CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Metrología y Pruebas, S. A. de C. V.
Privada Tecnologico No. 25
Nogales, Sonora México
(and satellite locations as listed on the scope)

Fulfills the requirements of

ISO/IEC 17025:2017

In the fields of

CALIBRATION, TESTING 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.

Jason Stine, Vice President

Expiry Date: 11 November 2025
Certificate Number: ACT-1890

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

Metrología y Pruebas, S. A. de C. V.

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CALIBRATION, TESTING AND DIMENSIONAL MEASUREMENT

Valid to: **November 11, 2025** Certificate Number: **ACT-1890**

CALIBRATION

Acoustics and Vibration Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meter	(70 to 130) dB 100 Hz to 10 kHz	0.93 dB	Sound Level Meter (reference) and Source PMP-C-036
Sound Level Source Devices	(70 to 109) dB 100 Hz to 10 kHz	0.93 dB	Sound Level Meter PMP-C-036
Acceleration	10 m/s^2 (80 to 5 000) Hz 50 m/s^2 (30 to 45) Hz	0.36 m/s^2 1.8 m/s^2	Portable Vibration Calibrator PMP-C-051 (g_n = 9.80665 m/s^2)

Chemical Quantities Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Particle Counter	(0.35 to 1.77) particles/L (10 to 50) particles/ft^3 (1.77 to 105 944) particles/L (50 to 3 000 000) particles/ft^3	17 % of reading 13 % of reading	Comparison to Master Particle Counter PMP-C-050
pH Meters [5]	4 pH 7 pH 10 pH	0.013 pH 0.013 pH 0.013 pH	Accredited pH Buffer Solutions PMP-C-040

Chemical Quantities Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters [5]	10 µS/cm 84 µS/cm 100 µS/cm 147 µS/cm 1 000 µs/cm 1 413 µS/cm 10 000 µS/cm 100 000 µS/cm	0.11 µS/cm 0.82 µS/cm 2.2 µS/cm 0.57 µS/cm 5.1 µS/cm 5.3 µS/cm 44 µS/cm 345 µS/cm	Accredited Conductivity Solutions PMP-C-037
Viscometers	Up to 10 cP (10 to 100) cP (100 to 1 000) cP (1 000 to 12 500) cP (1 250 to 6 800) cP (6 800 to 100 000) cP	0.092 cP 0.66 cP 8.5 cP 97 cP 663 cP 988 cP	Accredited Viscosity Standards PMP-C-037
Breathalyzer Ethanol weight per volume of vapor @ 34 °C	50 mg/210 L 0.1 g/210 L	1.4 mg/210 L 2.1 mg/210 L	Accredited Alcohol Reference Solution PMP-C-049
Gas Measurement Equipment	CO (100 ppm) H_2S (25 ppm) CH_4 (2.5 %vol, 50 %LEL) NO_2 (10 ppm) SO_2 (20 ppm) i-C_4H_{10} O_2 CO_2 C_5H_{12} HCN	2 % of reading 2 % of reading 2 % of reading 2 % of reading 2 % of reading 2 % of reading 2 % of reading 2 % of reading 5 % of reading 10 % of reading	Accredited Gas Reference PMP-C-044

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Leveled Sine Wave	5 mVp-p to 5.5 Vp-p 50 kHz to 100 MHz (50 to 300) MHz (300 to 600) MHz	 40 mV/V 45 mV/V 65 mV/V	Multifunction Calibrator PMP-C-010

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Square Wave Signal into 50 Ω load into 1 MΩ load Rise Time	 10 Hz to 10 kHz 1 mVp-p to 6.6 Vp-p 10 Hz to 10 kHz 1 mVp-p to 130 Vp-p 5 mVp-p to 2.5 Vp-p 1 kHz to 10 MHz	 1.2 mV/V 1.3 mV/V 1 ms/s	Multifunction Calibrator PMP-C-010
DC High Voltage – Source equipment	(1 to 20) kV	13 mV/V	High Voltage Probe, Multimeter PMP-C-001
DC High Voltage – Measuring equipment	(1 to 20) kV	13 mV/V	High Voltage Probe, Digital Multimeter, DC Hi-Pot PMP-C-001
DC Voltage – Source equipment	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1.02 kV	12 µV/V 8.3 µV/V 8.1 µV/V 10 µV/V 10 µV/V	Agilent Multimeter PMP-C-001
DC Voltage – Measuring equipment	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1.02 kV	12 µV/V 8.3 µV/V 8.1 µV/V 10 µV/V 10 µV/V	Agilent Multimeter, Multifunction Calibrator PMP-C-001
AC Voltage – Source equipment	(1 to 100) mV 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 mV to 1V 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 10) V 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	 0.1 mV/V 0.17 mV//V 0.4 mV/V 0.1 mV/V 0.16 mV//V 0.33 mV/V 0.82 mV/V 0.41 mV/V 0.16 mV/V 0.32 mV/V 0.82 mV/V	Agilent Multimeter PMP-C-003

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source equipment	(10 to 100) V 50 Hz to 1 kHz (1 to 20) kHz (100 to 1 000) V 50 Hz to 1 kHz	 0.22 mV/V 0.22 mV/V 0.43 mV/V	Agilent Multimeter, Multifunction Calibrator PMP-C-003
AC Voltage – Source equipment	(1 to 20) kV 60 Hz	 14 mV/V	Tektronix High Voltage Probe PMP-C-003
AC Voltage – Measuring equipment	(1 to 100) mV 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 mV to 1V 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 10) V 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) V 50 Hz to 1 kHz (1 to 20) kHz (100 to 1 000) V 50 Hz to 1 kHz	 0.1 mV/V 0.17 mV/V 0.4 mV/V 0.1 mV/V 0.16 mV/V 0.33 mV/V 0.82 mV/V 0.41 mV/V 0.16 mV/V 0.32 mV/V 0.82 mV/V 0.22 mV/V 0.23 mV/V 0.43 mV/V	Agilent Multimeter, Multifunction Calibrator PMP-C-003
AC Voltage – Measuring equipment	(1 to 20) kV 60 Hz	 14 mV/V	Hipotronics Transformer PMP-C-003
DC Current – Source equipment	(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	0.11 mA/A 24 µA/A 16 µA/A 7 µA/A 9 µA/A 7 µA/A 12 µA/A 30 µA/A	Agilent Multimeter PMP-C-002
DC Current – Source equipment	(1 to 11) A (11 to 550) A	0.54 mA/A 2.6 mA/A	Agilent Multimeter with Standard Shunts PMP-C-002

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measuring equipment	(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	90 µA/A 24 µA/A 16 µA/A 7 µA/A 9 µA/A 7 µA/A 12 µA/A 21 µA/A	Agilent Multimeter, Multifunction Calibrator PMP-C-002
DC Current – Measuring equipment Clamp-On Ammeters	(1 to 11) A (11 to 100) A (11 to 550) A	1.1 mA/A 0.92 mA/A 2.6 mA/A	Agilent Multimeter, Multifunction Calibrator, Shunt Resistors, 50-Turn Current Coil PMP-C-002
AC Current – Source equipment	(1 to 10) mA (50 to 100) Hz 100 Hz to 1 kHz (10 to 100) mA (50to 100) Hz 100 Hz to 1 kHz 100 mA to 1 A (50 to 100) Hz 100 Hz to 1 kHz	 0.8 mA/A 0.21 mA/A 0.21 mA/A 0.21 mA/A 0.21 mA/A 0.21 mA/A	Agilent Multimeter PMP-C-004
AC Current – Source equipment	(1 to 30) A 60 Hz	 0.41 mA/A	Agilent Multimeter. Current Shunts PMP-C-004
AC Current – Measuring equipment	(1 to 10) mA (50 to 100) Hz 100 Hz to 1 kHz (10 to 100) mA (50 to 100) Hz 100 Hz to 1 kHz 100 mA to 1 A (50 to 100) Hz 100 Hz to 1 kHz	 0.8 mA/A 0.5 mA/A 0.8 mA/A 0.51 mA/A 1 mA/A 1.2 mA/A	Agilent Multimeter, Multifunction Calibrator PMP-C-003
AC Current – Measuring equipment	(1 to 11) A 60 Hz (11 to 50) A 60 Hz	 1.6 mA/A 6.8 mA/A	Agilent Multimeter, Current Shunts PMP-C-003
AC Current – Measuring equipment Clamp-On Ammeters	(50 to 1 000) A 60 Hz	 4.6 mA/A	Multifunction Calibrator with 50-Turn Coil PMP-C-003

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Power – Measuring equipment	10.89 mW to 11 220 W	0.82 mW/W	Multifunction Calibrator PMP-C-005
DC Power – Source equipment	10.89 mW to 11 220 W	0.41 mW/W	Agilent Multimeter, Shunt Resistors, DC Power Supply PMP-C-005A
AC Power – Measuring equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 1 0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9 10.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	2.2 mW/W 3.3 mW/W 3.9 mW/W	Multifunction Calibrator PMP-C-005
AC Power – Source equipment	0.89 mW to 11220 W @ 60 Hz, P.F. = 1 0.89 mW to 11220 W @ 60 Hz, P.F. = 0.9 0.89 mW to 11220 W @ 60 Hz, P.F. = 0.8	1.4 mW/W 3 mW/W 4.4 mW/W	Agilent Multimeter, Shunt Resistors, DC Power Supply PMP-C-005
Resistance – Measuring equipment	Up to 0.1 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	0.23 mΩ/Ω 20 μΩ/Ω 17 μΩ/Ω 11 μΩ/Ω 11 μΩ/Ω 11 μΩ/Ω 17 μΩ/Ω 60 μΩ/Ω 0.5 mΩ/Ω 5 mΩ/Ω	Agilent Multimeter, Multifunction Calibrator PMP-C-006
Resistance – Source equipment	Up to 0.1 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	0.18 mΩ/Ω 20 μΩ/Ω 17 μΩ/Ω 11 μΩ/Ω 11 μΩ/Ω 11 μΩ/Ω 17 μΩ/Ω 60 μΩ/Ω 0.5 mΩ/Ω 5.1 mΩ/Ω	Agilent Multimeter PMP-C-006

