



PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

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

Master Supply de México, S. de R.L. de C.V.

*Calle Uva #6121, Colonia El Granjero
Ciudad Juarez, Chihuahua, México. C.P. 32690*

*(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):

***Chemical, Dimensional, Mechanical, Thermodynamic, Mass, Force and
Weighing Devices, Electrical, Time & Frequency and Optical 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

Initial Accreditation Date:

June 06, 2016

Issue Date:

July 23, 2020

Expiration Date:

September 30, 2022

Revision Date:

July 13, 2021

Accreditation No.:

89974

Certificate No.:

L20-428-R2

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*



Certificate of Accreditation: Supplement

Master Supply de México S. de R.L. de C.V.

Calle Uva #6121, Colonia El Granjero
 Ciudad Juarez, Chihuahua, México. C.P. 32690
 Contact Name: Deisy Carolina Gallegos Phone: 656-233-0828

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

Chemical

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
Dynamic Viscosity ^F	28.62 cP to 36.51 cP	0.41 % of reading	Viscosity Oil Standards G20 and PRT Sensor Thermometer ASTM D2162, ASTM D1200
	110.16 cP to 150.73 cP	0.41 % of reading	Viscosity Oil Standards G60 and PRT Sensor Thermometer ASTM D2162, ASTM D1200
	194.12 cP to 271.37 cP	0.41 % of reading	Viscosity Oil Standards G100 and PRT Sensor Thermometer ASTM D2162, ASTM D1200
	594.69 cP to 813.8 cP	0.41 % of reading	Viscosity Oil Standards G350 and PRT Sensor Thermometer ASTM D2162, ASTM D1200
Kinematic Viscosity Zahn Cups 1 to 5 ^F Ford Standard and Dip Type Cups 0 to 5 ^F ISO Type Cup 3 mm, 4 mm, 6 mm, 8 mm DIN Type Cup 4 mm	34.22 mm ² /s (cSt)	0.26 % of reading	Viscosity Oil Standards, PRT Sensor Thermometer and Stopwatch ASTM D2162-14
	43.8 mm ² /s (cSt)	0.26 % of reading	
	121.7 mm ² /s (cSt)	0.26 % of reading	
	165.3 mm ² /s (cSt)	0.26 % of reading	
	236.7 mm ² /s (cSt)	0.26 % of reading	
	331.3 mm ² /s (cSt)	0.26 % of reading	
	753.6 mm ² /s (cSt)	0.26 % of reading	
	1 035 mm ² /s (cSt)	0.26 % of reading	
Gas Detection Equipment- CO ₂ Fixed Point ^{FO}	5 % Volume	0.058 % of reading	Pre-mixed Calibration Standard Gas BS EN 60079-29-4:2010 CSA Standard C22.2 No. 152-M1984 QFD01 Internal Procedure
	10 % Volume	0.12 % of reading	
	30 % Volume	0.35 % of reading	
Gas Detection Equipment- O ₂ Fixed Point ^{FO}	0 % Volume	0.07 % of reading	
	5 % Volume	0.06 % of reading	
	15 % Volume	0.19 % of reading	
	21 % Volume	0.25 % of reading	
	23.8 % Volume	0.28 % of reading	
Gas Detection Equipment CO Fixed Point ^{FO}	100 ppm	1.2 % of reading	
Gas Detection Equipment- Propane (LEL) Fixed Point ^{FO}	0.52 % Volume (25 % LEL – Low Explosive Limit)	0.006 % of reading	
Gas Detection Equipment- CH ₄ ^{FO}	2.42 % Volume (50 % LEL)	1.2 % of reading	Pre-Mixed Calibration Standard Gas QFD01 Internal Procedure



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Gas Detection Equipment-Propane (C ₃ H ₈) Fixed Point ^{FO}	0.54 % Volume	0.006 % of reading	Standard Gas QFD01 Internal Procedure
pH Meter Fixed Points ^{FO}	4 pH	0.012 pH	Buffer Solution QFPH01 Internal Procedure
	7 pH	0.012 pH	
	10 pH	0.012 pH	
Electrolytic Conductivity ^{FO}	10 μ S/cm	0.55 μ S/cm	Conductivity Solutions QFC01 Internal Procedure
	100 μ S/cm	2.1 μ S/cm	
	1 000 μ S/cm	4.6 μ S/cm	
	1 500 μ S/cm	4.6 μ S/cm	
	10 000 μ S/cm	40 μ S/cm	
	100 000 μ S/cm	360 μ S/cm	

