



# PERRY JOHNSON LABORATORY ACCREDITATION, INC.

## Certificate of Accreditation

*Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:*

***A&C Metrology Services, S. de R.L. de C.V.***  
***Privada Galileo Galilei # 1618, Fraccionamiento Satélite Magisterial***  
***Puebla, Puebla, México. CP. 72320***

*(Hereinafter called the Organization) and hereby declares that Organization 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 (as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

***Dimensional, Chemical, Mass, Force and Weighing Devices, Thermodynamic, Mechanical, Volume, Electrical, Optical and Acoustic and Time and Frequency Calibration***  
*(As detailed in the supplement)*

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen  
President/Operations Manager

<i>Initial Accreditation Date:</i>	<i>Issue Date:</i>	<i>Expiration Date:</i>
September 22, 2011	January 24, 2020	February 28, 2022

<i>Accreditation No.:</i>	<i>Certificate No.:</i>
69307	L20-62

Perry Johnson Laboratory  
Accreditation, Inc. (PJLA)  
755 W. Big Beaver, Suite 1325  
Troy, Michigan 48084

*The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: [www.pjilabs.com](http://www.pjilabs.com)*



# Certificate of Accreditation: Supplement

**A&C Metrology Services, S. de R.L. de C.V.**  
 Privada Galileo Galilei # 1618, Fraccionamiento Satélite Magisterial  
 Puebla, Puebla, México. CP. 72320  
 Contact Name: Carlos Alberto Cid Phone: 222-887-2807

Accreditation is granted to the facility to perform the following calibrations:

## Dimensional

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Optical Comparator <sup>O</sup> X Axis Linearity Y Axis Linearity	300 mm	(1.96+ 0.013L) $\mu$ m	Glass Scale MDI-08
Optical Comparator Magnification <sup>O</sup>	5 X	0.25 %	
	10 X	0.25 %	
	20 X	0.25 %	
	50 X	0.25 %	
	100 X	0.25 %	
Optical Comparator Angularity <sup>O</sup>	0° to 360°	0.03°	Reticule 360° MDI-08
Optical Comparator Squareness of Y axis to X axis <sup>O</sup>	90°	0.03°	Square MDI-08
Microscope <sup>O</sup> X Axis Linearity Y Axis Linearity	300 mm 300 mm	(1.96 + 0.013L) $\mu$ m	Glass Scale MDI-08
Microscope Magnification <sup>O</sup>	20 X to 5 000 X	0.25 %	Microscope Test Target MDI-08
Optical Systems Only Linear Movement <sup>O</sup> X, Y, Z Axis	X: 0.1 mm to 300 mm	(0.52 + 7 x 10 <sup>-3</sup> L) $\mu$ m	Ruler Glasses mm Gages Blocks MDI-19
	Y: 0.1 mm to 300 mm		
	Z: 0.5 mm to 220 mm		
Micrometers <sup>FO</sup>	0.5 mm to 1 000 mm	(0.9 + 6 x 10 <sup>-3</sup> L) $\mu$ m	Master Blocks Grade "1" and Ring Master MDI-01
	1 000 mm to 2 000 mm	(2.42 + 6 x 10 <sup>-3</sup> L) $\mu$ m	
Caliper <sup>FO</sup>	0.1 mm to 2 000 mm	(0.55 + 0.014 8L) $\mu$ m	Master Blocks Grade "1" MDI-03
Height Gauges <sup>FO</sup>	0.1 mm to 1 000 mm	(8.7 + 0.006 8L) $\mu$ m	Master Blocks Grade "1" MDI-04
Linear Height <sup>O</sup>	0.1 mm to 1 000 mm	(0.33 + 0.001 7L) $\mu$ m	
Thickness Gauge <sup>F</sup>	0.02 mm to 500 mm	(0.8 + 0.022L) $\mu$ m	Master Blocks MDI-06



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Thickness Master <sup>FO</sup>	0.01 mm to 25 mm	0.38 $\mu$ m	Outside Micrometer MDI-10
Pin Gages	0.01 mm to 25 mm	0.38 $\mu$ m	Outside Micrometer MDI-10
Graduated Rules <sup>F</sup>	1 mm to 3 000 mm	(34.5 + 0.032L) $\mu$ m	CMM with vision equipment MDI-07
Measuring Tapes <sup>F</sup>	5 mm to 50 000 mm	(59+ 0.015L) $\mu$ m	Rule and Portable Microscope MDI-07
Pi Tapes <sup>F</sup>	0.5 mm to 5 000 mm	(0.012 + 0.023L) mm	
Roughness Tester Ra / Ry / Rz Fixed Point <sup>FO</sup>	3 $\mu$ m	0.1 $\mu$ m	Master Roughness MDI-02
Indicator <sup>FO</sup>	0.001 mm to 100 mm	(0.75 + 1.8 x 10 <sup>-3</sup> L) $\mu$ m	Micrometer Head, Master Blocks Grade "0" and Micrometer Head MDI-05
Performance Verification of Coordinate Measuring Machine Error Indication <sup>O</sup>	50 mm to 2 000 mm in the Space Diagonal	(0.33 + 0.004L) $\mu$ m	Master of Fixed Lengths and Blocks Master MDI-11
Performance verification of Coordinate Measuring Machine Scanning Error <sup>O</sup>	20 mm	1.2 $\mu$ m	Master Ball MDI-11
Roundness Measurement <sup>O</sup>	300 mm	0.43 $\mu$ m	Master Ball MDI-12
Surface Plate, Repeat Measurement Only <sup>FO</sup>	0.1 mm	1.5 $\mu$ m	Repeat Reading Gage MDI-13
Angle Meter and Protactor <sup>FO</sup>	0° to 360°	0.008°	Gage Blocks/ Sine Bar Angle Blocks MDI-17
AA CMM Volumetric Performance <sup>FO</sup>	0.5 mm to 3 000 mm	(3.85 + 0.011 4L) $\mu$ m	Gage Blocks, Grade 1 and Master Sphere MDI-20