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance Generation Equipment (High Value Resistors and Decade Resistors)	1 MΩ to 1 TΩ (50 to 1 000) V	23 mΩ/Ω	Multifunction Calibrator, Agilent Multimeter, High Value Resistance Decade (1 MΩ to 1 TΩ) PMP-C-006
Resistance Measuring Equipment (Megohmmeters)	Up to 1 MΩ (50 to 1 000) V 1 MΩ to 1 TΩ Up to 1 000 V 1 MΩ to 1 TΩ (1 to 5) kV	81 mΩ/Ω 24 mΩ/Ω 24 mΩ/Ω	Direct method with: High Value Resistance Decade (1 MΩ to 1 TΩ) PMP-C-006
Low Resistance, DC Shunt Resistance Equipment	0.5 mΩ to 1 Ω (Up to 300) A	0.45 mΩ/Ω	Agilent Multimeter, Shunt resistor 0.01 Ω, Shunt resistor 0.1 Ω PMP-C-006
AC Electrical Resistance at 60 Hz Shunt Resistance	0.5 mΩ to 1 Ω (1 to 60) A	2.5. mΩ/Ω	Multifunction Calibrator, Agilent Multimeter, DC Power Supply, Shunt Resistors PMP-C-006
Capacitance – Source equipment	10 nF to 10 µF 12 Hz to 100 kHz	0.42 mF/F	Capacitance Bridge, Precision LCR Meter PMP-C-009
Capacitance – Measuring equipment	(1 to 10 000) pF 0.33 pF to 0.33 mF	4 mF/F 0.9 mF/F	Capacitance Decade 1 pF Capacitor, 1 000 pF Capacitor, 10 000 pF Capacitor, Multifunction Calibrator PMP-C-009
Inductance – Source equipment	Up to 10 H 12 Hz to 100 kHz	69 µH/H	LCR Bridge, Precision LCR Meter PMP-C-029
Inductance – Measuring equipment	1 mH to 10 H	0.23 mH/H	Precision LCR Meter, Standard Inductors PMP-C-029
Phase Angle Output	(0 to 180) °	0.15 °	Phase Meter PMP-C-005
RTD Simulation – Measure/Source	Pt 385, 100 Ω (-196 to 1 000) °C	0.03 °C	Agilent Multimeter, Multifunction Calibrator PMP-C-020

Electrical – DC/Low Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Electrical Simulation			Multifunction Calibrator, Agilent Multimeter PMP-C-020
Type B	(600 to 1 820) °C	0.07 °C	
Type C	(0 to 2 316) °C	0.11 °C	
Type E	(-250 to 1 000) °C	0.08 °C	
Type J	(-250 to 1 200) °C	0.05 °C	
Type K	(-200 to 1 372) °C	0.07 °C	
Type L	(-200 to 900) °C	0.06 °C	
Type N	(-200 to 1 300) °C	0.07 °C	
Type R	(0 to 1 767) °C	0.08 °C	
Type T	(-250 to 400) °C	0.06 °C	
Type S	(0 to 1 767) °C	0.07 °C	
Type U	(-200 to 600) °C	0.08 °C	
Magnetic Field – Measure/Source	(0.3 to 3) mT 3 mT to 3 T	0.36 % of reading + 0.004 3 mT 0.56 % of reading	Magnetic Field Meter PMP-C-051

Electrical – RF/Microwave Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Power – Source 50 Ω load	(-60 to 10) dBm (10 MHz to 18 GHz) 10 dBm -60 dBm	 0.19 dB 0.4 dB	Power Meter with Power Sensors PMP-C-008
Power – Source 50 Ω load	(-80 to -10) dBm (10 MHz to 13.2 GHz) -10 dBm -80 dBm	 0.22 dB 0.21 dB	Spectrum Analyzer, Signal Generator (ref) PMP-C-008
Power – Measure 50 Ω load	(-60 to 10) dBm (10 MHz to 18 GHz) 10 dBm -60 dBm	 0.18 dB 0.4 dB	Power Meter with Power Sensors, Signal Generator (ref) PMP-C-008
Power – Measure 50 Ω load	(-80 to -10) dBm (10 MHz to 13.2 GHz) -10 dBm -80 dBm	 0.22 dB 0.22 dB	Spectrum Analyzer, Signal Generator (ref) PMP-C-008

Electrical – RF/Microwave Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF/Microwave Phase Modulation – Measure/Source	Carrier Frequency: 100 kHz to 13.2 MHz (0.1 to 45) rad	0.84 % of reading	Agilent PSA Spectrum Analyzer, Frequency Synthesizer, Frequency Generator PMP-C-008
Amplitude Modulation – Measure/Source Rate: Depths: (5 to 99) %	20 Hz to 10 kHz 50 Hz to 100 kHz Flatness – Measure Rate: 90 Hz to 10 kHz 100 kHz to 10 MHz 10 MHz to 13.2 GHz	0.7 % of reading 0.7 % of reading 1.2 % of reading	Agilent PSA Spectrum Analyzer, Frequency Synthesizer, Frequency Generator, PMP-C-008
RF/Microwave Frequency Modulation – Measure/Source	20 Hz to 10 kHz 50 Hz to 200 kHz FM Dev 50 Hz to 50 kHz 250 kHz to 10 MHz 10 MHz to 13.2 GHz	1 % of reading	Agilent PSA Spectrum Analyzer, Frequency Synthesizer, Frequency Generator PMP-C-008

Length – Dimensional Metrology Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Depth Micrometers	Up to 1 016 mm Up to 40 in	2.2 µm 87 µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014
Outside Micrometers	Up to 1 016 mm Up to 40 in	2.2 µin 87 µin	Gage Blocks (Grade 2, Grade 3) PMP-C-014 Reference Standard NMX-CH-099-IMNC-2005
Inside Micrometers	(5.08 to 1 016) mm (0.2 to 40) in	2.2 µm 87 µin	Gage Blocks Grade 2 Gage blocks Grade 3 PMP-C-014 NMX-CH-099-IMNC-2005
Dial and Digital Indicators	Up to 101.6 mm Up to 4 in	0.94 µm 37 µin	Gage Blocks Grade 2 PMP-C-014 NMX-CH-36-1994

Length – Dimensional Metrology Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Comparator [2] X, Y Axis – Linear Error of Indication	Up to 508 mm Up to 20 in	6.1 µm 240 µin	Glass Scales Gage Blocks Grade 2 Gage Block Grade 3 PMP-C-014
Optical Comparators [2] Angular	(0 to 360)°	0.017°	Angle block PMP-C-014
Optical Comparators [2] Magnification	5X 10X 20X 50X 100X	0.14 % of reading 0.07 % of reading 0.11 % of reading 0.07 % of reading 0.07 % of reading	Glass Ruler PMP-C-014
Height Measuring Equipment	Up to 609.6 mm Up to 24 in	11.2 µm 440 µin	Granite Surfase Gage Blocks PMP-C-014
Graduated Rules, Tape Measures	Up to 1 016 mm Up to 20 in	0.24 mm 0.009 3 in	Digital Indicator Stainless Ruler 5X Amplification Lens PMP-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999
Calipers [3]	Up to 1 016 mm Up to 40 in	(11.43 + 0.002*L*) µm (450 + 2*L*) µin	Gage Blocks Grade 2 PMP-C-014 NMX-CH-2:1993-SCFI
Coordinate Measuring Machines [2,3,6] X, Y, Z Axis (Linear Errors)	Up to 8 000 mm Up to 315 in	(0.1 + 0.002 3*L*) µm (4.4 + 2.24*L*) µin	PMP-C-014 (Axis Linear Errors and Volumetric Performance): API Laser Interferometer
Coating Thickness	Up to 0.508 mm Up to 20 000 µin	11 µm 430 µin	Digital Indicator Gage Blocks Grade 2 PMP-C-014
Surface Roughness Measuring Devices	Ra = 3.024 µm (119 µin) Ry = 9.3 µm (366 µin) Ra = 0.401 µm (15.8µin) Ry = 1.58µm (62.2 µin)	66 nm 2.6 µin 0.21 µm 8.1 µin 66 nm 2.6 µin 0.21 µm 8.1 µin	Mitutoyo Roughness Standard (Ra, Ry) Mitutoyo PMP-C-038

Length – Dimensional Metrology Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Roughness Standards	(0.4 to 3) µm	0.066 µm	Roughness Tester PMP-C-038
Levels	(0.000 19 to 3.814)°	0.005 8º	Level Table PMP-C-014
Surface Plates [1] Local Area Flatness (Repeat Reading)	Up to 3 600 x 2 032 mm Up to 144 x 80 in	1 µm 40 µin	Datum Gauge PMP-C-014
Surface Plates [1] Overall Flatness	Up to 609.6 x 914.4 mm Diagonal Up to 24 x 36 in	0.43 µm 17 µin	Interferometer PMP-C-014
Gages Blocks [3] Grade 1, 2 and 3 (FS)	(0.1 to 25.4) mm (25.4 to 50.8) mm (50.8 to 76.2) mm (76.2 to 101.6) mm (101.6 to 152.4) mm (0.004 to 1) in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 6) in	(0.078 + 0.000 8*L*) µm (0.052 + 0.001 8*L*) µm (0.089 + 0.001 1*L*) µm (0.095 + 0.001*L*) µm (0.002 5*L* - 0.059) µm (2.9 + 1*L*) µin (2.1 + 1.78*L*) µin (3.5 + 1.1*L*) µin (3.7 + 1*L*) µin (2.5*L* - 2.33) µin	Gage Blocks Grade 1 (GGG-G-15C), Gage Block Comparator PMP-C-014
Gages Blocks [3]	(152.4 to 1 016) mm (6 to 40) in	(0.015 + 0.001 3*L*) µm (0.6 + 1.3*L*) µin	Laser Interferometer PMP-C-014
Pin/Plug Gauges [3]	(0.254 to 101.6) mm (0.01 to 4) in	(1.04 + 0.005 5*L*) µm (41 + 5.5*L*) µin	Gage Blocks Grade 2, Universal Length Measuring Machine PMP-C-014
Ring Gages	(12.7 to 101.6) mm (0.5 to 4) in	1.2 µm 47 µin	Universal Length Measuring Machine PMP-C-014
Thickness Gauges & Measuring Equipment	(0.006 to 11.46) mm 236 µin to 0.45 in	2 µm 79 µin	ASTM E797 Thickness Gauge, Gage Blocks Grade 2 PMP-C-014
Angle Blocks	(0 to 90)°	0.02°	Vision Microscope PMP-C-014

Length – Dimensional Metrology Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plug Gage Pitch Diameter	M 1.6 x 0.35 to M 100 x 6 (0-80 to 4-12)	4.3 µm 170 µin	Supermicrometer, Gage Blocks Grade 2 PMP-C-014
Thread Plug Gage Major Diameter	M 1.6 x 0.35 to M 100 x 6 (0-80 to 4-12)	2.1 µm 82 µin	Supermicrometer, Gage Blocks Grade 2 PMP-C-014
Protractors	(0 to 360)°	0.019°	Angle Block, Gage Blocks Grade 2, Sine Bar PMP-C-014
Bore Gage	(0.762 to 304.8) mm (0.03 to 12) in	3.1 µm 120 µin	Ring Gages, Vision Microscope PMP-C-014
Radius Gage	(0.254 to 25.4) mm (0.01 to 1) in	1.3 µm 48 µin	Microscope "Vision Engineering Hawk" PMP-C-014

Mass and Mass Related Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Weights (Class 2 and below)	10 mg 1 g 50 g 100 g 200 g 1000 g 10 kg 20 kg 50 kg	8.4 µg 8.8 µg 70 µg 0.16 mg 0.49 mg 8.3 mg 86 mg 92 mg 0.25 g	ASTM E617 Class 1 Weights, Digital Scale (comparator); PMP-C-021, NIST Handbook 44, OIML R111 (ABBA Method)

