



CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board

11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Metrología y Pruebas, S. A. de C. V.
Boulevard Vildosola No. 229
Hermosillo, Sonora, Mexico

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

ISO/IEC 17025:2017

while demonstrating technical competence in the fields of

CALIBRATION & DIMENSIONAL MEASUREMENT

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

AC-1337

Certificate Number


ANAB Approval

Certificate Valid Through: 07/07/2020
Version No. 006 Issued: 08/02/2019



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.

Boulevard Vildosola No. 229

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CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: July 7, 2020

Certificate Number: AC-1337

CALIBRATION

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound ¹	(20 to 130) dB 100 Hz to 10 kHz	1 dB	Sound Calibrator Sound Level Meter PMPH-C-036

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters	10 µS 100 µS 1 000 µS 10 000 µS 100 000 µS	0.35 µS/cm ² 2.2 µS/cm ² 4.9 µS/cm ² 20 µS/cm ² 300 µS/cm ²	Traceable Conductivity Solutions PMPH-C-043
pH Meters	4.00 pH 6.86 pH 10.1 pH	0.013 pH 0.011 pH 0.013 pH	pH Buffer Solutions PMPH-C-040



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ^{1,3} Leveled Sine Wave (Relative to 50 kHz) Square Wave Signal 10 Hz to 10 kHz Rise Time 5 mV to 2.5 V	5 mV to 5.5 V 50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz $\pm (1 \text{ mV to } 6.6 \text{ V}) \text{ p-p}$ (50 Ω load) $\pm (1 \text{ mV to } 130 \text{ V}) \text{ p-p}$ (1 M Ω load) 1 kHz to 10 MHz	1.5 mV 2.7 mV 3.9 mV $(0.000 2 + 0.000 5E) \text{ mV}$ $(0.000 08 + 0.001 2E) \text{ mV}$ 0.1 ns	Fluke 5500A-SC600 Multiproduct Calibrator PMPH-C-010
DC High Voltage ^{1,3} - Source and Measure	(1 to 5) kV	$(-0.005 6 + 0.028E) \text{ kV}$	Tektronix P6015A Charged Plate Analyzer Monroe Electronics 268A-1T PMPH-C-001
AC High Voltage ³ - Source and Measure	700 V to 1.02 kV 40 Hz to 10 kHz (1.02 to 35) kV 60 Hz	$(-56 + 0.082E) \text{ V}$ $(-5.5 + 0.032E) \text{ V}$	(standard) Multimeter Fluke 8840A High Voltage Probe P6015A (generator) High Voltage Test Hipotronics PMPH-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 $\mu\text{V/V}$ 8 $\mu\text{V/V}$ 8 $\mu\text{V/V}$ 10 $\mu\text{V/V}$ 10 $\mu\text{V/V}$	Multimeter HP 3458A PMPH-C-001
DC Voltage – Measure 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 $\mu\text{V/V}$ 8 $\mu\text{V/V}$ 8 $\mu\text{V/V}$ 10 $\mu\text{V/V}$ 10 $\mu\text{V/V}$	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-C-001
AC Voltage – Source equipment	(1 to 100) mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz	0.073 mV/V 0.072 mV/V 0.073 mV/V	Multimeter HP 3458A PMPH-C-003



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source equipment ³	100 mV to 1V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.78 mV/V 0.78 mV/V 0.78 mV/V 1.1 mV/V	Multimeter HP 3458A PMPH-C-003
	(1 to 10) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	9.5 mV/V 12 mV/V 9.5 mV/V 9.5 mV/V	
	(10 to 100) V 40 Hz to 1 kHz (1 to 20) kHz	95 mV/V 120 mV/V	
	(100 to 1 020) V 40 Hz to 1 kHz	(1 300 + 0.21E) mV/V	
AC Voltage – Source equipment ³	(1 to 5) kV 60 Hz	(-43 + 0.044E) mV/V	Multimeter Fluke 8840A High Voltage Probe P6015A PMPH-C-003
AC Voltage – Measure equipment ^{1,3}	(1 to 100) mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz	0.073 mV/V 0.072 mV/V 0.073 mV/V	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-C-003
	100 mV to 1V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.78 mV/V 0.78 mV/V 0.78 mV/V 1.1 mV/V	
	(1 to 10) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	9.5 mV/V 12 mV/V 9.5 mV/V 9.5 mV/V	
	(10 to 100) V 40 Hz to 1 kHz (1 to 20) kHz	95 mV/V 120 mV/V	
AC Voltage – Measure equipment ^{1,3}	(100 to 1 020) V 40 Hz to 1 kHz	(1 300 + 0.21E) mV/V	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-C-003