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Dial Gauge Tester <sup>FO</sup>	0.1 mm to 100 mm	$(0.19 + 8.4 \times 10^{-3}L) \mu\text{m}$	Gage Blocks Grade 0 and Mu-Checker Digital MDI-27
Mu-Checker <sup>F</sup>	2 mm	0.09 $\mu\text{m}$	Gage Blocks Grade 0 MDI-21
Check Master <sup>F</sup>	10 mm to 1 016 mm	$(0.11 + 4.2 \times 10^{-3}L) \mu\text{m}$	Gage Blocks Grade 0 and Mu-Checker Digital MDI-22
Depth Micro Checker <sup>F</sup>	10 mm to 610 mm	$(0.35 + 3.8 \times 10^{-3}L) \mu\text{m}$	
Caliper Checker	10 mm to 1 016 mm	$(0.4 + 4.7 \times 10^{-3}L) \mu\text{m}$	
Riser Block <sup>F</sup>	300 mm	2 $\mu\text{m}$	
Height Master <sup>F</sup>	Up to 610 mm	$(0.5 + 0.003L) \mu\text{m}$	
Glass Scales <sup>F</sup>	305 mm	$(0.8 + 6 \times 10^{-3}L) \mu\text{m}$	
Reticle Resolution Length Radius and Protractor <sup>F</sup>	20 mm to 360°	2 $\mu\text{m}$	Microscope MDI-09
Linear Scales <sup>FO</sup>	0.5 mm to 3 000 mm	$(0.42 + 2.7 \times 10^{-3}L) \mu\text{m}$	Gage Blocks Grade 0 MDI-23
Laser Micrometer <sup>FO</sup>	0.1 mm to 50 mm	0.6 $\mu\text{m}$	Pin Gages MDI-01
Level <sup>F</sup>	0.02 mm/m to 2.5 mm/m	0.005 mm/m	Indicator MDI-18
Block Gauge Steel and Ceramics Steel Gauge Blocks Degrees of Accuracy "0", "1", "2" <sup>F</sup>	0.1 mm to 10.16 mm	0.027 $\mu\text{m}$	Stand Block Comparator with Length Gage MDI-16
	10.16 mm to 25.4 mm	0.041 $\mu\text{m}$	
	25.4 mm to 50.8 mm	0.069 $\mu\text{m}$	
	50.8 mm to 76.2 mm	0.12 $\mu\text{m}$	
	76.2 mm to 101.6 mm	0.14 $\mu\text{m}$	
Block Gauge Steel and Ceramics Steel Gauge Blocks <sup>F</sup>	101.6 mm to 508 mm	$(0.21 + 1.4 \times 10^{-3}L) \mu\text{m}$	Stand Block Comparator with Length Gage MDI-16
Ring Master <sup>F</sup>	0.5 mm to 305 mm	$(0.44 + 3.5 \times 10^{-3}L) \mu\text{m}$	Linear Height MDI-23



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Meter Counter Odometer <sup>FO</sup>	0.5 mm to 99 999 mm	$(0.3 + 2 \times 10^{-4}L)$ mm	Digital Meter Counter MDI-24
Length Meter (Distance Measurement) <sup>F</sup>	0.5 m to 30 m	0.001 6 m	Measuring Tape MDI-25
Diameter of Sphere <sup>FO</sup>	0.5 mm to 100 mm	0.38 $\mu$ m	Micrometer and Vision CMM MDI-10
Angle Blocks <sup>F</sup>	0° a 180°	0.01°	Vision CMM MDI-31
Thread Plug Gage (Pitch Diameter) <sup>FO</sup>	2 mm to 228.6 mm	1.5 $\mu$ m	Vision CMM/ Micrometer MDI-30
Thread Ring Gage (Pitch Diameter) <sup>F</sup>	2 mm to 228.6 mm	1.5 $\mu$ m	Mahr Federal 36B-10 MDI-30
Bore Gage <sup>FO</sup>	0.5 mm to 300 mm	$(0.37 + 9.8 \times 10^{-3}L)$ $\mu$ m	Micrometer Head MD-32
Profile Meter <sup>FO</sup>	Up to 300 mm	$(0.42 + 9.2 \times 10^{-3}L)$ $\mu$ m	Gage Blocks Grade 0 and Parallel Optic MDI-28
Squares <sup>F</sup>	90°	0.005°	CMM MDI-29
Theodolite Total Station Angle <sup>F</sup>	Horizontal Angle 0° to 360°	0.025°	CMM MDI-33
	Vertical Angle 30° to 330°	0.025°	
Automatic Level Height <sup>F</sup>	7 mm to 40 mm (20X -3 2X Magnification)	1.1 mm	CMM MDI-34