Mass and Mass Related Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances [1,4]	(0.001 to 1) g (1 to 60) g (60 to 200) g (200 to 1 000) g (1 to 10) kg (10 to 60) kg (60 to 100) kg (100 to 1 000) kg (1 000 to 2 500) kg	0.000 2 % of reading + 11 µg 0.000 3 % of reading + 10 µg 0.000 15 % of reading + 0.11 mg 0.001 % of reading – 1.6 mg 0.000 31 % of reading + 5.3 mg 0.006 % of reading – 0.56 mg 0.023 % of reading – 11 g 0.015 % of reading 0.015 % of reading	ASTM E617 Class 1, OIML M2, NIST Class F weights and internal procedure PMP-C-012 utilized in the calibration of the weighing system.
Volumetric Recipients (Pipettes, Burettes) (Test Tubes, Syringes) (Flask, Beakers, Hasty Glasses) (Graduated volumetric containers) (Graduated volumetric containers)	(10 to 100) µL (100 to 500) µL (500 to 1 000) µL 1 mL to 5 L (5 to 30) L	0.04 % of reading + 0.11 µL 0.032 % of reading + 0.16 µL 0.38 µL - 0.018 % of reading 0.02 % of reading 0.012 % of reading + 0.35 nL	Digital Balance PMP-C-033
Water Flow [1]	Up to 1 500 lpm	1 % of reading + 0.6 lpm	Comparison to Digital Flow Meter PMP-C-034
Torque Measuring Tools [1]	(0.9 to 20) N·m 8.0 lbf·in to 15 lbf·ft	0.056 N·m 0.5 lbf·in	Torque Transducer PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Tools [1]	(7.4 to 500) N·m (5.5 to 369) lbf·ft	0.62 N·m 0.46 lbf·ft	Torque Transducer PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Tools [1]	(400 to 678) N·m (295 to 500) lbf·ft	1.6 N·m 1.2 lbf·ft	Torque Transducer PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Devices [1]	(0.005 to 1) N·m (0.044 to 8.9) lbf·in	0.007 2 N·m 0.064 lbf·in	Dead Weights and Torque Disk PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Devices	(20.34 to 135.58) N·m (15 to 100) lbf·ft	0.047 % of reading + 0.14 N·m 0.047 % of reading + 0.11 lbf·ft	Dead Weighs and Torque Arm PMP-C-015

Mass and Mass Related Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Measuring Devices	(135.58 to 1355.8) N·m (100 to 1 000) lbf·ft	0.083 % of reading + 0.092 N·m 0.083 % of reading + 0.068 lbf·ft	Dead Weighs and Torque Arm PMP-C-015
Air Flow [1]	Up to 1 slpm (1 to 20) slpm (20 to 300) slpm	1.1 % of reading + 0.000 39 slpm 0.35 % of reading + 0.000 8 slpm 0.82 % of reading + 0.45 slpm	Comparison to Master Flow Meter PMP-C-030
Air Velocity [1]	(0.4 to 25) m/s	1 % of reading + 0.16 m/s	Comparison to Digital Anemometer PMP-C-030
Hydrometer [3]	(0.62 to 3) SG	0.023 SG – 0.4 % of reading	Dead Weights, Digital Scale, Digital Thermometer PMP-C-032 NBS Circular 555
Vacuum [1]	(-100 to 0) kPa (-14.5 to 0) psi	1.3 % of reading - 11 nPa 1.3 % of reading - 1.6 x 10^{-9} psi	Pressure Sensor, High Vacuum Meter PMP-C-013
Rockwell and Rockwell Superficial Hardness Testers [1]	(20 to 40) HRA (41 to 75) HRA (76 to 88) HRA (40 to 59) HRBW (60 to 80) HRBW (81 to 100) HRBW (20 to 39) HRC (40 to 59) HRC (60 to 70) HRC (70 to 77) HR15N (78 to 88) HR15N (89 to 92) HR15N (42 to 54) HR30N (55 to 73) HR30N (74 to 80) HR30N (20 to 37) HR45N (38 to 62) HR45N (63 to 74) HR45N	0.33 HRA 0.39 HRA 0.19 HRA 1.41 HRBW 0.9 HRBW 0.44 HRBW 0.4 HRC 0.34 HRC 0.35 HRC 0.43 HR15N 0.43 HR15N 0.23 HR15N 0.43 HR30N 0.3 HR30N 0.35 HR30N 0.65 HR45N 0.65 HR45N 0.65 HR45N	Indirect Verification using Hardness Blocks PMP-C-027

Mass and Mass Related Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell and Rockwell Superficial Hardness Testers [1]	(73 to 80) HR15TW (81 to 87) HR15TW (88 to 93) HR15TW (43 to 56) HR30TW (57 to 69) HR30TW (70 to 82) HR30TW (12 to 32) HR45TW (33 to 52) HR45TW (53 to 73) HR45TW	0.41 HR15TW 0.34 HR15TW 0.34 HR15TW 0.51 HR30TW 0.35 HR30TW 0.35 HR30TW 0.65 HR45TW 0.65 HR45TW 0.65 HR45TW	Indirect Verification using Hardness Blocks PMP-C-027
Durometers [7] Indenter Dimensions Length Tip Diameter Tip Radius Tip Angle Spring Force Types A, B, E, O Types C, D, OO	 (1 to 20) mm (1 to 20) mm (1 to 10) mm (5 to 90)° (0.55 to 8.05) N (4.445 to 44.45) N	 5 µm 5 µm 5 µm 0.02° 5 % of reading 0.5 % of reading	Direct Verification per ASTM D-2240 using Vision Microscope Balance; PMP-C-027
Force [1] (Tension and Compression)	Up to 0.1 N 0.1 N to 1 N 1 N to 2500 N 2.5 kN to 44.5 kN	0.086 % of reading).015 % of reading + 0.000 071 N 0.026 % of reading 0.06 % of reading – 0.000 77 kN	Dead weights; PMP-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Force [1] (Tension and Compression)	(44.5 to 222.4) kN	0.06 % of reading	Load Cells; PMP-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Pressure Measuring Equipment (Gauge Pressure) [1]	Up to 500 Pa	1.8 Pa	2" water column; PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC
Pressure Measuring Equipment (Gauge Pressure) [1]	Up to 21 MPa	7.3 % of reading + 27 Pa	Pressure Calibrator (3000 psi); PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC

Mass and Mass Related Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Measuring Equipment (Gauge Pressure) [1]	(21 to 137) MPa	37 kPa	Pressure Transducer; PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC
Pressure Measuring Equipment (Absolute Pressure)	Up to 106 kPa	0.058 % of reading + 0.16 kPa	Comparison to Master Absolute Pressure Gage; PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC

Photometry and Radiometry Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Light Intensity Meters	(100 to 7 000) lx	3 % of reading	Comparison to Master Illuminance Meter PMP-C-035
UV Meters (Medidores de UV)	Up to 19 W/cm^2	0.17 % of reading + 3.4 x 10^{-6} W/cm^2	Comparison to Master UV Meter PMP-C-035

Thermodynamic Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity	(10 to 75) %RH (75 to 97) %RH	2.2 %RH 2.5 %RH	Comparison to Digital Humidity Meter PMP-C-028
Temperature [1] (Temperature Sources, Installations, Ovens, Chambers, Dry Wells)	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.0038 % of reading + 0.028 °C 0.0091 % of reading + 0.028 °C 0.0082 % of reading + 0.03 °C	PMP-C-007 RTD with Digital Multimeter
	(660 to 1 000) ºC	0.088 % of reading + 1.3 °C	PMP-C-007 Thermocouple with Temperature Indicator
Temperature – RTD with Multimeter	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.0038 % of reading + 0.034 °C 0.0065 % of reading + 0.034 °C 0.0063 % of reading + 0.035 °C	PMP-C-007 RTD with Digital Multimeter, Dry Well, Bath Source

Thermodynamic Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature [1] (Digital/Analog Temperature Measuring Devices with Thermocouple, RTD, Thermistors, Mechanical/Analog Thermometers)	(-20 to 0) ºC (0 to 400) ºC (400 to 600) ºC	0.031 °C - 0.09 % of reading 0.009 % of reading + 0.031 °C 0.035 % of reading - 0.071 °C	PMP-C-007 using RTD with Digital Multimeter, Dry Well, Bath/Source.
	(600 to 1 000) ºC	0.053 % of reading + 1.8 °C	PMP-C-007 using Thermocouple with Temperature Indicator, High Temperature Oven
Temperature [1] (Environmental Thermometers)	(-20 to 0) ºC (0 to 100) ºC	0.5 % of reading + 0.14 °C 0.27 % of reading + 0.14 °C	PMP-C-007 using RTD with Digital Multimeter

Time and Frequency Nogales, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Timers, Stopwatches	(1 to 36 000) s (36 000 to 172 800) s	0.001 4 % of reading + 6.5 ms 0.000 13 % of reading + 0.47 s	Comparison to Frequency Counter PMP-C-008
Frequency – Measuring equipment	0.1 Hz to 18 GHz	1 nHz/Hz	GPS Receiver, Spectrum Analyzer, Frequency Counter, Signal Generator, Frequency Synthesizer; PMP-C-008
Frequency – Source equipment	Up to 18 GHz	1 nHz/Hz	GPS Receiver, Spectrum Analyzer, Frequency Counter, Power Meter with Power Sensors; PMP-C-008

DIMENSIONAL MEASUREMENT

3 Dimensional Nogales, Sonora

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
3D Dimensional Measurement [3]	Up to 1 in (1 to 2) in (2 to 6) in	95 µin (90 + 5*L*) µin (80 + 10*L*) µin	Vision System utilized as Reference, Customer Drawings, Vision Software

TESTING

Mechanical Nogales, Sonora

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Force Testing/ Tension and Compression Up to 445 kN	PMP-C-011	Cables and Materials	Universal Testing Machine and Load Cell System utilized as Reference

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CALIBRATION

Acoustics and Vibration Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meters [1]	(70 to 109) dB 100 Hz to 10 kHz	0.93 dB	Sound Level Meter (reference) and Source PMP-C-036
Sound Level Source Devices	(70 to 109) dB 100 Hz to 10 kHz	0.93 dB	Sound Level Meter PMP-C-036

Chemical Quantities Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters [5]	10 µS/cm 100 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm	0.35 µS/cm 2.2 µS/cm 4.9 µS/cm 20 µS/cm 300 µS/cm	Conductivity Solutions PMP-C-043
pH Meters [5]	4 pH 6.86 pH 10.1 pH	0.013 pH 0.011 pH 0.013 pH	pH Solutions PMP-C-040

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1,3] Leveled Sine Wave (Relative to 50 kHz)	5 mV to 5.5 V 50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz	 1.5 mV 2.7 mV 3.9 mV	Multifunction Calibrator PMP-C-010