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure equipment ^{1,3}	(1 to 5) kV 60 Hz	$(-43 + 0.049E)$ mV/V	(standards) Multimeter Fluke 8840A High Voltage Probe P6015A (generator) High Voltage Test Hipotronics PMPH-C-003
AC Voltage – Measure equipment ^{1,3}	(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	0.073 mV/V 0.072 mV/V 0.073 mV/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 $(1\ 300 + 0.21E)$ mV/V	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-C-003
AC Voltage – Measure equipment ^{1,3}	(1 to 5) kV 60 Hz	$(-43 + 0.044E)$ mV/V	(standards) Multimeter Fluke 8840A High Voltage Probe P6015A (generator) High Voltage Test Hipotronics PMPH-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	0.076 nA 64 μA/A 35 μA/A 36 μA/A 0.028 μA 0.1 μA 0.12 μA 0.000 12 A	Multimeter HP 3458A PMPH-C-002

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current ¹ – Source equipment	(1 to 50) A	$(-0.002\ 1 + 0.002\ 2I)\ A$	Multimeter HP 3458A with Shunt Resistor Leed & Northrup 4361 PMPH-C-002
DC Current ¹ – Measure equipment	(10 to 100) nA 100 nA to 1 μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	0.076 nA 64 μ A/A 35 μ A/A 36 μ A/A 0.028 μ A 0.1 μ A 0.12 μ A 0.000 12 A	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-C-002
DC Current ¹ – Measure equipment	(1 to 11) A (11 to 50) A	$(-0.011 + 0.011I)\ A$ $(0.14 - 0.000\ 54I)\ A$	(generator) Calibrator Fluke 5500A with Shunt Resistor Leeds & Northrup 4361 PMPH-C-002
DC Current ¹ – Measure equipment Clamp-On Ammeters	(50 to 550) A	$(0.09 + 0.002\ 2I)\ A$	(generator) Calibrator Fluke 5500A with Fluke 5500A coil PMPH-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	$(0.002 + 0.000\ 6I)\ mA$ $(0.002 + 0.000\ 3I)\ mA$ $(0.02 + 0.000\ 6I)\ mA$ $(0.02 + 0.000\ 3I)\ mA$ $(0.2 + 0.000\ 8I)\ mA$ $(0.2 + 0.001I)\ mA$	Multimeter HP 3458A PMPH-C-004
AC Current – Source equipment	(1 to 50) A 60 Hz	0.000 7 A	Multimeter HP 3458A with Shunt Resistor Leeds & Northrup 4361 PMPH-C-004