### Chemical

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pH Meters <sup>FO</sup>	2 pH to 12 pH	0.021 pH	Solution Reference Merck MQU-01
Conductivity <sup>FO</sup>	5 $\mu$ S/cm to 12.88 mS/cm	1 % of reading	Conductivity Solutions MQU-02
Refractometer <sup>FO</sup>	0 to 90 °Brix	0.39 °Brix	Standard Solutions Refractometer MQU-03



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## Mass, Force, and Weighing Devices

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Balance <sup>FO</sup>	0.5 g to 10 000 g (Res.= 0.000 1 g)	$(2 \times 10^{-4} + 4.33 \times 10^{-7}Wt) \text{ g}$	OIML Class E2 MMA-01
	5 g to 500 g (Res.= 0.001 g)	$(1.2 \times 10^{-3} + 7.01 \times 10^{-7}Wt) \text{ g}$	OIML Class F1 MMA-01
	500 g to 5 000 g (Res.= 0.01 g)	$(1.12 \times 10^{-2} + 7.74 \times 10^{-7}Wt) \text{ g}$	
	5 000 g to 25 000 g (Res.= 0.01 g)	$(0.116 + 3.71 \times 10^{-8}Wt) \text{ g}$	
Scales <sup>O</sup>	10 kg to 60 kg (Res.= 0.001 g)	$(1.1 \times 10^{-3} + 9.25 \times 10^{-6}Wt) \text{ kg}$	OIML Class M1 MMA-01
	60 kg to 600 kg (Res.= 0.01 kg)	$(1.12 \times 10^{-2} + 8.56 \times 10^{-6}Wt) \text{ kg}$	
	600 kg to 5 000 kg (Res.= 0.1 Kg)	$(0.346 + 2.84 \times 10^{-6}Wt) \text{ kg}$	
	Up to 60 kg (Res.= 0.001 g)	$(1.1 \times 10^{-3} + 9.25 \times 10^{-6}Wt) \text{ kg}$	
	5 000 kg to 50 000 kg (Res.= 1 kg)	$(2.5 + 2 \times 10^{-4}Wt) \text{ kg}$	Direct Comparison Substitution Loads Class M1 Weights MMA-04
Force – Tension <sup>FO</sup> (Dynamometer, Universal Machine and Load Cells)	0.1 N to 980.67 kN	0.1 % of reading	Load Cells and Mass F1 MFZ-01 and MFZ-02
Force – Compression <sup>FO</sup> (Dynamometer, Universal Machine and Load Cells)	0.1 N to 1 961.63 kN	0.1 % of reading	Load Cells and Mass F1 MFZ-01 and MFZ-02
Mass Weight Class M1, M2 and M3 <sup>F</sup>	20 kg	0.33 g	Double Substitution Class F1 Weights Set MMA-02
	10 kg	0.17 g	
	5 kg	0.08 g	
	2 kg	0.033 g	
	1 kg	0.017 g	
	500 g	8.4 mg	
	200 g	3.4 mg	
	100 g	1.7 mg	
	20 g	0.83 mg	



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## Mass, Force, and Weighing Devices

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Mass Weight Class M1, M2 and M3 <sup>F</sup>	10 g	0.67 mg	Double Substitution Class F1 Weights Set MMA-02
	5 g	0.53 mg	
	2 g	0.4 mg	
	1 g	0.33 mg	
	500 mg	0.27 mg	
	200 mg	0.2 mg	
	100 mg	0.17 mg	
	50 mg	0.13 mg	
	20 mg	0.1 mg	
	10 mg	0.08 mg	
	5 mg	0.067 mg	
	2 mg	0.067 mg	
	1 mg	0.067 mg	
Mass Weight Class F2 <sup>F</sup>	20 kg	0.1 g	
	10 kg	53 mg	
	5 kg	26 mg	
	2 kg	10 mg	
	1 kg	5.3 mg	
	500 g	2.6 mg	
	200 g	1 mg	
	100 g	0.53 mg	
	50 g	0.33 mg	
	20 g	0.26 mg	
	10 g	0.2 mg	
	5 g	0.16 mg	
	2 g	0.13 mg	
	1 g	0.1 mg	
	Mass Weight Class F2 <sup>F</sup>	500 mg	
200 mg		0.066 mg	
100 mg		0.053 mg	
50 mg		0.04 mg	



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Mass Weight Class F2 <sup>F</sup>	20 mg	0.033 mg	Double Substitution Class F1 Weights Set MMA-02
	10 mg	0.026 mg	
	5 mg	0.02 mg	
	2 mg	0.02 mg	
	1 mg	0.02 mg	