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Square Wave Signal into 50 Ω load into 1 MΩ load Rise Time	 10 Hz to 10 kHz 1 mVp-p to 6.6 Vp-p 10 Hz to 10 kHz 1 mVp-p to 130 Vp-p 5 mVp-p to 2.5 Vp-p 1 kHz to 10 MHz	 0.05 % of reading + 0.2 µV 0.12 % of reading + 80 nV 0.1 ns	Multifunction Calibrator PMP-C-010
DC High Voltage – Source/Measure [1]	(1 to 5) kV	2.8 % of reading - 5.6 V	Keysight Multimeter, High Voltage Probe, PMP-C-001
AC High Voltage – Source/Measure [1]	(0.7 to 1.02) kV 40 Hz to 10 kHz (1.02 to 35) kV 60 Hz	8.2 % of reading - 56 V 3.2 % of reading - 5.5 V	Keysight Multimeter, High Voltage Probe, PMP-C-003
DC Voltage – Source equipment	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1.02 kV	12 µV/V 8 µV/V 8 µV/V 10 µV/V 10 µV/V	Agilent Multimeter PMP-C-001
DC Voltage – Measuring equipment [1]	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1.02 kV	12 µV/V 8 µV/V 8 µV/V 10 µV/V 10 µV/V	Agilent Multimeter, Multifunction Calibrator PMP-C-001
AC Voltage – Source equipment	(1 to 100) mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 mV to 1V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	 7.3 µV/V 7.2 µV/V 7.3 µV/V 0.78 mV/V 0.78 mV/V 0.78 mV/V 1.1 mV/V	Agilent Multimeter PMP-C-003

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source equipment	(1 to 10) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) V 40 Hz to 1 kHz (1 to 20) kHz (100 to 1 020) V 40 Hz to 1 kHz	 9.5 mV/V 12 mV/V 9.5 mV/V 9.5 mV/V 95 mV/V 120 mV/V 21 % of reading + 1.3 V	Agilent Multimeter PMP-C-003
AC Voltage – Measuring equipment [1]	(1 to 100) mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 mV to 1V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 10) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) V 40 Hz to 1 kHz (1 to 20) kHz (100 to 1 020) V 40 Hz to 1 kHz	 7.3 µV/V 7.2 µV/V 7.3 µV/V 0.78 mV/V 0.78 mV/V 0.78 mV/V 1.1 mV/V 9.5 mV/V 12 mV/V 9.5 mV/V 9.5 mV/V 95 mV/V 120 mV/V 21 % of reading + 1.3 V	Agilent Multimeter, Multifunction Calibrator PMP-C-003
AC Voltage – Measuring equipment [1]	(1 to 5) kV 60 Hz	 4.9 % of reading – 43 V	Keysight Multimeter, High Voltage Probe Hipotronics High Voltage Tester PMP-C-003

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure equipment [1]	(1 to 100) mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 mV to 1V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 10) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) V 40 Hz to 1 kHz (1 to 20) kHz (100 to 1 020) V 40 Hz to 1 kHz	 73 µV/V 72 µV/V 73 µV/V 0.78 mV/V 0.78 mV/V 0.78 mV/V 1.1 mV/V 9.5 mV/V 12 mV/V 9.5 mV/V 9.5 mV/V 95 mV/V 0.12 V/V 21 % of reading + 1.3 V	Agilent Multimeter, Multifunction Calibrator PMP-C-003
AC Voltage – Measuring equipment [1]	(1 to 5) kV 60 Hz	4.4 % of reading - 43 V	Keysight Multimeter, High Voltage Probe, Hipotronics High Voltage Tester PMP-C-003
DC Current – Source equipment	(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	76 pA 64 µA/A 35 µA/A 36 µA/A 28 nA 0.1 µA 0.12 µA 0.12 mA	Agilent Multimeter PMP-C-002
DC Current – Source equipment [1]	(1 to 50) A	0.22 % of reading - 2.1 mA	Agilent Multimeter with Leeds & Northrup Shunt Resistor PMP-C-002

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measuring equipment [1]	(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	76 pA 64 µA/A 35 µA/A 36 µA/A 28 nA 0.1 µA 0.12 µA 0.12 mA	Agilent Multimeter, Multifunction Calibrator PMP-C-002
DC Current – Measuring equipment [1]	(1 to 11) A (11 to 50) A	0.06 % of reading - 11 mA 0.14 A - 0.054 % of reading	Multifunction Calibrator with Shunt Resistor PMP-C-002
DC Current – Measuring equipment Clamp-On Ammeters [1]	(50 to 550) A	0.22 % of reading + 90 mA	Multifunction Calibrator And 50-turn Coil PMP-C-002
AC Current – Source equipment	(1 to 10) mA (40 to 100) Hz 100 Hz to 1 kHz (10 to 100) mA (40 to 100) Hz 100 Hz to 1 kHz 100mA to 1 A (40 to 100) Hz 100 Hz to 1 kHz	 0.06 % of reading + 2 µA 0.03 % of reading + 2 µA 0.06 % of reading + 20 µA 0.03 % of reading + 20 µA 0.08 % of reading + 0.2 mA 0.1 % of reading + 0.2 mA	Agilent Multimeter PMP-C-004
AC Current – Source equipment	(1 to 50) A 60 Hz	0.7 mA	Agilent Multimeter with Shunt Resistor PMP-C-004
AC Current – Measuring equipment [1]	(1 to 10) mA (40 to 100) Hz 100 Hz to 1 kHz (10 to 100) mA (40 to 100) Hz 100 Hz to 1 kHz 100mA to 1 A (40 to 100) Hz 100 Hz to 1 kHz	 0.06 % of reading + 2 µA 0.03 % of reading + 2 µA 0.06 % of reading + 20 µA 0.03 % of reading + 20 µA 0.08 % of reading + 0.2 mA 0.1 % of reading + 0.2 mA	Agilent Multimeter, Multifunction Calibrator PMP-C-004
AC Current – Measuring equipment [1]	(1 to 11) A 60 Hz (11 to 50) A 60 Hz	 0.15 % of reading - 0.9 mA 0.14 A - 0.05 % of reading	Multifunction Calibrator with Shunt Resistor PMP-C-004

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measuring equipment Clamp-On Ammeters [1]	(50 to 550) A 60 Hz	0.2 % of reading + 70 mA	Multifunction Calibrator And Coil PMP-C-004
DC Power Source equipment	10.89 mW to 11 220 W	0.04 % of reading - 2 µW	Agilent Multimeter with Shunt Resistor PMP-C-005
AC Power – Source equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 1	0.12 % of reading + 10 µW	Agilent Multimeter with Shunt Resistor PMP-C-005
AC Power – Source equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9	0.21 % of reading + 12 µW	Agilent Multimeter with Shunt Resistor PMP-C-005
AC Power - Source equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	0.3 % of reading + 9.2 µW	Agilent Multimeter with Shunt Resistor PMP-C-005
DC Power Measuring equipment [1]	10.89 mW to 11 220 W	0.2 % of reading - 2 µW	Multifunction Calibrator PMP-C-005
AC Power – Measuring equipment [1]	0.89 mW to 11 220 W @ 60 Hz, P.F. = 1	0.12 % of reading + 10 µW	Multifunction Calibrator PMP-C-005
AC Power – Measuring equipment [1]	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9	0.12 % of reading + 12 µW	Multifunction Calibrator PMP-C-005
AC Power – Measuring equipment [1]	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	0.3 % of reading + 9.2 µW	Multifunction Calibrator PMP-C-005
Resistance – Measuring equipment [1]	(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	20 µΩ/Ω 19 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 18 µΩ/Ω 61 µΩ/Ω 0.52 mΩ/Ω 0.29 mΩ/Ω	Agilent Multimeter, Multifunction Calibrator PMP-C-006

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source equipment	(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	20 µΩ/Ω 19 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 18 µΩ/Ω 61 µΩ/Ω 0.52 mΩ/Ω 0.29 mΩ/Ω	Agilent Multimeter PMP-C-006
Resistance – Source/Measuring Equipment (High Value Resistors and Decade Resistors)	100 kΩ to 1 TΩ up to 5 000 V Max	23 mΩ/Ω	Multifunction Calibrator, Agilent Multimeter, High Voltage Probe PMP-C-006
DC Shunt Resistance Equipment [1]	0.5 mΩ to 1 Ω @ (1 to 50) A	0.005 % of reading + 11 µΩ	Agilent Multimeter with Shunt resistor PMP-C-006
AC electrical Resistance at 60 Hz Shunt Resistance [1]	1 mΩ to 1 Ω (1 to 50) A	0.005 % of reading + 11 µΩ	Agilent Multimeter with Shunt resistor PMP-C-006
Capacitance – Source equipment [1]	100 pF to 10 µF 50 Hz to 1 kHz 75 kHz to 30 MHz	42 µF/mF 42 µF/mF	LCR Meter PMP-C-009
Capacitance – Measuring equipment [1]	100pF to 1 µF 50 Hz to 1 kHz 75kHz to 30MHz	(0.07 + 0.000 001*C*) pF	Capacitance Decade PMP-C-009
Dissipation Factor – Measuring equipment [1,3]	(0.000 1 to 9 999) DF 50 Hz to 100 kHz (0.000 001 to 9.999 99) DF 75 kHz to 30 MHz	0.000 1 DF 0.000 5 DF	LCR Meter PMP-C-009
Inductance – Source equipment	0.01 pH to 99 999 H @ 50 Hz to 100 kHz 0.001 nH to 99 999 H 75 kHz to 30 MHz	0.02 % of reading 0.05 % of reading	LCR Meter PMP-C-029
Inductance [1,3] – Measuring equipment	100 mH to 2 H	0.23 mH/H	Inductance Decade PMP-C-029
Q Factor – Measuring equipment [1,8]	(0.000 1 to 9 999) Q-factor 50 Hz to 100 kHz (0.01 to 99 999.9) Q-factor 75 kHz to 30 MHz	0.000 1 0.000 5	LCR Meter PMP-C-029

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Electrical Simulation [1]	Type B		Multifunction Calibrator PMP-C-020
	(600 to 800) °C	0.44 °C	
	(800 to 1 000) °C	0.34 °C	
	(1 000 to 1 550) °C	0.3 °C	
	(1 550 to 1 820) °C	0.33 °C	
	Type C		
	(0 to 150) °C	0.3 °C	
	(150 to 650) °C	0.26 °C	
	(650 to 1 000) °C	0.31 °C	
	(1 000 to 1 800) °C	0.5 °C	
	(1 800 to 2 316) °C	0.84 °C	
	Type E		
	(-250 to -100) °C	0.5 °C	
	(-100 to -25) °C	0.16 °C	
	(-25 to 350) °C	0.14 °C	
	(350 to 650) °C	0.16 °C	
	(650 to 1 000) °C	0.21 °C	
	Type J		
	(-250 to -100) °C	0.27 °C	
	(-100 to -30) °C	0.16 °C	
	(-30 to 150) °C	0.14 °C	
	(150 to 760) °C	0.17 °C	
	(760 to 1 200) °C	0.23 °C	
	Type K		
	(-200 to -100) °C	0.33 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.16 °C	
	(120 to 1 000) °C	0.26 °C	
	(1 000 to 1 372) °C	0.4 °C	
	Type L		
	(-200 to -100) °C	0.37 °C	
	(-100 to 800) °C	0.26 °C	
	(800 to 900) °C	0.17 °C	
	Type N		
	(-200 to -100) °C	0.4 °C	
	(-100 to -25) °C	0.22 °C	
	(-25 to 120) °C	0.19 °C	
	(120 to 410) °C	0.18 °C	
	(410 to 1 300) °C	0.27 °C	