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current ¹ – Measure 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	(0.002 + 0.000 6 <i>I</i>) mA (0.002 + 0.000 3 <i>I</i>) mA (0.02 + 0.000 6 <i>I</i>) mA (0.02 + 0.000 3 <i>I</i>) mA (0.2 + 0.000 8 <i>I</i>) mA (0.2 + 0.001 <i>I</i>) mA	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-C-004
AC Current ¹ – Measure equipment	(1 to 11) A 60 Hz (11 to 50) A 60 Hz	(-0.000 9 + 0.001 5 <i>I</i>) A (0.14 - 0.000 5 <i>I</i>) A	(generator) Calibrator Fluke 5500A with Shunt Resistor Leed & Northrup 4361 PMPH-C-004
AC Current ¹ – Measure equipment Clamp-On Ammeters	(50 to 550) A 60 Hz	(0.07 + 0.002 <i>I</i>) A	(generator) Calibrator Fluke 5500A with Fluke 5500A coil PMPH-C-004
DC Power Source equipment ³	10.89 mW to 11 220 W	(-0.002 + 0.000 4 <i>J</i>) mW	Multimeter HP 3458A with Shunt Resistor Leed & Northrup 4361 PMPH-C-005
AC Power – Source equipment ³	10.89 mW to 11 220 W @ 60 Hz, P.F. = 1	(0.01 + 0.001 2 <i>J</i>) mW	Multimeter HP 3458A with Shunt Resistor Leed & Northrup 4361 PMPH-C-005
AC Power – Source equipment ³	10.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9	(0.012 + 0.002 1 <i>J</i>) mW	Multimeter HP 3458A with Shunt Resistor Leed & Northrup 4361 PMPH-C-005
AC Power - Source equipment ³	10.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	(0.009 2 + 0.003 <i>J</i>) mW	Multimeter HP 3458A with Shunt Resistor Leed & Northrup 4361 PMPH-C-005
DC Power Measure equipment ^{1,3}	10.89 mW to 11 220 W	(-0.002 + 0.004 <i>J</i>) mW	Calibrator Fluke 5500A PMPH-C-005
AC Power ^{1,3} – Measure equipment	10.89 mW to 11 220 W @ 60 Hz, P.F. = 1	(0.01 + 0.001 2 <i>J</i>) mW	Calibrator Fluke 5500A PMPH-C-005



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power ^{1,3} – Measure equipment	10.89 mW to 11 220 W @ 60 Hz, P.F. = 0.9	(0.012 + 0.002 1J) mW	Calibrator Fluke 5500A PMPH-C-005
AC Power ^{1,3} – Measure equipment	10.89 mW to 11 220 W @ 60 Hz, P.F. = 0.8	(0.009 2 + 0.003J) mW	Calibrator Fluke 5500A PMPH-C-005
Resistance ¹ – Measure 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 520 μΩ/Ω 290 μΩ/Ω	(standard) Multimeter HP 3458A (generator) Calibrator Fluke 5500A PMPH-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 520 μΩ/Ω 290 μΩ/Ω	HP 3458A PMPH-C-006
Generation and Measuring Resistance Equipment ¹ High value resistors and decade	0.5 mΩ to 1 Ω up to 50 A Max	450 μΩ/Ω	Indirect method Calibrator Fluke 5500A Multimeter HP 3458A Shunt resistor 0.01Ω Shunt resistor 0.1Ω PMPH-C-006
Generation and Measuring Resistance Equipment ¹ High value resistors and decade	100 kΩ to 1 TΩ up to 5 000 V Max	23 mΩ/Ω	Indirect method Calibrator Fluke 5500A Multimeter HP 3458A High Voltage Probe Tektronix P6015A PMPH-C-006
DC Shunt Resistance Equipment ^{1,3}	1 mΩ to 1 Ω @ (1 to 11) A 1mΩ to 1Ω @ (11 to 50) A	(0.011 + 0.000 05R) mΩ	Multimeter HP 3458A Shunt resistor 0.01Ω Shunt resistor 0.1Ω PMPH-C-006



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC electrical Resistance at 60 Hz Shunt Resistance ^{1,3}	1 mΩ to 1 Ω @ (1 to 11) A 1 mΩ to 1 Ω @ (11 to 50) A	(0.011 + 0.000 05R) mΩ	Multimeter HP 3458A Shunt resistor 0.01Ω Shunt resistor 0.1Ω PMPH-C-006
Capacitance ^{1,3} Source equipment	100 pF to 10 μF 50 Hz to 1 kHz 75 kHz to 30 MHz	0.042 mF/mF	LCR HP 4285A PMPH-C-009
Capacitance ^{1,3} – Measure equipment	100pF to 1 μF 50 Hz to 1 kHz 75kHz to 30MHz	(0.07 + 0.000 001C) pF	LCR Bridge GenRad 1689-PI LCR HP 4285A PMPH-C-009
D Factor ¹ – Measure equipment	(0.000 1 to 9 999) DF 50 Hz to 100 kHz	0.000 1 DF	LCR Bridge GenRad 1689M
	(0.000 001 to 9.999 99) DF 75 kHz to 30 MHz	0.000 5 DF	LCR HP 4285A PMPH-C-009
Inductance ¹ – Source equipment	0.01 pH to 99 999 H @ 50 Hz to 100 kHz	0.02 % of reading	LCR Bridge GenRad 1689M
	0.001 nH to 99 999 H 75 kHz to 30 MHz	0.05 % of reading	LCR HP 4285A PMPH-C-029
Inductance ^{1,3} – Measure equipment	100 mH to 2 H	0.23 mH/H	LCR HP 4285A GenRad 1482-L GenRad 1482-Q PMPH-C-029
Q Factor – Measure equipment ¹	(0.000 1 to 9 999) Q 50 Hz to 100 kHz	0.000 1 Q	LCR Bridge GenRad 1689M
	(0.01 to 99 999.9) Q 75 kHz to 30 MHz	0.000 5 Q	LCR HP 4285A PMPH-C-029
Thermocouple 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	0.44 °C 0.34 °C 0.3 °C 0.33 °C	Calibrator Fluke 5500A PMPH-C-020