### Thermodynamic

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED	
Thermocouple Type K and J <sup>FO</sup>	-20 °C to 1 200 °C	0.8 °C	Thermocouples Type K Fluke 52 Dry Well MTE-03	
Sterilizer and Climatic Chambers, Ovens, Incubators <sup>FO</sup>	-50 °C to 300 °C	0.8 °C		
Water Baths, Temperature Calipers and Bain-Marie <sup>FO</sup>	-50 °C to 300°C	0.8 °C		
Furnaces – Muffle <sup>FO</sup>	50 °C to 1 300 °C	0.8 °C		
Humidity <sup>FO</sup>	10 % to 95 % RH	1.1 % RH	Humidity Probe Vaisala Mod. HMP75 Humidity Chamber MHU-01	
Thermometer Liquids in Glass <sup>FO</sup>	-40 °C to 250 °C	0.062 °C	Platinum Resistance Thermometer Wika Model CTP5000-250-D and Platinum Resistance Thermometer Accumac Mod. AM1750-20 Dry Well Temperature Bath MTE-01, MTE-02	
	250 °C to 650 °C	0.57 °C		
Thermometer Digital <sup>FO</sup>	-20 °C to 250 °C	0.057 °C		
	250 °C to 650 °C	1.2 °C		
Thermometer Bimetallic <sup>FO</sup>	-20 °C to 250 °C	0.057 °C		
	250 °C to 650 °C	0.12 °C		
Thermometer Infrared <sup>FO</sup>	10 °C to 650 °C	1 °C		Fluke 62 MAX Black Body MTE-01





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Pressure Gauge and Pressure Transducer Differential <sup>FO</sup>	5 Pa to 40 Pa	0.4 Pa	Column Pressure Gage/ Digital Pressure Gage MPR-01
	0.04 kPa to 100 kPa	0.01 kPa	Digital Pressure Gage MPR-01
Pressure Gauge Absolute <sup>FO</sup>	5 kPa to 110 kPa	0.005 kPa	Pressure Gage Digital and Barometer MPR-03
Pressure Gauge Meters and Transducer <sup>FO</sup>	6.9 kPa to 70 MPa	0.1 % of reading	Digital Pressure Gage Druck DPI 104-IS Fluke 700G31,
Vacuum Gauge Meters and Transducer <sup>FO</sup>	-11 psi to 1 psi	0.015 psi	Fluke 00G06 MPR-01, MPR-02
Torque Transducer and Torque Analyzers <sup>F</sup>	0.1 N·m to 2 700 N·m	0.3 % of reading	Torque Wheel and Dead Weights OIML Class F1 and M1 MPT-02
Torque Meter and Dynamic Torque <sup>FO</sup>	0.1 N·m to 1 000 N·m	0.5 % of reading	Torque Transducer MPT-01, MPT-03
Speedometer and Velocity of Displacement <sup>O</sup>	0.005 m/s to 1 m/s	0.5 mm/s	Block Gage & Chronometer MTF-03
Speedometer and Velocity of Displacement <sup>FO</sup>	5 mm/min to 2 000 mm/min	(0.037 + 0.01L) mm/min	Linear Scales Chronometer MTF-03
Density Immersion <sup>FO</sup>	0.5 g/cm <sup>3</sup> to 1.6 g/cm <sup>3</sup> (Res.= 0.000 2 g/cm <sup>3</sup> )	0.000 12 g/cm <sup>3</sup>	Balance MQU-05
Viscosity Dynamic <sup>FO</sup>	0.1 Pa·s to 53.36 Pa·s	0.000 4 Pa·s	Standard Oil MQU-04
Kinematic Viscosity Ford, Zahn, DIN, ISO, BS and AFNOR Cups No. 2, 3, 4, 5, 6 <sup>FO</sup>	5 mm <sup>2</sup> /s to 75 470 mm <sup>2</sup> /s	0.21 mm <sup>2</sup> /s	Standard Oil MQU-04
Anemometer <sup>FO</sup>	0.3 m/s to 13 m/s	0.18 m/s	Hot Wire Anemometer MFT-05
Accelerometer / Vibrometer <sup>FO</sup>	3 m/s <sup>2</sup> to 8 m/s <sup>2</sup>	1.5 % of reading	Vibration Gauge (Calibrator) MTF-06



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Flow Meters (Gas) <sup>F</sup>	0.1 L/min to 250 L/min	$(0.659\ 1 + 1.1 \times 10^{-3}Q)$ L/min	Flow Meter Fluke 922 MTF-08
Flow Meters (Water) <sup>F</sup>	1 L/min to 500 L/min	0.005 8 l/min	Digital Scale MTF-09
	1 L/min to 8 000 L/min	$(0.008\ 2 + 8 \times 10^{-4}Wt)$ l/min	Ultrasonic Flow Meter Handhold Model TDS-100H MTF-09
Indirect Verification of Brinell Hardness Tester HBW 10/3 000 <sup>O</sup>	100 HBW to 650 HBW	4.5 HBW	Hardness Test Blocks ISO 6506-2 MDU-03
Indirect Verification of Micro Hardness Tester Vickers HV 0.5 <sup>O</sup>	200 HV to 700 HV	6 HV	Hardness Test Blocks ISO 6507-2 MDU-04
Indirect Verification of Leeb Hardness Tester LD <sup>FO</sup>	500 LD to 800 LD	16 HLD	Test Block A9556/A956M-17A MDU-06
Indirect Verification of Rockwell Hardness Testers HRBW <sup>O</sup>	20 HRBW to 59 HRBW	0.6 HRBW	Hardness Test Blocks ISO 6508-2 MDU-01
	60 HRBW to 84 HRBW	0.35 HRBW	
	85 HRBW to 100 HRBW	0.49 HRBW	
Indirect Verification of Rockwell Hardness Testers HRC <sup>O</sup>	20 HRC to 34 HRC	0.34 HRC	
	35 HRC to 59 HRC	0.32 HRC	
	60 HRC to 70 HRC	0.24 HRC	
Direct Verification of IRHD Durometer Hardness			
Tester Types N, H, L, M, and P Extension at Penetrator Diameter	5 mm to 0.01 mm	6 $\mu$ m	Optical Comparator MDI-09
Measurement Force Types A, B, E & O Types C, D & DO <sup>F</sup>	6 N	0.001 8 N	Electronic Balance MDU-07



