30) in (30 to 40) in	28µin 37 µin 68 µin 90 µin	Master Step Gage, Master Sphere
Extensometers [1,2]	(0 to 2) in	(49 + 7.6*L*) µin	Direct Verification per ASTM E83

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Dynamic Viscosity @ 25 °C	(6.2 to 210 000) cP	0.52 % of reading	Cannon Viscosity Standards

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Rockwell Hardness Testers[1]	(20 to 30) HRC (35 to 55) HRC (60 to 65) HRC (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW (70 to 77) HR15N (78 to 88) HR15N (90 to 92) HR15N (20 to 31) HR45N (37 to 61) HR45N (66 to 72) HR45N	0.45 HRC 0.40 HRC 0.40 HRC 1 HRBW 0.70 HRBW 0.51 HRBW 0.55 HR15N 0.5 HR15N 0.55 HR15N 0.55 HR45N 0.5 HR45N 0.50 HR45N	Indirect Verification per ASTM E18
Rockwell Hardness Testers[1]	(43 to 56) HR30TW (57 to 69) HR30TW (70 to 83) HR30TW (74 to 80) HR15TW (81 to 86) HR15TW (87 to 93) HR15TW	0.4 HR30TW 0.4 HR30TW 0.45 HR30TW 0.45 HR15TW 0.4 HR15TW 0.4 HR15TW	Indirect Verification per ASTM E18
Microindentation Hardness Testers Vickers Vickers: Repeatability under forces P(gf):	$100 \leq P < 500$ (100 to 240) HV (240 to 600) HV > 600 HV $500 \leq P \leq 1000$ (100 to 240) HV (240 to 600) HV >600 HV	 4 HV 11 HV 22 HV 1.7 HV 3.4 HV 9.1 HV	Indirect Verification per ASTM E384
Shore Durometers (force only)	(0 to 100) points	0.35 points	Gauge Blocks, Balance, Weights
Gauge Pressure – Measure	(-15 to 30) psi (0 to 1 000) psi (0 to 10 000) psi	0.03 % of reading + 0.000 64 psi 0.016 % of reading + 0.08 psi 0.015 % of reading + 0.71 psi	Process Calibrator with various Pressure Modules
Torque[1]	(0.01 to 400) ozf·in (0.1 to 5) lbf·in (1.0 to 400) lbf·in (20 to 250) lbf·ft (250 to 600) lbf·ft	0.83 % of reading 0.92 % of reading 0.7 % of reading 0.66 % of reading 0.68 % of reading	Torque System

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Torque Analyzers, Transducer	1 ozf·in to 200 lbf·in (16 to 500) lbf·ft	0.08 % of reading 0.14 % of reading	Torque Wheel and Weights
Force - Tension & Compression	(0 to 220) kgf	0.019 % of reading + 0.005 3 kgf	Direct Comparison to Dead Weights
	(0 to 1 000) lbf (1 000 to 10 000) lbf	0.012 % of reading + 0.43 lbf 0.11 % of reading + 1.3 lbf	Comparison to Standard Load Cell
Scales and Balances[4]	(0 to 500) g	1.5 µg/g + 0.013 mg	Using Weights ASTM E617 Class 0
	(0.5 to 100) kg	3.2 µg/g	Using Weights ASTM E617 Class 1
	(0.5 to 1 000) kg	0.19 mg/g	Using Weights OIML Class M2
Flow – Air	30 mL/min to 50 L/min	0.42 % of reading	Bios Flow System with Flow Cells

Photometry and Radiometry

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Optical Power - Measure	(1300, 1310 & 1550) nm (-60 to 10) dBm	0.1 dB	EXFO Optical Calibration System
Optical Power - Source	(1310 & 1550) nm (-60 to 10) dBm	0.1 dB	EXFO Optical Calibration System

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Relative Humidity – Measuring Equipment	11 %RH 33 %RH 75.4 %RH 97 %RH	0.7 %RH 0.7 %RH 0.9 %RH 1.5 %RH	Saturated Salt Solutions
	(0 to 100) %RH	0.8 % of reading + 1 %RH	Comparison to Humidity Meter
Relative Humidity – Measure	(0 to 100) %RH	0.81 % of reading + 0.85 %RH	Comparison to Humidity Meter

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature - Source	(-20 to 300) °C	0.17 °C	Dry Block Calibrator
Temperature - Measure	(-100 to 800) °C	0.014 % of reading + 0.081 °C	Digital Thermometer
Radiation (Infrared) Thermometers	(35 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 500) °C	0.59 ºC 1 ºC 1.8 ºC 2.8 ºC	Precision Infrared Calibrator ε= (0.9 to 1.0), λ = (8 to 14) µm

Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Photo Tachometer[1]	(0 to 100 000) rpm	0.000 38 % of reading + 0.013 rpm	Multiproduct Calibrator with LED and Series Resistor
Frequency[1] - Source and Measure	1 mHz to 26.5 GHz	2.5 parts in 10^{11}	Frequency Standard, Counter
Frequency – Source[2]	(0.01 to 120) Hz 120 Hz to 1.2 kHz (1.2 to 120) kHz 120 kHz to 1.2 MHz	3 µHz/Hz + 61 µHz 3 µHz/Hz + 61 µHz 3 µHz/Hz + 120 µHz 3 µHz/Hz + 10 mHz	Multiproduct Calibrator
Frequency – Source[2]	(1.2 to 2) MHz 2 MHz to 6 GHz 10 MHz to 26.5 GHz	3 µHz/Hz + 12 mHz 1.3 µHz/Hz + 0.02 Hz (1.2×10^{-7}) Hz + R	Signal Generators
Timers, Stopwatches, Chronometers	1 s to 24 hr	55 ms	Frequency Counter

DIMENSIONAL MEASUREMENT

3 Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Coordinate Measurements[2] 3-Axis Volumetric and Linear Displacement. Fixtures and Part Measurements	94.5 in	(150 + 2*L*) µin	Faro CMM Arm

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, t = time in seconds, R = resolution of unit under test
3. 1 mil = 0.001 inch.
4. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The uncertainties presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
5. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1969.11.

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