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Simulation ¹	Type C		Calibrator Fluke 5500A PMPH-C-020
	(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		
Type R			
(0 to 250) °C	0.57 °C		
(250 to 400) °C	0.35 °C		
(400 to 1000) °C	0.33 °C		
(1000 to 1767) °C	0.4 °C		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Simulation ¹	Type S		Calibrator Fluke 5500A PMPH-C-020
	(0 to 250) °C	0.47 °C	
	(250 to 1 000) °C	0.36 °C	
	(1 000 to 1 400) °C	0.37 °C	
	(1 400 to 1 767) °C	0.46 °C	
	Type T		
	(-250 to -150) °C	0.63 °C	
	(-150 to 0) °C	0.24 °C	
	(0 to 120) °C	0.16 °C	
	(120 to 400) °C	0.14 °C	
RTD Simulation ¹	Type U		Calibrator Fluke 5500A PMPH-C-020
	(-200 to 0) °C	0.56 °C	
	(0 to 600) °C	0.27 °C	
	Pt 385, 100 Ω		
	(-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	
	(630 to 800) °C	0.23 °C	
	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 3926, 100 Ω			
(-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		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RTD Simulation ¹	Pt 385, 200 Ω		Calibrator Fluke 5500A PMPH-C-020
	(-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		
Cu 427 10 Ω			
(-100 to 260) °C	0.3 °C		





Electrical – RF/Microwave

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)	0.2 dB	HP 8484 ^a , HP 8481A Agilent E9301A Agilent E4418-EPM HP E4445A PMPH-C-008
	(-60 to +20) dBm (10 MHz to 6 GHz)	0.2 dB	
	(-35 to + 20) dBm (10 MHz to 18 GHz)	0.2 dB	
	(-70 to -20) dBm (10 MHz to 18 GHz)	0.2 dB	
RF Power - Source ¹ 50 Ohm load	(-127 to +13) dBm (100 KHz to 999 MHz)	0.2 dB	HP 8484A, HP 8481A Agilent E9301A Agilent E4418-EPM HP 8673E, HP E4433B HP E4445A PMPH-C-008
	(-120 to +8) dBm (2 to 18) GHz	0.2 dB	
	(-136 to +17) dBm (250 kHz to 4 GHz)	0.2 dB	
Phase Modulation ¹ – Measure Carrier Frequency: 100 kHz to 13.2 MHz	200 Hz to 20 kHz	1 % of reading	Agilent PSA E4445A HP 8673E HP E4433B PMPH-C-008
Amplitude Modulation ¹ - Source and Measure Rate: 20 Hz to 10 kHz 50 Hz to 100 kHz Flatness – Measure	Depths: 5% to 99%	0.75 % of reading	Agilent PSA E4445A HP 8673E HP E4433B PMPH-C-008
	100 kHz to 10 MHz	1.5 % of reading	
10 MHz to 13.2 GHz			
10 MHz to 13.2 GHz Rate: 90 Hz to 10 kHz Depth (5 to 99) %	0.4 % of reading		
Frequency Modulation ¹ - Source and 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	1.5 % of reading	Agilent PSA E4445A HP 8673E HP E4433B PMPH-C-008
	200 Hz to 300 kHz (-80 to -0.1) dB	1 % of reading	