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
Bench Micrometer ^{FO}	0.127 mm to 101.6 mm (0.005 in to 4 in)	(0.032 + 5.5 x 10 ⁻⁸ L) μ m (1.2 + 2.1 x 10 ⁻⁶ L) μ in	Grade 0 Gage Block (Comparison Method) JIS B 7502
Dial and Digital Calipers ^{FO}	0.127 mm to 1 000 mm (0.005 in to 39.37 in)	(0.7 + 2.8 x 10 ⁻⁴ L) μ m (2.7 + 1.1 x 10 ⁻² L) μ in	Grade 0 Gage Block Comparison JIS B 7507
Dial and Digital Depth Micrometers ^{FO}	0.127 mm to 101.6 mm (0.005 in to 4 in)	(0.08 + 5.5 x 10 ⁻⁷ L) μ m (3.14 + 2.16 x 10 ⁻⁵ L) μ in	Grade 0 Gage Block Comparison JIS B7502
Dial and Digital Indicators ^F	0.002 54 mm to 101.6 mm	(0.15 + 3.4 x 10 ⁻⁴ L) μ m	Grade AS-1 Gage Block Comparison JIS B7502
	101.6 mm to 914.4 mm	(0.6 + 3.4 x 10 ⁻⁴ L) μ m	
Laser Micrometer ^O	0.31 mm to 50.8 mm	(0.29 + 1.9 x 10 ⁻³ L) μ m	Class XXX Cylindrical Pin CENAM Technical Guide
Optical Comparator and Vision Systems Length ^O X Axis Linearity Y Axis Linearity Z Axis Linearity	0.1 mm to 355.6 mm	(22 + 0.011L) nm	Grade 0 Gage block Set Multi-Magnification Glass Scale JIS B 7184
	0.1 mm to 355.6 mm	(22 + 0.011L) nm	
	0.1 mm to 355.6 mm	(22 + 0.011L) nm	



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Optical Comparator and Vision Systems Magnification ^O	10 X	0.05 % of magnification	Multi-Magnification Glass Scales JIS B 7184
	20 X	0.05 % of magnification	
	25 X	0.05 % of magnification	
	31.25 X	0.03 % of magnification	
	50 X	0.01 % of magnification	
	62.5 X	0.01 % of magnification	
Optical Comparator and Vision Systems Squareness ^O	90°	0.11°	Precision Angle Block Set JIS B 7184
Optical Comparator Angularity ^O	0° to 90°	$(0.1 + 9.9 \times 10^{-5}L)^\circ$	
Cylindrical Pin Outside Diameter ^F	0.22 mm to 50 mm	$(0.36 + 2.3 \times 10^{-5}L) \mu\text{m}$	Laser Micrometer Z Mike Model 1220S ASME B89.1.5
Surface Roughness Tester – Rz ^{FO}	0.34 μm to 10.5 μm	$(0.04 + 1.6 \times 10^{-3}L) \mu\text{m}$	Roughness Standard EAL-G20
Surface Roughness Tester – RSm ^{FO}	9.9 μm to 100.5 μm	$(0.04 + 2 \times 10^{-4}L) \mu\text{m}$	Roughness Standard Mahr Federal 2246001
Surface Roughness Tester – Ra ^F	0.1 μm to 3.18 μm	$(0.01 + 0.003L) \mu\text{m}$	EAL-G20
Surface Plates ^{FO} Flatness	150 mm to 2 400 mm diagonal	$(0.31 + 9.8 \times 10^{-4}L) \mu\text{m}$	RAHN-AA-48 Planekator and Digital Indicator JIB B 7513
Repeatability	0.05 mm	0.31 μm	Repeat-o-Meter and Digital Indicator JIS B 7513
Roughness Standard Ra ^F	0.1 μm to 6 μm	$(0.039 + 9.2 \times 10^{-5}L) \mu\text{m}$	Surface Roughness Tester Mitutoyo SJ-400 EAL-G20
Roughness Standard Rz ^F	0.397 μm to 10.05 μm	$(0.037 + 4.3 \times 10^{-3}L) \mu\text{m}$	Surface Roughness Tester Mitutoyo SJ-400 EAL-G20
Coating Thickness Measuring Equipment- Eddy Current & Magnetic Induction Coating Thickness Testers ^{FO}	23.8 μm to 6 950 μm	$(239 + 0.01L) \text{nm}$	Standard Thickness Shims D7091