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Direct Verification of Shore Durometer Hardness Tester Types A, B, C, D, E, O & DO Extension at zero reading	2.46 mm to 2.54 mm	6 $\mu$ m	ASTMD-2240  Optical Comparator MDI-09
Indenter Shape (Not all parameters apply to all of Durometer Types) Indenter Diameter Indenter Tip Diameter Indenter Tip Radius Indenter Tip Angle		6 $\mu$ m 6 $\mu$ m 6 $\mu$ m 0.1°	Optical Comparator Optical Comparator Optical Comparator Optical Comparator MDI-09
Durometer Indenter Spring Types A, B, E & O Types C, D & DO <sup>F</sup>	0.55 N to 8.05 N 4.445 N to 44.45 N	0.045 N 1.4 N	Electronic Balance Electronic Balance MDU-02

## Volume

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Micropipettes <sup>F</sup>	1 $\mu$ L to 100 $\mu$ L	0.3 % of reading	Balance Radwag Mod. AS 82/220.R2 MVO-01
	100 $\mu$ L to 1 000 $\mu$ L	0.3 % of reading	
Pipettes, Burettes <sup>F</sup>	1 mL to 100 mL	0.2 % of reading	Analytical Scale Shimadzu Mod. UX1020H MVO-01
Probes <sup>F</sup>	100 mL to 1 000 mL	0.8 % of reading	
Flask, Graduated Cylinders, Graduated Jugs <sup>F</sup>	10 mL to 20 000 mL	0.7 % of reading	Analytical Scale Balance Radwag Mod. WLC20/A2 MVO-01



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 Privada Galileo Galilei # 1618, Fraccionamiento Satélite Magisterial  
 Puebla, Puebla, México. CP. 72320  
 Contact Name: Carlos Alberto Cid Phone: 222-887-2807

Accreditation is granted to the facility to perform the following calibrations:

## Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type E <sup>FO</sup>	-200 °C to 0 °C	0.9 °C	Electrical Simulation of Thermocouple Output Process Calibrator 726 MTE-03
	0 °C to 950 °C	0.7 °C	
	Temperature Calibration Indication, and Control Equipment used with Thermocouple Type J <sup>FO</sup>	-200 °C to 0 °C	
	0 °C to 1 200 °C	0.7 °C	
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type K <sup>FO</sup>	-200 °C to 0 °C	1.2 °C	
	0 °C to 1 370 °C	0.8 °C	
Temperature Calibration, Indication and Control Equipment used with RTD, Type Pt 100 <sup>FO</sup>	-200 °C to 0 °C	1.2 °C	Electrical Simulation of RTD Output Process Calibrator 726 MTE-03
	-0 °C to 630 °C	0.8 °C	
pH Meter <sup>FO</sup>	-500 mV a 500 mV (0 pH to 14 pH)	1 mV (0.02 pH)	Electrical Simulation Process Calibrator 726 MQU-01
Equipment to Measure AC/DC Current Clamp-on Meters (Toroidal) <sup>FO</sup>	1 A to 1 500 A	0.07 % of reading	Tresmiller Multifunction Calibrator 1 000A and Turn Clamp Coil EA002 MEL-01, MEL-02 CENAM Technical Guide
Equipment to Measure DC Voltage <sup>FO</sup>	1 mV to 100 mV	0.62 % of reading	Trasmiller Multifunction Calibrator 1000A/ EA002 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	0.1 V to 1 V	0.36 % of reading	
	1 V to 10 V	0.48 % of reading	
	10 V to 100 V	0.54 % of reading	
	100 V to 1 000 V	0.87 % of reading	
Equipment to Measure AC Voltage At the listed frequencies <sup>FO</sup>			
50 Hz to 20 kHz	30 Mv to 100 Mv	0.011 % of reading	
50 Hz to 20 kHz	100 mV to 1 V	0.034 % of reading	
50 Hz to 20 kHz	1 V to 10 V	0.041 % of reading	
50 Hz to 20 kHz	10 V to 100 V	0.014 % of reading	
50 Hz to 1 kHz	100 V to 1 000 V	0.017 % of reading	