Electrical – DC/Low Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Electrical Simulation [1]	Type R (0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	 0.57 °C 0.35 °C 0.33 °C 0.4 °C 0.47 °C 0.36 °C 0.37 °C 0.46 °C 0.63 °C 0.24 °C 0.16 °C 0.14 °C 0.56 °C 0.27 °C	Multifunction Calibrator PMP-C-020
RTD Electrical Simulation [1]	Cu 427 10 Ω (-100 to 260) °C Pt 385, 100 Ω (-200 to -80) ºC (-80 to 0) ºC (0 to 100) ºC (100 to 300) ºC (300 to 400) ºC (400 to 630) ºC (630 to 800) ºC Pt 3916, 100 Ω (-200 to -190) °C (-190 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	 0.3 °C 0.05 ºC 0.05 ºC 0.07 ºC 0.09 ºC 0.1 ºC 0.12 ºC 0.23 ºC 0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.1 °C 0.23 °C	Multifunction Calibrator PMP-C-020

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RTD Electrical Simulation [1]	Pt 3926, 100 Ω		Multifunction Calibrator PMP-C-020
	(-200 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.12 °C	
	(300 to 400) °C	0.13 °C	
	(400 to 600) °C	0.14 °C	
	(600 to 630) °C	0.16 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 600) °C	0.09 °C	
	(600 to 630) °C	0.11 °C	
	Pt 385, 1000 Ω		
	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.03 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.23 °C	
	PtNi 385, 120 Ω (Ni120)		
	(-80 to 0) °C	0.08 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 260) °C	0.14 °C	

Electrical – RF/Microwave Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure [1] 50 Ω load	(-136 to 30) dBm 10 kHz to 13.2 GHz (-60 to 20) dBm 10 MHz to 6 GHz (-35 to 20) dBm 10 MHz to 18 GHz (-70 to -20) dBm 10 MHz to 18 GHz	0.2 dB 0.2 dB 0.2 dB 0.2 dB	Power Sensors, Power Meters PMP-C-008
RF Power – Source [1] 50 Ohm load	(-127 to 13) dBm 100 kHz to 999 MHz (-120 to +8) dBm (2 to 18) GHz (-136 to +17) dBm 250 kHz to 4 GHz	0.2 dB 0.2 dB 0.2 dB	Power Sensors, Power Meters PMP-C-008
Phase Modulation – Measure [1] Carrier Frequency: 100 kHz to 13.2 MHz	200 Hz to 20 kHz	1 % of reading	Performance Spectrum Analyzer PMP-C-008
Amplitude Modulation – Source/Measure Rate [1] 20 Hz to 10 kHz 50 Hz to 100 kHz Flatness – Measure	(5% to 99) %Depth 100 kHz to 10 MHz 10 MHz to 13.2 GHz 10 MHz to 13.2 GHz Rate: 90 Hz to 10 kHz Depth: (5 to 99) %	0.75 % of reading 1.5 % of reading 0.4 % of reading	Performance\ Spectrum Analyzer, Power Sensors, Power Meters PMP-C-008
Frequency Modulation – Source/Measure Modulation Rate: 20 Hz to 10 kHz 50 Hz to 200 kHz Modulation Distortion	250 kHz to 10 MHz 10 MHz to 13.2 GHz 200 Hz to 300 kHz (-80 to -0.1) dB	1.5 % of reading 1.5 % of reading 1 % of reading	Performance Spectrum Analyzer PMP-C-008

Length – Dimensional Metrology Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Outside Micrometers [1,3]	Up to 1 016 mm Up to 40 in	(1 + 0.22*L*) µm (39 + 8.6*L*) µin	Gage Blocks Grade 2, Gage blocks Grade 3 PMP-C-014 Reference Standard NMX-CH-099-IMNC-2005
Depth Micrometers [1,3]	Up to 1 016 mm Up to 40 in	(1 + 0.22*L*) µm (39 + 8.6*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014
Dial and Digital Indicators [1,3]	Up to 101.6 mm Up to 4 in	(0.88 + 0.083*L*) µm (35 + 3.3*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014 NMX-CH-36-1994
Calipers [1,3]	Up to 1 016 mm Up to 40 in	(9.6 + 0.089*L*) µm (380 + 3.5*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014 NMX-CH-2:1993-SCFI
Height Measuring Equipment [3]	Up to 1 016 mm Up to 40 in	(0.95 + 0.22*L*) µm (38 + 8.6*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014
Optical Comparator [2,3] X, Y Axis – Linear Error of Indication	Up to 508 mm Up to 20 in	(0.33 + 0.014*L*) µm (13 + 14*L*) µin	Glass Scales, Gage Blocks Grade 2, Gage Block Grade 3 PMP-C-014
Optical Comparators [2] Angle Measurement	(0 to 360)º	0.019°	Angle block PMP-C-014
Optical Comparators [2] Magnification	5x 10x 20x 50x 100x	0.1 % of reading 0.051 % of reading 0.076 % of reading 0.051 % of reading 0.051 % of reading	Glass Ruler PMP-C-014
Graduated Rules, Tape Measures	Up to 25 m Up to 985 in	0.076 µm 3 µin	Interferometer PMP-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999
Graduated Rules, Tape Measures	Up to 25 m Up to 985 in	(20 + 0.008*L*) µm (790 + 0.33*L*) µin	Digital Indicator, Stainless Ruler, 5X Amplification Lens PMP-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999

Length – Dimensional Metrology Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Coordinate Measuring Machines [2,3,6] X, Y, Z Axis - Linear Errors	Up to 4 in (4 to 25) in (25 to 80) in (80 to 315) in	17 □in (2.2 + 3.7*L*) µin (3.9*L* – 2.7) µin (7.1 + 3.8*L*) µin	PMP-C-014 (Linear Errors and Volumetric Performance): API Laser Interferometer
Coating Thickness [1,3]	Up to 6.35 mm Up to 0.25 in	(0.72 + 0.043*L*) µm (28 + 1.7*L*) µin	Digital Indicator Gage Blocks Grade 2 PMP-C-014
Roughness Measuring Devices [1]	Ra = 2.94 µm (116 µin) Ry = 366 µm (9.3 µin)	61 nm 0.2 µm	Roughness Standard (Ra, Ry) PMP-C-038
Levels [1,3]	(-4 125 to +4 125)″	0.42″	Sine Bar PMP-C-014
Digital Levels [1]	(15, 30, 45, 90)°	0.42″	Angle Blocks PMP-C-014
Surface Plates [1] Local Area Flatness (Repeat Reading)	Up to (192 x 192) in	21 µin	Repeat-o-meter PMP-C-014
Surface Plates [1] Overall Flatness	Up to (192 x 192) in	11 µin	Interferometer PMP-C-014
Gages Blocks [3] Grade 1, 2 and 3 (FS)	(0.254 to 152.9) mm (0.01 to 6) in	(0.1+ 0.047*L*) µm (3.9 + 1.9*L*) µin	Gage Blocks Grade 1 FS, Gage Blocks Comparator

Mass and Mass Related Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Weights (Class 2 and below)	10 mg 1 g 50 g 100 g 200 g 1000 g 10 kg 20 kg 50 kg	8.4 µg 8.8 µg 70 µg 0.16 mg 0.49 mg 8.3 mg 86 mg 92 mg 0.25 g	ASTM E617 Class 1 Weights, Digital Scale (comparator); PMP-C-021, NIST Handbook 44, OIML R111 (ABBA Method)

Mass and Mass Related Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances [1,4]	(0.001 to 1) g (1 to 60) g (60 to 200) g (200 to 1 000) g (1 to 10) kg (10 to 60) kg (60 to 100) kg (100 to 1 000) kg (1 000 to 2 500) kg	0.000 2 % of reading + 11 µg 0.000 3 % of reading + 10 µg 0.000 15 % of reading + 0.11 mg 0.001 % of reading – 1.6 mg 0.000 31 % of reading + 5.3 mg 0.006 % of reading – 0.56 mg 0.023 % of reading – 11 g 0.015 % of reading 0.015 % of reading	ASTM E617 Class 1, OIML M2, NIST Class F weights and internal procedure PMP-C-012 utilized in the calibration of the weighing system.
Volumetric Recipients [3] (measuring cylinder, flask, beaker precipitate, special containers, containers volumetric of graduates collar, plastic, glass and metallic)	(10 to 100) µL (100 to 500) µL (500 to 1 000) µL 1 mL to 5 L (5 to 30) L	0.04 % of reading + 0.11 µL 0.032 % of reading + 0.16 µL 0.38 µL – 0.018 % of reading 0.02 % of reading 0.012 % of reading + 0.35 nL	Digital Balance PMP-C-033
Water Flow [2]	Up to 3 000 lpm	0.5 % of reading + 0.9 lpm	Comparison to Master Water Flow Meter PMP-C-034
Torque Measuring Tools [1]	(0.005 to 1) N·m (1 to 20) N·m (20 to 500) N·m	0.4 % of reading + 1 µN·m 0.7 % of reading - 4 mN·m 0.8 % of reading - 20 mN·m	Dead Weights, Torque Arm PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Tools [1]	(67.8 to 678) N·m	0.48 % of reading – 0.11 N·m	Torque Transducer, Torque Meter PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Tools [1]	(678 to 1 355) N·m	(2.9 + 0.000 7*T*) N·m	Torque Transducer, Torque Meter PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Devices	(20.34 to 135.58) N·m (15 to 100) lbf·ft	0.036 % of reading + 0.17 N·m 0.036 % of reading + 0.13 lbf·ft	Dead Weights, Torque Arm PMP-C-015