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Coating Thickness Standards -Foil and Coated Plates Thickness Shims ^{FO}	0.1 mm to 3.01 mm	(0.027 + 5.8L) nm	CMI (Eddy-Current) Thickness Meter D7091
Ultrasonic Thickness Testers ^{FO}	1 mm to 50.8 mm	(7 + 2.3 x 10 ⁻³ L) μ m	Grade 0 Gage Block Comparison D7091
Rulers / Scales ^{FO}	0.1 mm to 1 000 mm	(12 + 2 x 10 ⁻³ L) μ m	Linear Scale OIML-R035-1-e CEM DI-012
	1 000 mm to 5 000 mm	(13 + 1 x 10 ⁻³ L) μ m	
Measuring Tape ^{FO}	0.1 mm to 1 000 mm	(289 + 2.1 x 10 ⁻⁶ L) μ m	
	1 000 mm to 5 000 mm	(57 + 1.2 x 10 ⁻³ L) μ m	
Linear Measurement Scales ^{FO}	100 mm to 1 092 mm	(0.34 + 2.4 x 10 ⁻⁴ L) μ m	Grade 3 & Grade 0 Gage Blocks – Comparison OIML R 35-1
Angularity ^{FO}	1° to 90°	(0.002 9 + 1.4 x 10 ⁻⁵ L) °	Angle Blocks NMX-CH-151-IMNC
Thread Plug Gage Major Diameter ^{FO}	(0-80 to 4-20)	1.3 μ m	Bench Micrometer ANSI/ASME B1.2
Thread Plug Gage Pitch Diameter ^{FO}	(0-80 to 4-20)	1.4 μ m	Thread Wire & Bench Micrometer ANSI/ASME B1.2
Glass Scales & Reticle Metallic Indication ^F	0.005 mm to 2 000 mm	(0.12 + 1.33 x 10 ⁻⁶ L) μ m	Vision System STARRED AV300+-Z-QC5300-3LED JIS B07541
Radius Gauge ^F	0.025 mm to 25.4 mm	(0.94 + 2.5 x 10 ⁻³ L) μ m	Vision System STARRED AV300+-Z-QC5300-3LED ISO 2768-2
	0.001 in to 1 in	(0.037 + 9.8 x 10 ⁻⁵ L) μ in	
Steel Block Gauge and Ceramics Steel Blocks Gauge Degrees of Accuracy "0", "1", "2"	0.5 mm to 100 mm (0.005 in to 4 in)	(0.091 + 7.9 x 10 ⁻⁴ L) μ m [(3.6 + 0.031L) μ in]	Grade 00 Gage Blocks Mechanical Comparator JIS B 7506



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

Mass, Force and Weighting Devices

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Analytical Balances ^O	1 mg to 100 g (Res.= 0.000 1 g)	$(1 \times 10^{-4} + 3 \times 10^{-7}Wt)$ g	Verification with ASTM Class 1 Weights
	0.05 kg to 0.5 kg (Res.= 0.001 g)	$(1 \times 10^{-6} + 1.2 \times 10^{-6}Wt)$ kg	Euramet-cg18
Scales ^O	0.1 kg to 1 kg (Res.= 0.001 g)	$(1 \times 10^{-6} + 7.7 \times 10^{-7}Wt)$ kg	Verification with ASTM Class 1 Weights OIML R76-1 and OIML R 76-2
	1 kg to 10 kg (Res.= 0.01 g)	$(1.6 \times 10^{-5} + 5.1 \times 10^{-6}Wt)$ kg	Verification with ASTM Class M1 Weights OIML R76-1 and OIML R 76-2
Scales ^O	10 kg to 100 kg (Res.= 0.01 kg)	$(9.3 \times 10^{-4} + 1 \times 10^{-5}Wt)$ kg	Verification with ASTM Class M1 Weights OIML R76-1 and OIML R 76-2
	50 kg to 500 kg (Res.= 0.1 kg)	$(9.7 \times 10^{-3} + 6.6 \times 10^{-6}Wt)$ kg	Parallelepiped ASTM Class M1 Weights OIML R76-1 and OIML R 76-2
	0.5 lb to 50 lb (Res.= 0.001 lb)	$(1 \times 10^{-3} + 2.2 \times 10^{-5}Wt)$ lb	Class OIML F2 Weights OIML R76-1 and OIML R 76-2
	50 lb to 500 lb (Res.= 0.01 lb)	$(8 \times 10^{-3} + 5.5 \times 10^{-5}Wt)$ lb	
Scales- (Substitution loads Method) ^O	50 kg to 2 500 kg (Res.= 0.1 kg)	$(1.3 \times 10^{-1} + 3 \times 10^{-5}Wt)$ kg	Parallelepiped ASTM Class M1 Weights and Balanced Substitution Load OIML R76-1 and OIML R 76-2
	500 kg to 5 000 kg (Res.= 1 kg)	$(1.3 + 1.5 \times 10^{-4}Wt)$ kg	Parallelepiped Mass Weight Set Class M1 and Balanced Substitution Loads OIML R76-1 and OIML R 76-2
Torque Transducers, Torque Analyzers ^F (Clockwise and Counterclockwise)	0.28 N·m to 2.82 N·m (2.5 lbf·in to 25 lbf·in)	0.16 % of reading	Torque Calibration Wheel and weights Euramet_cg-14