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Equipment to Measure Resistance <sup>FO</sup>	0.1 $\Omega$ to 1 $\Omega$	0.006 6 % of reading	Trasmiller Multifunction Calibrator 1000A/ EA002 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	1 $\Omega$ to 10 $\Omega$	0.001 % of reading	
	10 $\Omega$ to 100 $\Omega$	0.000 9 % of reading	
	100 $\Omega$ to 1 000 $\Omega$	0.000 8 % of reading	
	1 k $\Omega$ to 10 k $\Omega$	0.000 8 % of reading	
	10 k $\Omega$ to 100 k $\Omega$	0.001 8 % of reading	
	100 k $\Omega$ to 1 M $\Omega$	0.002 1 % of reading	
	1 M $\Omega$ to 10 M $\Omega$	0.007 3 % of reading	
Equipment to Measure DC Current <sup>FO</sup>	10 to 100 $\mu$ A	0.006 5 % of reading	Trasmiller Multifunction Calibrator 1 000A/ EA002 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	0.1 mA to 1 mA	0.002 1 % of reading	
	1 mA to 10 mA	0.002 2 % of reading	
	10 mA to 100 mA	0.004 2 % of reading	
	100 mA to 1 000 mA	0.004 1 % of reading	
	1 A to 10 A	0.008 % of reading	
Equipment to Output DC Voltage <sup>FO</sup>	10 mV to 100 mV	20 $\mu$ V	Trasmiller Multifunction Calibrator 1 000A/ EA002 Multimeter Digital and Fluke 726 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	0.1 V to 1 V	120 $\mu$ V	
	1 V to 10 V	1.2 mV	
	10 V to 100 V	12 mV	
	100 V to 1 000 V	240 mV	
Equipment to Measure Capacitance <sup>FO</sup>	1 nF to 11 nF	0.077 % of reading	Trasmiller Multifunction Calibrator 1 000A/ EA002 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	11 nF to 110 nF	0.077 % of reading	
	110 nF to 1.1 $\mu$ F	0.11 % of reading	
Equipment to Measure AC Voltage At the listed frequencies <sup>FO</sup>			Trasmiller Multifunction Calibrator 1 000A/ EA002 Multimeter Digital and Fluke 726 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
10 Hz to 500 kHz	20 mV to 200 mV	0.025 % of reading	
10 Hz to 500 kHz	0.2 V to 2 V	0.025 % of reading	
10 Hz to 100 kHz	2 V to 20 V	0.025 % of reading	
40 Hz to 20 kHz	20 V to 200 V	0.025 % of reading	
40 Hz to 10 kHz	200 V to 1 000 V	0.025 % of reading	



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## Electrical

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Equipment to Measure AC Current At the listed frequencies <sup>FO</sup>			Trasmiller Multifunction Calibrator 1 000A/ EA002 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
50 Hz to 1 kHz	1 $\mu$ A to 100 $\mu$ A	0.24 % of reading	
50 Hz to 1 kHz	100 $\mu$ A to 1 mA	0.072 % of reading	
50 Hz to 1 kHz	1 mA to 10 mA	0.012 % of reading	
50 Hz to 1 kHz	10 mA to 100 mA	0.015 % of reading	
50 Hz to 1 kHz	100 mA to 1 A	0.016 % of reading	
50 Hz to 1 kHz	1 A to 10 A	0.033 % of reading	
Equipment to Output Frequency 119 V <sup>FO</sup>	10 kHz	10 $\mu$ Hz	Trasmiller Multifunction Calibrator 1000A/ EA002 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
Equipment to Measure AC Current 5 kHz <sup>FO</sup>	100 mA	10 $\mu$ Hz	
Equipment to Measure Frequency <sup>FO</sup>	1 Hz to 10 MHz	0.001 % of reading	Trasmiller Multifunction Calibrator 1000A/ EA002 Multimeter Digital and Fluke 726 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
Equipment to Output AC Voltage At the listed frequencies <sup>FO</sup>			
10 Hz to 1.999 kHz	Up to 100 mV	0.03 mV	
2 kHz to 20 kHz	Up to 100 mV	0.07 mV	
Equipment to Output AC Voltage At the listed frequencies <sup>FO</sup>			
10 Hz to 1.999 kHz	0.1 V to 1 V	0.03 mV	
2 kHz to 20 kHz	0.1 V to 1 V	0.07 mV	
Equipment to Output AC Voltage At the listed frequencies <sup>FO</sup>			
10 Hz to 1.999 kHz	1 V to 10 V	0.03 mV	
2 kHz to 20 kHz	1 V to 10 V	0.07 mV	
Equipment to Output AC Voltage <sup>FO</sup> 40 Hz to 1 kHz	10 V to 100 V	30 mV	
	100 V to 1 000 V	300 mV	



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Equipment to Output AC Current At the listed frequencies <sup>FO</sup>			Trasmiller Multifunction Calibrator 1000A/ EA002 Multimeter Digital and Fluke 726 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
10 Hz to 10 kHz	10 $\mu$ A to 100 $\mu$ A	0.4 $\mu$ A	
10 Hz to 10 kHz	0.1 mA to 1 mA	0.8 $\mu$ A	
10 Hz to 10 kHz	1 mA to 10 mA	8 $\mu$ A	
10 Hz to 10 kHz	10 mA to 100 mA	80 $\mu$ A	
10 Hz to 10 kHz	0.1 A to 1 A	0.8 mA	
10 Hz to 1 kHz	1 A to 10 A	15 mA	
Equipment to Output Resistance <sup>FO</sup>			Trasmiller Multifunction Calibrator 1000A/ EA002 Multimeter Digital and Fluke 726 MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	10 $\Omega$	0.001 % of reading	
	100 $\Omega$	0.001 % of reading	
	1 k $\Omega$	0.01 % of reading	
	10 k $\Omega$	0.01 % of reading	
	100 k $\Omega$	0.01 % of reading	
	1 M $\Omega$	0.01 % of reading	
	10 M $\Omega$	0.011 % of reading	
Equipment to Output Frequency <sup>FO</sup>	1 Hz to 100 kHz	0.000 55 % of reading	
Equipment to Measure AC & DC Current (Transconductance Amplifier) <sup>FO</sup>	2 A to 20 A	0.028 % of reading	
Equipment to Output AC Voltage (Hipot) <sup>FO</sup>	0.5 kV to 5 kV	1.9 % of reading	
Equipment to Output DC Voltage (Hipot)	2.4 kV to 10 kV	2 % of reading	
Equipment to Measure DC Power <sup>FO</sup>	2 W to 3 000 W	0.000 35 % of reading	
	1 W to 30 000 W	0.03 % of reading	
Equipment to Measure AC & DC Current <sup>FO</sup> (45 Hz to 65 Hz)	20 A to 30 A	0.32 % of reading	
	30 A to 60 A	0.35 % of reading	
	60 A to 120A	0.42 % of reading	
	120 A to 300 A	0.55 % of reading	