Mass and Mass Related Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Measuring Devices	(135.58 to 1355.8) N·m (100 to 1 000) lbf·ft	0.08 % of reading + 0.11 N·m 0.08 % of reading + 0.08 lbf·ft	Dead Weights, Torque Arm PMP-C-015
Air Flow [1]	Up to 20 slpm Up to 300 slpm	0.25 % of reading + 0.000 4 slpm 0.33 % of reading + 0.24 slpm	Comparison to Air Flow Meters PMP-C-030
Air Velocity (Air Speed)	Up to 25 m/s	0.87 % of reading + 0.18 m/s	Wind Tunnel with Master Anemometer PMP-C-030
Hydrometers [3]	(0.62 to 3) SG	0.42 % of reading + 0.023 SG	Digital Scale Digital Thermometer PMP-C-032 NBS Circular 555
Vacuum Meters [1] (Source/Measure)	(0.000 001 to 0.001) mbar 0.004 mbar to 1 bar	1.6 % of reading 1.3 % of reading + 0.000 05 mbar	High Vacuum Pressure Sensor PMP-C-013
Rockwell Hardness Testers [1]	21.31 HRC 25.29 HRC 28.33 HRC 46.12 HRC 52.97 HRC 64.06 HRC 64.20 HRC 42.13 HRBW 42.66 HRBW 48.59 HRBW 71.42 HRBW 73.27 HRBW 73.43 HRBW 90.73 HRBW 91.51 HRBW 98.22 HRBW 98.40 HRBW	0.65 HRC 0.65 HRC 0.62 HRC 0.55 HRC 0.55 HRC 0.54 HRC 0.54 HRC 0.46 HRBW 0.37 HRBW 0.40 HRBW 0.29 HRBW 0.27 HRBW 0.31 HRBW 0.48 HRBW 0.41 HRBW 0.42 HRBW 0.42 HRBW	Indirect Verification using Hardness Test Blocks PMP-C-027
Superficial Rockwell Hardness Testers [1]	76.88 HR15TW 84.07 HR15TW 91.21 HR15TW	0.26 HR15TW 0.25 HR15TW 0.44 HR15TW	Indirect Verification using Hardness Test Blocks PMP-C-027

Mass and Mass Related Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Durometers (Types A, B, C, D) Spring Force Only	(0 to 100) Duro	0.58 Duro	Partial Direct Verification per ASTM D2240 using Digital Scale; PMP-C-027
Force [1] (Tension and Compression)	Up to 0.1 N (0.1 to 1) N (1 to 2 500) N (2.5 to 44.5) kN	0.086 % of reading 0.015 % of reading + 71 µN 0.026 % of reading 0.06 % of reading – 0.77 N	Dead Weights; PMP-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Force Transducers, Force Tools, Force Measuring Equipment [1]	5.6 N to 6.67 kN (6.67 to 66.7) kN (45 to 222) kN	0.2 % of reading + 8 mN 0.2 % of reading - 5 N 0.1 % of reading + 80 µN	Multifunction Calibrator, Digital Multimeter, Deadweights; PMP-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Force Transducers, Force Tools, Force Measuring Equipment [1] (compression)	(222 to 1 760) kN	1 % of reading - 3.7 N	Load Cell; PMP-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Pressure Measuring Equipment (Gauge Pressure)	Up to 500 Pa Up to 2 inH2O	0.37 % of reading – 8.5 mPa 0.37 % of reading - 0.000 034 inH_2O	Water Column; PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC
Pressure Measuring Equipment (Gauge Pressure)	Up to 30 psig Up to 0.2 MPa Up to 3 000 psig Up to 20.7 MPa	0.1 % of reading - 0.000 004 psi 0.1 % of reading - 28 mPa 0.07 % of reading - 0.000 001 psi 0.07 % of reading - 6.9 mPa	Pressure Calibrator; PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC
Pressure Measuring Equipment (Gauge Pressure)	(3 000 to 20 000) psig (20.7 to 138) MPa	5.3 psi 36.5 kPa	Pressure Sensor; PMP-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC

Photometry and Radiometry Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Power – Wavelength (nm)	(-38 to 20) dB (850 to 1 550) nm	1 dB 4 % of reading	Comparison to Master Power Meter PMP-C-039
Light Intensity Meters	(0.1 to 10 000) lux (10 k to 100 k) lux	0.4 % of reading + 0.006 lux 4.3 % of reading	Comparison to Master Illuminance Meter PMP-C-035
UV Meters	Up to 19.99 mW/cm^2 20 mW/cm^2 to 19 W/cm^2	0.82 % of reading 0.2 % if reading - 0.000 003 W/cm^2	Comparison to Master UV Meter PMP-C-035

Thermodynamic Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Source/Measure [1]	(10 to 75) %RH (75 to 97) %RH	2.2 %RH 2.5 %RH	Comparison to Humidity Meter and Thermometer using Certified Salts PMP-C-028
Temperature – Furnace System Accuracy Test (SAT), Furnace Temperature Uniformity Test (TUS) [1]	50 °C to 150 °C	0.15 % of reading + 0.16 °C	Temperature Measurement System; PMP-C-053 per the current version of AMS2750
	150 °C to 300 °C	0.25 % of reading + 0.052 °C	Temperature Measurement System; PMP-C-053 per the current version of AMS2750
	300 °C to 400 °C	1.6 % of reading - 3.8 °C	Temperature Measurement System; PMP-C-053 per the current version of AMS2750
Liquid-in-Glass Thermometers (Partial and Full Immersion)	(-30 to 300) °C	0.000 33 % of reading + 0.045 °C	RTD with Digital Multimeter PMP-C-007
Temperature [1] (Temperature Sources, Installations, Ovens, Chambers, Dry Wells)	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.003 8 % of reading + 0.028 °C 0.009 1 % of reading + 0.028 °C 0.008 2 % of reading + 0.030 °C	RTD with Digital Multimeter PMP-C-007

Thermodynamic Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature [1] (Temperature Sources and Temperature Chambers)	(660 to 1 000) ºC	0.088 % of reading + 1.3 °C	Thermocouple Probe and Temperature Indicator PMP-C-007
Temperature – RTD with Multimeter	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.003 8 % of reading + 0.034 °C 0.006 5 % of reading + 0.034 °C 0.006 3 % of reading + 0.035 °C	Comparison to RTD with Digital Multimeter, Dry Well, Temperature Bath; PMP-C-007
Temperature [1] (Digital/Analog Temperature Measuring Devices with Thermocouple, RTD, Thermistors; Mechanical/ Analog Thermometers)	(-20 to 0) ºC (0 to 400) ºC (400 to 600) ºC	0.031 °C - 0.09 % of reading 0.009 % of reading + 0.031 °C 0.035 % of reading - 0.071 °C	RTD with Digital Multimeter, Dry Well, Temperature Bath; PMP-C-007
Temperature [1] Temperature Measuring Devices (Digital, Mechanical)	(600 to 1 000) ºC	0.053 % of reading + 1.8 °C	Thermocouple Probe with Temperature Indicator, High Temperature Oven; PMP-C-007
Temperature [1] Environmental Thermometers	(-20 to 0) ºC (0 to 100) ºC	0.5 % of reading + 0.14 °C 0.27 % of reading + 0.14 °C	Comparison to RTD with Digital Multimeter PMP-C-007
Temperature [1] (Temperature Sources, Installations, Ovens, Chambers, Dry Wells)	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.003 8 % of reading + 0.028 °C 0.009 1 % of reading + 0.028 °C 0.008 2 % of reading + 0.030 °C	Comparison to RTD with Digital Multimeter PMP-C-007

Time and Frequency Hermosillo, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure	0.1 Hz to 18 GHz	1 nHz/Hz	GPS Receiver PMP-C-008
Timers, Stopwatches	(1 to 36 000) s (36 000 to 172 800) s	0.001 4 % of reading + 6.5 ms 0.000 13 % of reading + 0.47 s	Comparison to Frequency Counter PMP-C-008

DIMENSIONAL MEASUREMENT

3 Dimensional Hermosillo, Sonora

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
3D Dimensional Measurement [3]	Up to 1 in (1 to 10) in (10 to 20) in (20 to 25) in	49 µin (44 + 5.5*L*) µin (26 + 7.3*L*) µin (10 + 8*L*) µin	Coordinate Measuring Machine utilized as Reference, Customer Drawings, CMM Software
3D Dimensional Measurement [3]	Up to 1 in (1 to 2) in (2 to 6) in	95 µin (90 + 5*L*) µin (80 + 11*L*) µin	Vision System utilized as Reference, Customer Drawings, Vision Software

Services performed at satellite location

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CALIBRATION

Acoustics and Vibration Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meters [1]	(70 to 109) dB 100 Hz to 10 kHz	0.93 dB	Sound Level Meter (reference) and Source PMP-C-036
Sound Level Source Devices	(70 to 109) dB 100 Hz to 10 kHz	0.93 dB	Sound Level Meter PMP-C-036

Chemical Quantities Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters [5]	1.77 µS/cm 9.8 µS/cm 84.6 µS/cm 501 µS/cm 1002 µS/cm 1413 µS/cm 10 070 µS/cm 99 880 µS/cm	0.13 µS/cm 0.1 µS/cm 0.82 µS/cm 2.4 µS/cm 3.3 µS/cm 5.2 µS/cm 31.2 µS/cm 310 µS/cm	Accredited Conductivity Solutions PMP-C-043
pH Meters [5]	4 pH 7.01 pH 10 pH	0.017 pH 0.013 pH 0.025 pH	Accredited pH Buffer Solutions PMP-C-040

Electrical – DC/Low Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Leveled Sine Wave	5 mVp-p to 5.5 Vp-p 50 kHz to 100 MHz (50 to 300) MHz (300 to 600) MHz	 40 mV/V 45 mV/V 65 mV/V	Multifunction Calibrator PMP-C-010
Oscilloscopes Square Wave Signal into 50 Ω load into 1 MΩ load Rise Time	 10 Hz to 10 kHz 1 mVp-p to 6.6 Vp-p 10 Hz to 10 kHz 1 mVp-p to 130 Vp-p 5 mVp-p to 2.5 Vp-p 1 kHz to 10 MHz	 1.2 mV/V 1.3 mV/V 1 ms/s	Multifunction Calibrator PMP-C-010
DC High Voltage – Source/Measure [1]	(1 to 5) kV	2.4 % of reading - 0.49 V	High Voltage Probe with Digital Multimeter PMP-C-001
AC High Voltage – Source/Measure [1]	(0.7 to 1) kV 60 Hz (1 to 35) kV 60 Hz	 7 % of reading - 43 V 3.2 % of reading - 18 V	High Voltage Probe with Digital Multimeter PMP-C-003
DC Voltage – Source equipment	(1 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V 100 V to 1000 V	0.011 % of reading + 35 nV 43 nV - 3 % of reading 2.7 % of reading + 33 nV 1.3 % of reading + 0.38 µV 0.78 % of reading + 9.7 µV	Agilent Multimeter, Multifunction Calibrator PMP-C-001
DC Voltage – Measuring equipment [1]	(1 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V 100 V to 1000 V	0.011 % of reading + 35 nV 43 nV - 3 % of reading 2.7 % of reading + 33 nV 1.3 % of reading + 0.38 µV 0.78 % of reading + 9.7 µV	Agilent Multimeter, Multifunction Calibrator PMP-C-001
AC Voltage – Source and Measure	(1 to 100) mV 50 Hz to 100 kHz 100 mV to 1V 50 Hz to 100 kHz (1 to 10) V 50 Hz to 100 kHz (10 to 100) V 50 Hz to 50 kHz (100 to 700) V 50 Hz to 1 kHz	 0.02 % of reading + 12 nV 9.4 % of reading + 52 nV 9.4 % of reading + 0.12 µV 0.000 1 % of reading + 6.6 µV 0.000 24 % of reading - 50 µV	Agilent Multimeter, Multifunction Calibrator PMP-C-003