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Mechanical

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Torque Transducers, Torque Analyzers ^F (Clockwise and Counterclockwise)	2.82 N·m to 28.2 N·m (25 lbf·in to 250 lbf·in)	0.008 % of reading + 0.024 N·m	Torque Calibration Wheel and weights Euramet_cg-14
	6.77 N·m to 67.79 N·m (60 lbf·in to 600 lbf·in)	0.15 % of reading	
	13.55 N·m to 135.58 N·m (120 lbf·in to 1 200 lbf·in)	0.15 % of reading	Torque Calibration wheel or Arm and weights Euramet_cg-14
	54.23 N·m to 542.32 N·m (480 lbf·in to 4 800 lbf·in)	0.049 % of reading + 0.37 N·m	Torque Calibration Arm and weights Euramet_cg-14
Torque Meters ^{FO} (Clockwise and counterclockwise)	0.282 N·m to 2.82 N·m	0.057 % of reading + 0.002 9 N·m	AIMCO Torque Analyzer ISO 6789
	0.56 N·m to 28.2 N·m	0.97 % of reading	
	6.77 N·m to 67.7 N·m	0.44 % of reading	Mountz Torque Transducer and Indicator ISO 6789
	13.56 N.m to 135.6 N.m	0.23 % of reading	
	54.23 N·m to 542.32 N·m	0.23 % of reading	
Volumetric Gas Flow Rate Meters ^{FO}	0.01 cm ³ /min to 10 cm ³ /min	0.26 % of reading	Omega Gas Mass Flowmeter (Direct Comparison) JIS B 7556
	10 cm ³ /min to 500 cm ³ /min	0.45 % of reading	
	0.5 L/min to 20 L/min	0.46 % of reading	Meriam LFE & Flow Computer System (Direct Comparison) JIS B 7556
	8.3 L/min to 87.3 L/min	0.3 % of reading	
	84.8 L/min to 1 210 L/min	0.3 % of reading	
	20 L/min to 500 L/min	0.49 % of reading	Endress + Hauser Coriolis Mass Flow Meter JIS B 7556
	500 L/min to 2 500 L/min	0.005 % of reading	
	0.1 mL/min to 100 mL/min	0.26 % of reading	
Volumetric Gas Flow Restrictors ^{FO}	0.01 cm ³ /min to 10 cm ³ /min	0.26 % of reading	Omega Gas Mass Flowmeter, Fluke Series 700 & 750 Pressure Modules (Direct Comparison) JIS B 7556
	10 cm ³ /min to 500 cm ³ /min	0.45 % of reading	
	0.5 L/min to 20 L/min	0.46 % of reading	