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Equipment to Measure Current <sup>FO</sup> (30 mA)	-30 mA to -20 mA	5.3 $\mu$ A	Trasmiller Multifunction Calibrator 1000A/ EA002 Process Control Adapter MEL-01, MEL-02, MEL-04 CENAM Technical Guide
	-20 mA to -10 mA	1.5 $\mu$ A	
	-10 mA to 0 mA	1 $\mu$ A	
	Up to 10 mA	1 $\mu$ A	
	10 mA to 20 mA	1.5 $\mu$ A	
	20 mA to 30 mA	5.3 $\mu$ A	
Equipment to Measure Voltage <sup>FO</sup> (100 mV)	-100 mV to -50 mV	4.5 $\mu$ V	
	-50 mV to -20 mV	3.7 $\mu$ V	
	-20 mV to 0 mV	3.2 $\mu$ V	
Equipment to Measure Voltage <sup>FO</sup> (100 mV)	Up to 20 mV	3.3 $\mu$ V	
	20 mV to 50 mV	3.7 $\mu$ V	
	50 mV to 1 000 mV	4.6 $\mu$ V	
Equipment to Measure Voltage <sup>FO</sup> (1 V)	-1 V to -0.5 V	19 $\mu$ V	
	-0.5 V to -0.2 V	14 $\mu$ V	
	-0.2 V to 0 V	15 $\mu$ V	
	0 V to 0.2 V	13 $\mu$ V	
	0.2 V to 0.5 V	14 $\mu$ V	
	0.5 V to 1V	18 $\mu$ V	
Equipment to Measure Voltage <sup>FO</sup> (30 V)	-30 V to -20 V	790 $\mu$ V	
	-20 V to -10 V	280 $\mu$ V	
	-10 V to 0 V	180 $\mu$ V	
	Up to 10 V	220 $\mu$ V	
	10 V to 20 V	260 $\mu$ V	
	20 V to 30 V	720 $\mu$ V	
Equipment to Measure Resistance <sup>FO</sup> (5 k $\Omega$ )	Up to 1 k $\Omega$	15 m $\Omega$	
	1 k $\Omega$ to 2 k $\Omega$	40 m $\Omega$	
	2 k $\Omega$ to 3 k $\Omega$	45 m $\Omega$	
	3 k $\Omega$ to 4 k $\Omega$	60 m $\Omega$	
	4 k $\Omega$ to 5 k $\Omega$	75 m $\Omega$	





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Equipment to Measure Resistance <sup>FO</sup> (50 k $\Omega$ )	Up to 10 k $\Omega$	200 m $\Omega$	Trasmiller Multifunction Calibrator 1000A/ EA002 Process Control Adapter MEL-01, MEL-02, MEL-04 CENAM Technical Guide	
	10 k $\Omega$ to 50 k $\Omega$	750 m $\Omega$		
	Up to 10 k $\Omega$	300 $\mu\Omega$		
	10 k $\Omega$ to 50 k $\Omega$	2 m $\Omega$		
Equipment to Measure Resistance <sup>FO</sup> (500 $\Omega$ )	Up to 100 k $\Omega$	2.5 m $\Omega$		
	100 k $\Omega$ to 500 k $\Omega$	7.5 m $\Omega$		
Equipment to Output 24 V Loop Supply-ON Fixed Point <sup>FO</sup>	24 V	21 mV		
Equipment to Output 24 V Loop OFF Fixed Point <sup>FO</sup>	0 V	210 mV		
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type B <sup>FO</sup>	600 °C to 1 820 °C (-1.792 mV to 13.82 mV)	0.45 °C (1.4 $\mu$ V)		Electrical Simulation of Thermocouple Output Trasmiller multifunction Calibrator 1000A Thermocouple Simulator EA001A MEL-03 CENAM Technical Guide
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type C <sup>FO</sup>	0 °C to 2 316 °C (-0 mV to 37.07 mV)	0.35 °C (1.6 $\mu$ V)		
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type E <sup>FO</sup>	-250 °C to 1 000 °C (-9.718 mV to 76.373 mV)	0.3 °C (2.2 $\mu$ V)		
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type J <sup>FO</sup>	-210 °C to 1 200 °C (-8.095 mV to 69.553 mV)	0.2 °C (1.8 $\mu$ V)		
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type K <sup>FO</sup>	-200 °C to 1 370 °C (-5.891 mV to 54.819 mV)	0.2 °C (1.7 $\mu$ V)		
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type L <sup>FO</sup>	-200 °C to 900 °C (-8.158 mV to 53.14 mV)	0.1 °C (1.7 $\mu$ V)		