Length – Dimensional metrology

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	$(1 + 0.22L) \mu\text{m}$ $(39 + 8.6L) \mu\text{in}$	Gage Blocks Grade 2 Gage blocks Grade 3 PMPH-C-014 Reference Standard NMX-CH-099-IMNC-2005
Depth Micrometers ^{1,3}	Up to 1 016 mm Up to 40 in	$(1 + 0.22L) \mu\text{m}$ $(39 + 8.6L) \mu\text{in}$	Gage Blocks Grade 2 Gage Blocks Grade 3 PMPH-C-014
Dial and Digital Indicators ^{1,3}	Up to 101.6 mm Up to 4 in	$(0.88 + 0.083L) \mu\text{m}$ $(35 + 3.3L) \mu\text{in}$	Calibration Tester Dial Gage Tester PMPH-C-014 NMX-CH-36-1994
Calipers ^{1,3}	Up to 1 016 mm Up to 40 in	$(9.6 + 0.089L) \mu\text{m}$ $(380 + 3.5L) \mu\text{in}$	Gage Blocks Grade 2 Gage Blocks Grade 3 PMPH-C-014 NMX-CH-2:1993-SCFI
Height Measuring Equipment ³	Up to 1 016 mm Up to 40 in	$(0.95 + 0.22L) \mu\text{m}$ $(38 + 8.6L) \mu\text{in}$	Gage Blocks Grade 2 Gage Blocks Grade 3 PMPH-C-014
Optical Comparators ^{1,3}	Up to 508 mm Up to 20 in	$(0.96 + 0.048L) \mu\text{m}$ $(38 + 1.9L) \mu\text{in}$	Glass Scales Gage Blocks Grade 2 Gage Block Grade 3 PMPH-C-014
Graduated Rules and Flexometers ³	Up to 25 m Up to 985 in	$0.076 \mu\text{m}$ $3 \mu\text{in}$	MPC273 API Laser Interferometer PMPH-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999
Graduated Rules and Flexometers ³	Up to 101.6 mm Up to 4 in	$(20 + 0.008L) \mu\text{m}$ $(790 + 0.33L) \mu\text{in}$	Digital Indicator Stainless Ruler 5X Amplification Lens PMPH-C-014 NOM-040-SCFI-1994 & NOM-046-SCFI-1999
Coordinate Measuring Machines Linear Error ^{2,3}	Up to 609.6 mm Up to 24 in	$(0.23 + 0.05L) \mu\text{m}$ $(9.1 + 2L) \mu\text{in}$	Gage Blocks Grade 2 Gage Blocks Grade 3 PMPH-C-014
Coordinate Measuring Machines Linear Error ^{2,3}	(100 to 25 000) mm (3.93 to 98) in	$(0.005 + 0.013L) \mu\text{m}$ $(0.2 + 0.5L) \mu\text{in}$	API Laser Interferometer XD5LS

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Coordinate Measuring Machines Volumetric error ²	(200 to 800) mm (8 to 32) in	4.3 μ m 170 μ in	Ball Bars PMPH-C-014
Coating Thickness ^{1,3}	Up to 6.35 mm Up to 0.25 in	(0.72 + 0.043L) μ m (28 + 1.7L) μ in	Digital Indicator Gage Blocks Grade 2 PMPH-C-014
Rugosity ¹	Ra = 2.94 μ m (116 μ in) Ry = 366 μ m (9.3 μ in)	0.061 μ m 0.2 μ m	Rugosity Standard (Ra, Ry) Mitutoyo PMPH-C-038
Levels ¹	(-4 125 to +4 125) arc sec	0.42 arc sec	MPC286 Level Table Traceable to NIST PMPH-C-014
Digital Levels ¹	(15, 30, 45, 90) °	0.42 arc sec	Angle Blocks Mitutoyo PMPH-C-014
Surface Plates ¹ Local Area Flatness (Repeat Reading)	Up to (192 x 192) in	21 μ m	Repeatability Gauge Repeat-o-meter PMPH-C-014
Surface Plates ¹ Overall Flatness	Up to (192 x 192) in	11 μ m	MPC273 API Laser Interferometer PMPH-C-014
Gages Blocks ³ Grade 1, 2 and 3 (FS)	(0.254 to 152.9) mm (0.01 to 6) in	(0.1 + 0.047L) μ m (3.9 + 1.9L) μ in	Gage Blocks Grade 1 FS Gage Blocks Comparator