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Volumetric Gas Flow Restrictors ^{FO}	8.3 L/min to 87.3 L/min	0.3 % of reading	Meriam LFE & Flow Computer System, Fluke series 700 & 750 Pressure Modules (Direct Comparison) JIS B 7556
	84.8 L/min to 1 210 L/min	0.3 % of reading	
	0.1 mL/min to 100 mL/min	0.26 % of reading	USON Leak Rate Calibration Kit (Bubble Displacement Meter) Stopwatch, Fluke Series 700 & 750 Pressure Modules JIS B 7556
Gas Flow Rate in to Vacuum (Calibrated Leak Standard) ^F	5×10^{-12} cm ³ /s to 0.001 cm ³ /s	8.1 % of reading	Mass Spectrometer, Calibrated Leak Standard E499/E499M
Air Velocity Handheld: Rotational Anemometers Pressure Anemometer Tube Anemometer Thermoelectric Anemometer ^F	1 m/s to 80 m/s	$(0.002 + 0.0036v)$ m/s	Pitot, Tube, Airflow Meter Wind Tunnel ASTM D6011
	3 m/s to 25 m/s	$(0.011 + 2 \times 10^{-4}v)$ m/s	Rotating Vane Anemometer Wind Tunnel ASTM D6011
	0.5 m/s to 25 m/s	$(0.006 + 0.01v)$ m/s	Rotational Thermo-Anemometer, Wind Tunnel ASTM D6011
Vacuum Gages and Transducers (Air) ^{FO}	-6.894 kPa to 0.068 kPa (-1 psi to 0.01 psi)	$(0.0018 + 1 \times 10^{-4}P)$ kPa $(2.6 \times 10^{-4} + 1.4 \times 10^{-5}P)$ psi	750P22 Pressure Transducer ASME B40.100
	-90.1 kPa to -9 kPa (-13.06 psi to -1.3 psi)	$(0.0016 + 1.1 \times 10^{-5}P)$ kPa $(2.3 \times 10^{-4} + 1.5 \times 10^{-6}P)$ psi	Fluke PM500-BG1M. Pressure Measurement Module ASME B40.100
Vacuum Gauges and Transducer ^F	-497.68 Pa to -24.88 Pa	$(0.011 + 3.1 \times 10^{-6}P)$ Pa	Dwyer Portable Electronic Point Gage ASME B40.100



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Pressure Gauges and Pressure Transducers (Air or Nitrogen) ^{FO}	0.068 kPa to 6.894 kPa (0.01 psi to 1 psi)	(0.001 8 + 1 x 10 ⁻⁴ P) kPa	750P22 Pressure Transducer ASME B40.100
	10.3 kPa to 103.4 kPa (1.5 psi to 15 psi)	(0.024 + 3.5 x 10 ⁻⁵ P) kPa (0.003 5 + 5.1 x 10 ⁻⁶ P) psi	700PD4 Pressure Transducer Fluke 700PCK Kit ASME B40.100
Pressure Gauges and Pressure Transducers (Air, Nitrogen or Non-Corrosive Gas or Compatible) ^{FO}	20 kPa to 200 kPa (3 psi to 29 psi)	(0.0012 + 1 x 10 ⁻⁵ P) kPa	Fluke PM500-BG1M. Pressure Measurement Module ASME B40.100
	200 kPa to 1 000 kPa (29 psi to 145 psi)	(0.004 + 1.4 x 10 ⁻⁵ P) kPa	Fluke PM500-BG7M. Pressure Measurement Module ASME B40.100
	1 000 kPa to 7 000 kPa (145 psi to 1015.26 psi)	(0.04 + 1.5 x 10 ⁻⁵ P) kPa	Fluke PM500-G200K Pressure Measurement Module ASME B40.100
Pressure - Gauges and Transducers (Gas & Liquid Compatible Media) ^{FO}	689.5 kPa to 6895 kPa (100 psi to 1 000 psi)	(0.62 + 2.3 x 10 ⁻⁴ P) kPa	Fluke 744 Process Calibrator 700P08 Pressure Transducer ASME B40.100
	2 068 kPa to 20 684 kPa (300 psi to 3 000 psi)	(6.3 + 1.4 x 10 ⁻⁴ P) kPa	Fluke 750R29 Pressure Transducer + Digital Calibrator (indicator) ASME B40.100
	3 447 kPa to 34 474 kPa (500 psi to 5 000 psi)	(1.1 + 2.8 x 10 ⁻⁴ P) kPa	Fluke 750P30 Pressure Transducer + Digital Calibrator (indicator) ASME B40.100
Pressure - Gauges and Transducers (Gas & Liquid Compatible Media) ^{FO}	6 895 kPa to 68 948 kPa (1 000 psi to 10 000 psi)	(6.2 + 1.6 x 10 ⁻⁴ P) kPa	Fluke 750P31 Pressure Transducer + Digital Calibrator (indicator) ASME B40.100
Pressure Gages and Transducer (Air, Nitrogen, or non-corrosive Gases)	0.5 Pa to 497.68 Pa	(0.011 + 3.1 x 10 ⁻⁶ P) Pa	Dwyer Portable Electronic Point Gage ASME B40.100