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### Electrical

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Temperature Calibration Indication, and Control Equipment used with Thermocouple Type N <sup>FO</sup>	-200 °C to 1 300 °C (-3.99 mV to 47.513 mV)	0.3 °C (1.7 $\mu$ V)	Electrical Simulation of Thermocouple Output Trasmiller multifunction Calibrator 1000A Thermocouple Simulator EA001A MEL-03 CENAM Technical Guide
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type R <sup>FO</sup>	0 °C to 1 760 °C (0 mV to 21.003 mV)	0.55 °C (1.5 $\mu$ V)	
Temperature Calibration Indication, and Control Equipment used with Thermocouple Type S <sup>FO</sup>	0 °C to 1 760 °C (0 mV to 18.609 mV)	0.55 °C (1.5 $\mu$ V)	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type T <sup>FO</sup>	-250 °C to 400 °C (-6.18 mV to 20.872 mV)	0.4 °C (1.5 $\mu$ V)	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type U <sup>FO</sup>	-200 °C to 600 °C (-5.696 mV to 34.309 mV)	0.15 °C (1.6 $\mu$ V)	
Pressure Simulation and Measure <sup>FO</sup>	-1 bar to 700 bar 2 mA to 20 mA	0.2 % of reading	Electrical Simulation using Trasmiller Multifunction Calibrator 1000A/ EA022 and Fluke 726 MEL-03
Flow Simulation and Measure <sup>FO</sup>	1 L/min to 5 000 L/min 2 mA to 20 mA	0.2 % of reading	
Torque Simulation and Measure <sup>FO</sup>	0.1 Nm to 500 Nm 0.1 mV to 50 mV	0.2 % of reading	
Conductivity Simulation and Measure <sup>FO</sup>	1 mS/cm to 1 000 mS/cm 0.001 $\Omega$ to 1 $\Omega$	0.2 % of reading	

### Optical

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Luxmeter <sup>F</sup>	20 lux to 7 000 lux	0.8 % of reading	Luxmeter Comparison MTF-04
Equipment for Visual Appraisal of the Colors and Color Difference <sup>F</sup>	900 lux to 11 000 lux Light Chambers	1 % of reading	Luxmeter ASTM D-1729 MTF-04



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## Acoustic

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Sound Level <sup>F</sup>	94 dB	0.12 dB	Sound Level Calibrator EXTECH 407766 MTF-07
	114 dB	0.12 dB	

## Time & Frequency

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Tachometer <sup>FO</sup>	1.047 rad/s to 3 142 rad/s	0.64 rad/s	Tachometer Mitutoyo PH-200LC 0.1 rpm MTF-02
Photo-Tachometer Centrifuges and Tachometer <sup>FO</sup>	3 142 rad/s to 6 283 rad/s	0.064 rad/s	Tachometer Mitutoyo PH-200LC 0.1 rpm & Trasmiller Multifunction MTF-02
Stopwatch/ Timer <sup>FO</sup>	3 600 s	0.35 s	Stopwatch Casio Sp 960-12 MTF-01
	86 400 s	1.2 s	
Melt Flow Index Time <sup>FO</sup>	1 min to 10 min	0.84 s	Stopwatch ASTM D1238-13

1. The CMC (Calibration and Measurement Capability) stated for calibrations included on this scope of accreditation represents the smallest measurement uncertainty attainable by the laboratory when performing a more or less routine calibration of a nearly ideal device under nearly ideal conditions. It is typically expressed at a confidence level of 95 % using a coverage factor  $k$  (usually equal to 2). The actual measurement uncertainty associated with a specific calibration performed by the laboratory will typically be larger than the CMC for the same calibration since capability and performance of the device being calibrated and the conditions related to the calibration may reasonably be expected to deviate from ideal to some degree.
2. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.
3. The presence of a superscript F means that the laboratory performs calibration of the indicated parameter at its fixed location. Example: Outside Micrometer<sup>F</sup> would mean that the laboratory performs this calibration at its fixed location.



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4. The presence of a superscript O means that the laboratory performs calibration of the indicated parameter onsite at customer locations. Example: Outside Micrometer<sup>O</sup> would mean that the laboratory performs this calibration onsite at the customer's location.
5. The presence of a superscript FO means that the laboratory performs calibration of the indicated parameter both at its fixed location and onsite at customer locations. Example: Outside Micrometer<sup>FO</sup> would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.
6. Measurement uncertainties obtained for calibrations performed at customer sites can be expected to be larger than the measurement uncertainties obtained at the laboratories fixed location for similar calibrations. This is due to the effects of transportation of the standards and equipment and upon environmental conditions at the customer site which are typically not controlled as closely as at the laboratories fixed location.
7. The term L represents length in inches or millimeters as appropriate to the uncertainty statement.
8. The term Wt represents weight in pounds or grams (including SI multiple and submultiple units) appropriate to the uncertainty statement.
9. The term Q represents Flow Rate in L/min including SI multiple and submultiple units) as appropriate to the uncertainty statement.