Electrical – DC/Low Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measuring Equipment	(700 to 5 000) V 60 Hz	2 % of reading - 9 V	Digital Multimeter, High Voltage Probe PMP-C-003
DC Current – Source/Measuring equipment	(10 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	1.2 % of reading - 0.28 nA 0.11 % of reading - 1 nA 0.002 9 % of reading + 27 pA 0.002 8 % of reading + 30 pA 0.002 5 % of reading + 0.27 nA 0.002 6 % of reading + 3.9 pA 0.004 3 % of reading - 0.14 µA 0.013 % of reading – 7.2 µA	Agilent Multimeter PMP-C-002
DC Current – Source/Measuring equipment [1]	(1 to 11) A (11 to 50) A	0.059 % of reading - 0.64 mA 0.011 % of reading + 4.1 mA	Multifunction Calibrator with Shunt Resistor PMP-C-002
DC Current – Measuring equipment Clamp-On Ammeters [1]	(50 to 550) A	0.28 % of reading - 0.11 A	Multifunction Calibrator, 50-turn Coil PMP-C-002
AC Current – Source/Measuring equipment	(1 to 10) mA 40 Hz to 1 kHz (10 to 100) mA 40 Hz to 1 kHz 100 mA to 1 A 40 Hz to 1 kHz	0.08 % of reading + 0.15 nA 0.089 % of reading - 7.2 µA 0.1 % of reading - 18 µA	Agilent Multimeter, Multifunction Calibrator PMP-C-004
AC Current – Source equipment	(1 to 50) A 60 Hz	6 mA - 0.007 6 % of reading	Digital Multimeter with Shunt Resistor PMP-C-004
AC Current – Measuring equipment [1]	(1 to 11) A 60 Hz (11 to 100) A 60 Hz	0.1 % of reading + 0.4 mA 8 mA - 0.001 6 % of reading	Multifunction Calibrator with Shunt Resistor PMP-C-004
AC Current – Measuring equipment Clamp-On Ammeters [1]	(50 to 550) A 60 Hz	0.27 % of reading + 5.2 mA	Multifunction Calibrator, 50-turn Coil PMP-C-004
DC Power – Source equipment	10.89 mW to 11 220 W	0.04 % of reading - 2 µW	Digital Multimeter, Shunt Resistor PMP-C-005
AC Power – Source equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 1	0.12 % of reading + 10 µW	Digital Multimeter, Shunt Resistor PMP-C-005

Electrical – DC/Low Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Source equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9	0.21 % of reading + 12 µW	Digital Multimeter with Shunt Resistor PMP-C-005
AC Power – Source equipment	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	0.3 % of reading + 9.2 µW	Digital Multimeter with Shunt Resistor PMP-C-005
DC Power – Measuring equipment [1]	10.89 mW to 11 220 W	0.04 % of reading - 2 µW	Multifunction Calibrator PMP-C-005
AC Power – Measuring equipment [1]	0.89 mW to 11 220 W @ 60 Hz, P.F. = 1	0.12 % of reading + 10 µW	Multifunction Calibrator PMP-C-005
AC Power – Measuring equipment [1]	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9	0.21 % of reading + 12 µW	Multifunction Calibrator PMP-C-005
AC Power – Measuring equipment [1]	0.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	0.3 % of reading + 9.2 µW	Multifunction Calibrator PMP-C-005
Resistance – Measuring equipment [1]	(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	20 µΩ/Ω 19 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 18 µΩ/Ω 61 µΩ/Ω 0.52 mΩ/Ω 0.29 mΩ/Ω	Digital Multimeter, Multifunction Calibrator PMP-C-006
Resistance – Source equipment	(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	20 µΩ/Ω 19 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 18 µΩ/Ω 61 µΩ/Ω 0.52 mΩ/Ω 0.29 mΩ/Ω	Digital Multimeter PMP-C-006
Generation/Measuring Resistance Equipment [1] (High value resistors, Decades)	100 kΩ to 10 GΩ Up to 5 kV	2.6 % of reading - 12 MΩ	Multifunction Calibrator, Agilent Digital Multimeter, High Voltage Probe PMP-C-006
DC Shunt Resistance Equipment [1]	0.5 mΩ to 1 Ω @ (1 to 50) A	0.059 % of reading - 17 µΩ	Agilent Digital Multimeter, Shunt resistor PMP-C-006

Electrical – DC/Low Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Resistance – Shunt Resistance [1]	0.5 mΩ to 1 Ω (1 to 50) A	0.059 % of reading - 17μΩ	Multimeter Agilent 3458A Shunt resistor PMP-C-006
Capacitance [1,3] Source equipment	100 pF to 10 μF 50 Hz to 1 kHz 75 kHz to 30 MHz	 0.42 mF/F 0.42 mF/F	LCR Meter PMP-C-009
Capacitance [1,3] – Measuring equipment	100 pF to 1 μF 50 Hz to 1 kHz 75 kHz to 30MHz	0.000 1 % of reading + 70 fF	Capacitance Decade PMP-C-009
Thermocouple Electrical Simulation [1]	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °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 Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C Type J (-250 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C Type K (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C	 0.44 °C 0.34 °C 0.3 °C 0.33 °C 0.3 °C 0.26 °C 0.31 °C 0.5 °C 0.84 °C 0.5 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C 0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C 0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °C	Multifunction Calibrator PMP-C-020

Electrical – DC/Low Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Electrical Simulation [1]	Type L (-200 to -100) °C (-100 to 800) °C (800 to 900) °C Type N (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C Type R (0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	 0.37 °C 0.26 °C 0.17 °C 0.4 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C 0.57 °C 0.35 °C 0.33 °C 0.4 °C 0.47 °C 0.36 °C 0.37 °C 0.46 °C 0.63 °C 0.24 °C 0.16 °C 0.14 °C 0.56 °C 0.27 °C	Multifunction Calibrator PMP-C-020
RTD Electrical Simulation [1]	Cu 427 10 Ω (-100 to 260) °C Pt 385, 100 Ω (-200 to -80) ºC (-80 to 0) ºC (0 to 100) ºC (100 to 300) ºC (300 to 400) ºC (400 to 630) ºC (630 to 800) ºC	 0.3 °C 0.05 ºC 0.05 ºC 0.07 ºC 0.09 ºC 0.1 ºC 0.12 ºC 0.23 ºC	Multifunction Calibrator PMP-C-020

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RTD Electrical Simulation [1]	Pt 3926, 100 Ω		Multifunction Calibrator PMP-C-020
	(-200 to -80) ºC	0.05 ºC	
	(-80 to 0) ºC	0.05 ºC	
	(0 to 100) ºC	0.07 ºC	
	(100 to 300) ºC	0.09 ºC	
	(300 to 400) ºC	0.1 ºC	
	(400 to 630) ºC	0.12 ºC	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.25 °C	
	(-190 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.09 °C	
	(400 to 600) °C	0.1 °C	
	(600 to 630) °C	0.23 °C	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.12 °C	
	(300 to 400) °C	0.13 °C	
	(400 to 600) °C	0.14 °C	
	(600 to 630) °C	0.16 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 600) °C	0.09 °C	
	(600 to 630) °C	0.11 °C	

Electrical – DC/Low Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RTD Electrical Simulation [1]	Pt 385, 1000 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 PtNi 385, 120 Ω (Ni120) (-80 to 0) °C (0 to 100) °C (100 to 260) °C	 0.03 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.07 °C 0.23 °C 0.08 °C 0.08 °C 0.14 °C	Multifunction Calibrator PMP-C-020

Length – Dimensional Metrology Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Outside Micrometers [1,3]	Up to 1 016 mm Up to 40 in	(0.26 + 0.23*L*) µm (10 + 9.2*L*) µin	Gage Blocks Grade 2, Gage blocks Grade 3, PMP-C-014 Reference Standard NMX-CH-099-IMNC-2005
Depth Micrometers [1,3]	Up to 1 016 mm Up to 40 in	(0.3 + 0.23*L*) µm (12 + 9.2*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014
Dial and Digital Indicators [1,3]	Up to 101.6 mm Up to 4 in	(0.25 + 0.14*L*) µm (9.7 + 5.3*L*) µin	Calibration Tester, Dial Gage Tester PMP-C-014 NMX-CH-36-1994
Calipers [1,3]	Up to 1 016 mm Up to 40 in	(2.3 + 0.2*L*) µm (89 + 7.8*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014 NMX-CH-2:1993-SCFI
Height Measuring Equipment [3]	Up to 1 016 mm Up to 40 in	(0.81 + 0.22*L*) µm (32 + 8.5*L*) µin	Gage Blocks Grade 2, Gage Blocks Grade 3 PMP-C-014

Length – Dimensional Metrology Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Comparator [2,3] X, Y Axis – Linear Error of Indication	Up to 508 mm Up to 20 in	(0.33 + 0.014*L*) µm (13 + 14*L*) µin	Glass Scales Gage Blocks Grade 2 Gage Block Grade 3 PMP-C-014
Optical Comparators [2] Angular	(0 to 360)º	0.019°	Angle block PMP-C-014
Optical Comparators [2] Magnification	5x 10x 20x 50x 100x	0.1 % of reading 0.051 % of reading 0.076 % of reading 0.051 % of reading 0.051 % of reading	Glass Ruler PMP-C-014
Graduated Rules, Tape Measures [3]	Up to 25 m Up to 985 in	(0.019 + 0.000 005*L*) µm (0.73 + 0.000 2*L*) µin	Laser Interferometer; PMP-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999
Graduated Rules, Tape Measures [3]	Up to 2 032 mm Up to 80 in	0.24 mm 0.009 4 in	Digital Indicator, Stainless Ruler, 5X Amplification Lens; PMP-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999
Coating Thickness [1,3]	Up to 1.5 mm Up to 0.06 in	(0.001 9 - 0.000 7*L*) mm (0.000 075 + 0.000 028*L*) in	Digital Indicator, Gage Blocks Grade 2; (GGG-G-15C) PMP-C-014
Surface Roughness Measuring Devices [1]	2.99 µm Ra 118 µin Ra 0.4 µm Ry 16 µin Ry	61 nm 2.4 µin 61 nm 2.4 µm	Mitutoyo Roughness Standards PMP-C-038
Levels [1]	(0 to 60)°	0.000 7°	Surface Plate, Sine Bar, Gage Blocks PMP-C-014
Surface Plates [1] Local Area Flatness (Only) (Repeat Reading)	Up to (192 x 192) in	(37 + 0.02*L*) µin	Repeat-o-meter PMP-C-014
Pin/Plug Gauges	(0.254 to 101.6) mm (0.01 to 4) in	0.36 µm 14 µin	Gage Blocks Grade 2, Universal Length Measuring machine PMP-C-014