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dead Weights ³	(0.01 to 200) g	(0.000 3 + 0.000 001W) mg	Class 1 Stainless Weights PMPH-C-021 NIST Handbook 44 OIML R111 ABBA Method

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dead Weights ³	(0.2 to 4) kg (4 to 20) kg (20 to 60) kg	(0.000 4 + 0.000 003W) g (-0.16+0.000 04W) g (0.29 + 0.000 01W) g	Digital Scale as Comparison Element Class M2 Weights and Scales PMPH-C-021 NIST Handbook 44 OIML R111 ABBA Method
Scales and Balances ³	Up to 20 kg	(-0.00 06+0.000 03W) g	Class 1 Stainless Weights PMPH-C-012 NOM-010-SCFI-1994, NMX-CH-31-1982, NMX-CH-047-1996-IMNC & NMX-CH-059-1996-IMNC
Scales and Balances ^{1,3}	(20 to 2 000) kg	(-0.002 9 + 0.000 18W) g	On site Class F Cast Iron Weights PMPH-C-012 NOM-010-SCFI-1994, NMX-CH-31-1982, NMX-CH-047-1996-IMNC & NMX-CH-059-1996-IMNC
Volume ³	(0.0001 to 1) ml (1 to 200) ml (200 to 3 000) ml (3 000 to 30 000) ml (30 000 to 60 000) ml	(0.006 + 0.04V) ml (0.04 + 0.000 5V) ml (0.015 + 0.000 2V) ml (-0.01 + 0.000 2V) ml (0.3 + 0.000 2V) ml	Dead Weights Digital Scale PMPH-C-033 NOM-042-SCFI-1997 & NMX-CH-049-IMNC-2006
Water Flow ^{2,3}	Up to 3 000 l/min	(0.9 + 0.005F) l/min	Water Flow Meter PMPH-C-034
Torque Transducers, Tools, and Measuring Equipment ^{1,3}	(0.005 to 1) Nm (1 to 20) Nm (20 to 500) Nm	(0.000 001 + 0.004T) Nm (-0.004 + 0.007T) Nm (-0.02 + 0.008T) Nm	Dead Weights with Torque Arm PMPH-C-015 CNM-MMF-PT-002 & EA-10/14
Torque Transducers, Tools, and Measuring Equipment ^{1,3}	(67.8 to 678) Nm	(-0.11 + 0.004 8T) Nm	Torque Transducer Torque Meter TM-200 PMPH-C-015 CNM-MMF-PT-002 & EA-10/14



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Transducers, Tools, and Measuring Equipment ³	(678 to 1 355) Nm	(2.9 + 0.000 7T) Nm	Torque Transducer Torque Meter ETA Mk. V PMPH-C-015 CNM-MMF-PT-002 & EA-10/14
Air Flow ^{1,3}	Up to 20 sl/min Up to 300 sl/min	(0.000 4 + 0.002 5A) sl/min (0.24 + 0.003 3A) sl/min	Air Flow Transducers PMPH-C-030
Air Velocity ³ (Air Speed)	Up to 25 m/s	(0.18 + 0.008 7Y) m/s	Wind Tunnel with Anemometer Master PMPH-C-030
Specific Gravity ³	(0.62 to 3) SG	(0.023 - 0.004 2G) SG	Dead Weights Digital Scale Digital Thermometer PMPH-C-032 NBS Circular 555
Vacuum meters ^{1,3} Generate / Measure	1 bar to 4 x 10 ⁻³ mbar (1x10 ⁻³ to 1x10 ⁻⁹) mbar	(0.000 05 + 0.013U) mbar 0.016U mbar	Pressure Sensor Instrutech CVG101GA Edwards high Vacuum AIM-S-MW25 PMPH-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 Test Blocks PMPH-C-027