Length – Dimensional Metrology Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plug Gage Pitch Diameter	M 1.6 x 0.35 to M 100 x 6 (0-80 to 4-12)	5.1 µm 200 µin	Supermicrometer, Gage block set grade 2 PMP-C-014
Thread Plug Gage Major Diameter	M 1.6 x 0.35 to M 100 x 6 (0-80 to 4-12)	1.8 µm 71 µin	Super micrometer Gage block set grade 2 PMP-C-014
Protractors	(0 to 360)°	0.059°	Angle Block PMP-C-014
Bore Gage	(0.762 to 304.8) mm (0.03 to 12) in	3.1 µm 120 µin	Ring gages Vision Microscope PMP-C-014
Radius Gage	(0.254 to 25.4) mm (0.01 to 1) in	4.1 µm 160 µin	Vision Microscope PMP-C-014
Angle Blocks	(0 to 90)°	0.014°	Vision Microscope PMP-C-014
Ring Gages	(12.7 to 101.6) mm (0.5 to 4) in	0.36 µm 14 µin	Universal measuring machine PMP-C-014

Mass and Mass Related Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances [4]	(0.001 to 1) g (1 to 60) g (60 to 200) g (200 to 1 000) g (1 to 10) kg (10 to 60) kg (60 to 100) kg (100 to 1 000) kg (1 000 to 2 500) kg	0.000 2 % reading + 11 µg 0.000 3 % reading + 10 µg 0.000 15 % reading + 0.11 mg 0.001 % reading - 1.6 mg 0.000 31 % reading + 5.3 mg 0.006 % reading - 0.56 mg 0.023 % reading - 11 g 0.015 % reading 0.015 % reading	ASTM E617 Class 1, OIML M2, NIST Class F weights and internal procedure PMP-C-012 utilized in the calibration of the weighing system.

Mass and Mass Related Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Volumetric Recipients [3] (measuring cylinder, flask, beaker precipitate, special containers, containers volumetric of graduates collar, plastic, glass and metallic)	(10 to 100) µL (100 to 500) µL (500 to 1 000) µL 1 mL to 5 L (5 to 30) L	0.04 % of reading + 0.11 µL 0.032 % of reading + 0.16 µL -0.018 % of reading + 0.38 µL 0.02 % of reading 0.012 % of reading + 0.35 nL	Digital Balance PMP-C-033
Torque Transducers, Torque Measuring Equipment [1]	(0.005 to 1) N·m (1 to 20) N·m (20 to 500) N·m (500 to 1 000) N·m	0.37 % of reading + 0.000 84 N·m 0.76 % of reading + 0.003 1 N·m 0.84 % of reading - 0.13 N·m 0.19 % of reading + 3.3 N·m	Dead Weights, Torque Arm, Torque Transducer; PMP-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Measuring Devices	(20.34 to 135.58) N·m 15 lbf·ft to 100 lbf·ft	0.036 % of reading + 0.17 N·m 0.036 % of reading + 0.13 lbf·ft	Dead Weighs, Torque Arm PMP-C-015
Torque Measuring Devices	(135.58 to 677.9) N·m 100 lbf·ft to 500 lbf·ft	(0.011 % of reading + 0.075 N·m 0.11 % of reading + 0.055 lbf·ft	Dead Weighs, Torque Arm PMP-C-015
Torque Measuring Devices	(677.9 to 1 355.8) N·m 500 lbf·ft to 500 lbf·ft	(0.06 % of reading + 0.38 N·m (0.06 % of reading + 0.28 lbf·ft	Dead Weighs, Torque Arm PMP-C-015
Hydrometers [3]	(0.62 to 3) SG	0.02 % of reading + 0.005 6 SG	Digital Scale Digital Thermometer PMP-C-032 NBS Circular 555
Rockwell Hardness Testers [1]	21.31 HRC 25.29 HRC 28.33 HRC 46.12 HRC 52.97 HRC 64.06 HRC 64.20 HRC	0.64 HRC 0.64 HRC 0.62 HRC 0.55 HRC 0.54 HRC 0.53 HRC 0.53 HRC	Indirect Verification using Hardness Test Blocks PMP-C-027

Mass and Mass Related Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers [1]	42.13 HRBW 42.66 HRBW 48.59 HRBW 71.42 HRBW 73.27 HRBW 73.43 HRBW 90.73 HRBW 91.51 HRBW 98.22 HRBW 98.40 HRBW	0.46 HRBW 0.37 HRBW 0.4 HRBW 0.29 HRBW 0.27 HRBW 0.31 HRBW 0.48 HRBW 0.41 HRBW 0.42 HRBW 0.42 HRBW	Indirect Verification using Hardness Test Blocks PMP-C-027
Durometers (Types A, B, C, D) Spring Force Only	(0 to 100) Duro	0.58 Duro	Partial Direct Verification per ASTM D2240 using Digital Scale; PMP-C-027
Force [1] (Tension and Compression)	Up to 0.1 N (0.1 to 1) N (1 to 2 500) N (2.5 to 44.5) kN	0.086 % of reading 0.015 % of reading + 0.000 071 N 0.026 % of reading 0.06 % of reading – 0.000 77 kN	Dead Weights; PMP-C-011, NMX-CH-27-1994-SCFI, NMX-CH-023-1994-SCFI
Force Transducers, Force Tools, Force Measuring Equipment [1]	5.5 N to 6.67 kN (6.67 to 66.7) kN (45 to 222) kN	0.22 % of reading + 0.66 N 0.25 % of reading - 1.7 N 0.23 % of reading + 120 N	Master Load Cell, Multiproduct Calibrator Digital Multimeter; PMP-C-011, NMX-CH-27-1994-SCFI, NMX-CH-023-1994-SCFI
Pressure Measuring Equipment (Gauge Pressure)	Up to 30 psig Up to 0.2 MPa Up to 3 000 psig Up to 20.7 MPa	0.1 % of reading - 0.000 004 psi 0.1 % of reading - 28 mPa 0.07 % of reading - 0.000 001 psi 0.07 % of reading - 6.9 mPa	Pressure Calibrator; PMP-C-013 NMX-CH-058-1994, NMX-CH-060-2006-IMNC
Pressure Measuring Equipment (Gauge Pressure)	(20.7 to 138) MPa (3 000 to 20 000) psi	9.1 psi	Pressure Sensor; PMP-C-013 NMX-CH-058-1994, NMX-CH-060-2006-IMNC

Photometry and Radiometry Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Light Intensity Meters [3]	(0.1 to 10 000) lux (10 000 to 100 000) lux	7 % of reading - 75 lux 11 % of reading - 890 lux	Comparison to Master Illuminance Meter PMP-C-035
UV Meters [3]	Up to 19.99 mW/cm^2 19.99 mW to 30 W/cm^2	5 % of reading + 0.000 2 mW/cm^2 4 % of reading + 2.5 mW/cm^2	Comparison to Master UV Meter PMP-C-035

Thermodynamic Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Source/Measure [1]	(10 to 75) %RH (75 to 97) %RH	2.2 %RH 2.5 %RH	Comparison to Humidity Meter and Thermometer using Certified Salts PMP-C-028
Temperature [1] Furnace System Accuracy Test (SAT), Furnace Temperature Uniformity Test (TUS)	(50 to 150) °C	0.15 % of reading + 0.16 °C	Temperature Measurement System; PMP-C-053 per the current version of AMS2750
	(150 to 300) °C	0.25 % of reading + 0.052 °C	Temperature Measurement System; PMP-C-053 per the current version of AMS2750
	(300 to 400) °C	1.6 % of reading - 3.8 °C	Temperature Measurement System; PMP-C-053 per the current version of AMS2750
Temperature [1] (Temperature Sources, Installations, Ovens, Chambers, Dry Wells Temperature Sources, Temperature Chambers	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.003 8 % of reading + 0.028 °C 0.009 1 % of reading + 0.028 °C 0.008 2 % of reading + 0.03 °C	RTD with Digital Multimeter PMP-C-007
	(660 to 1 000) ºC	0.088 % of reading + 1.3 °C	Thermocouple Probe with Temperature Indicator, PMP-C-007
Temperature – RTD with Multimeter	(-80 to 0) ºC (0 to 232) ºC (232 to 660) ºC	0.003 8 % of reading + 0.034 °C 0.006 5 % of reading + 0.034 °C 0.006 3 % of reading + 0.035 °C	Comparison to RTD with Digital Multimeter, Dry Well, Temperature Bath; PMP-C-007

Thermodynamic Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature [1] (Digital/Analog Temperature Measuring Devices with Thermocouple, RTD, Thermistors; Mechanical/ Analog Thermometers)	(-20 to 0) ºC (0 to 400) ºC (400 to 600) ºC	-0.09 % of reading + 0.031 °C 0.009 % of reading + 0.031 °C 0.035 % of reading - 0.071 °C	RTD with Digital Multimeter, Dry Well, Temperature Bath; PMP-C-007
Temperature [1] Temperature Measuring Devices (Digital, Mechanical)	(600 to 1 000) ºC	0.053 % of reading + 1.8 °C	Thermocouple Probe with Temperature Indicator, High Temperature Oven; PMP-C-007
Temperature [1] Environmental Thermometers	(-20 to 0) ºC (0 to 100) ºC	0.5 % of reading + 0.14 °C 0.27 % of reading + 0.14 °C	Comparison to RTD with Digital Multimeter PMP-C-007

Time and Frequency Guaymas, Sonora

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure	0.1 Hz to 18 GHz	1 nHz/Hz	GPS Receiver PMP-C-008
Timers, Stopwatches	(1 to 36 000) s (36 000 to 172 800) s	0.001 4 % of reading + 6.5 ms 0.000 13 % of reading + 0.47 s	Comparison to Frequency Counter PMP-C-008

DIMENSIONAL MEASUREMENT

3 Dimensional Guaymas, Sonora

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
3D Dimensional Measurement [3]	Up to 1 in (1 to 10) in (10 to 20) in (20 to 25) in	49 µin (44 + 5.5*L*) µin (26 + 7.3*L*) µin (10 + 8*L*) µin	Coordinate Measuring Machine utilized as Reference, Customer Drawings, CMM Software

3 Dimensional Guaymas, Sonora

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
3D Dimensional Measurement [3]	Up to 1 in (1 to 2) in (2 to 6) in	95 µin (90 + 5*L*) µin (80 + 11*L*) µin	Vision System utilized as Reference, Customer Drawings, Vision Software

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. This parameter is only available on-site and not in the laboratory's facilities.
3. L = length in inches or mm; SG = specific gravity; DF = dissipation factor; ″ = arc-second.
4. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The uncertainties presented here do 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. Nominal values are approximate. The actual values will be used at the time of calibration, along with the appropriate measurement uncertainty.
6. Volumetric performance test (reproducibility) is done using a non-calibrated ball length bar per ASME B89.4.1-1997.
7. Not all parameters apply to all Durometer Types.
8. This parameter is a dimensionless parameter (no unit of measure).
9. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1890.

Jason Stine, Vice President