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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 Test Blocks PMPH-C-027
Shore Hardness Testers Spring Force Only Types A, B Types C, D	(0 to 100) Duro	0.58 Duro	Dead Weights Digital Scale PMPH-C-027
Force Transducers, Tools, and Measuring Equipment ³	(0.1 to 5.5) N	(-0.000 004 + 0.003N) N	Dead weights PMPH-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Force Transducers, Tools, and Measuring Equipment ^{1,3}	5.6 N to 6.67 kN (6.67 to 66.7) kN (45 to 222) kN	(0.008 + 0.002N) N (-0.005 + 0.002N) kN (0.000 08 + 0.001N) kN	Load Cell Fluke 5500A HP 3458A PMPH-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Force Transducers, Tools, and Measuring Equipment ^{1,3} (compression)	(222 to 1 760) kN	(-0.003 7 + 0.01N) kN	Load Cell 250 Ton PMPH-C-011 NMX-CH-27-1994-SCFI & NMX-CH-023-1994-SCFI
Relative Pressure ³	Up to 500 Pa Up to 2 inH2O	(-0.000 034 + 0.003 7P) inH2O	Water Column PMPH-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC
Relative Pressure ³	Up to 0.2 Mpa Up to 30 psi (Up to 20.7) Mpa (Up to 3 000) psi	(-0.000 004 + 0.001P) psi (-0.000 001 + 0.000 7P) psi	Pressure Calibrator PMPH-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC
Relative Pressure	(20.7 to 138) Mpa (3 000 to 20 000) psi	5.3 psi	Pressure Sensor PMPH-C-013 NMX-CH-058-1994 & NMX-CH-060-2006-IMNC



Photometry and Radiometry

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	Power Meter PMPH-C-039
Light Intensity Meters ³	(0.1 to 10 000) lux (10 k to 100 k) lux	(0.006 + 0.004x) lux (0.043x) lux	Minolta T-1 PMPH-C-035
UV Meters ³	Up to 19.99 mW/cm ² 20 mW to 19W/cm ²	0.008 2 mW/cm ² (-0.000 003 + 0.002z) W/cm ²	Meter UV Dymax RCH-108-4 PMPH-C-035

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity ^{1,3}	(10 to 95) %RH	(0.7+0.008h) %RH	Reference Materials Humidity Meter Thermometer PMPH-C-028
Temperature ³	(-30 to 400) °C (400 to 600) °C	(0.039 + 0.000 005t) °C 1.4 °C	RTD / SPRT / HP 34401 Thermocouple/ Fluke 51 II PMPH-C-007

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency ¹ – Source and Measure	0.1 Hz to 18 GHz	1 x 10 ⁻⁹ Hz/Hz	GPS Receiver HP Z3801A PMPH-C-008

DIMENSIONAL MEASUREMENT


3 Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Dimensional Inspection CMM 3D / Inspeccion Dimensional	X = Up to 24 in (609.6 mm) Y = Up to 2 in (508 mm) Z = Up to 12 in (304.8 mm)	(0.000 01 + 0.000 002L) in (0.000 01 + 0.000 001L) in (0.000 01 + 0.000 002L) in	Coordinate Measuring Machine and Vision System used as Reference Customer Drawings CMM and 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. *A* = applied air flow in standard liters/minute; *C* = applied electromagnetic capacitance in Farads; *E* = applied electromagnetic voltage in Volts; *F* = applied water flow in liters/minute; *G* = applied and in terms of specific gravity; *h* = applied Relative Humidity in percent RH; *H* = applied inductance in Henrys; *I* = applied current in amperes; *J* = applied electromagnetic power in Watts; *L* = applied length in millimeters or inches; *N* = applied to force in Newtons; *P* = applied pressure in Pascal or psi; *R* = applied electromagnetic resistance in Ohms; *t* = applied temperature in degrees Celsius; *T* = applied torque in Newton-meters; *U* = applied vacuum in millibars; *V* = applied volume in liters; *W* = applied weight in grams; *x* = applied light intensity in lux; *Y* = applied air velocity or air speed in meters/second; and *z* = applied Ultraviolet light in Watts per centimeter squared.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1337.



Vice President