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Force Gauges (Tension, Compression) ^{FO}	0.098 N to 0.981 N (Res.= 0.001 N)	$(6.1 \times 10^{-4} + 9.4 \times 10^{-4}F)$ N	OIML Class M1 Weights ISO 376
	0.981 N to 9.806 N (Res. = 0.001 N)	$(1.1 \times 10^{-2} + 7.7 \times 10^{-4}F)$ N	
	9.806 N to 98.06 N (Res.= 0.01 N)	$(0.01 + 2 \times 10^{-5}F)$ N	Class M1 Weights ISO 376
Force Gauges (Tension, Compression) ^{FO}	98.06 N to 216 N (Res.= 0.01 N)	$(0.015 + 2.3 \times 10^{-5}F)$ N	Class ASTM3 Weights ISO 376
	500 N to 5 000 N (Res.= 0.01 N)	$(0.06 + 3.8 \times 10^{-5}F)$ N	Force Transducer HBM S9M (Comparison Method) ISO 376
	216 N to 2 224 N (Res.= 0.1 N)	$(0.07 + 1.5 \times 10^{-4}F)$ N	Class ASTM7 Weights ISO 376
	5 000 N to 50 000 N (Res.= 0.1 N)	$(3 + 4.8 \times 10^{-5}F)$ N	Force Transducer HBM S9M (Comparison Method) ISO 376
	4 448 N to 22 241 N (Res.= 1 N)	$(1.9 + 1.6 \times 10^{-3}F)$ N	MARK-10 Load Cell (Comparison Method) ISO 376
	8 896 N to 88 964 N (Res. = 1 N)	$(17 + 1.1 \times 10^{-3}F)$ N	Transducer Techniques Load Cell & Indicator (Comparison Method) ISO 376
Digital and Analog Dynamometers and Force Gauges Tools (Tension, Compression) ^{FO}	0.889 N to 8.896 N (Res.= 0.001 N)	$(1.4 \times 10^{-4} + 1.1 \times 10^{-3}F)$ N	OIML Class M1 weights ISO 7500-1 (Comparison Method)
	8.896 N to 88.964 N (Res.= 0.01 N)	$(0.015 + 1.5 \times 10^{-5}F)$ N	OIML Class M1 weights (Comparison Method)
	22.241 N to 222.410 N (Res.= 0.01 N)	$(0.015 + 2.6 \times 10^{-5}F)$ N	NIST Class F weights ISO 7500-1 (Comparison Method)
	222.41 N to 2 224 N (Res.= 0.1 N)	$(0.1 + 2 \times 10^{-4}F)$ N	Honeywell Load Cell ISO 7500-1 (Comparison Method)
	445 N to 4 448 N (Res.= 1 N)	$(0.9 + 8.1 \times 10^{-4}F)$ N	Honeywell Load Cell ISO 7500-1 (Comparison Method)
	4 449 N to 44 482 N (Res.= 1 N)	$(9.9 + 2 \times 10^{-6}F)$ N	
	44 482 N to 88 964 (Res.= 1 N)	$(28 + 2.4 \times 10^{-7}F)$ N	



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 Contact Name: Deisy Carolina Gallegos Phone: 656-233-0828

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

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
Relative Humidity Measuring Equipment ^F	11 % RH to 95 % RH	(0.58 + 3 x 10 ⁻³ H) % RH	Digital Humidity Meter Vaísala MI70/HMP75 Constant Climate Chamber CENAM Technical Guide
Temperature Sources -Low temperature chambers and freezer -Direct comparison ^O	-75 °C to 0.002 °C	0.073 % of reading	Hart Scientific 1502 Thermometer ASME B40.200
Temperature Measuring Thermometers, Dial and Liquid in Glass -Direct Comparison ^{FO}	-25 °C to 0.002 °C	0.09 % of reading	Hart Scientific 1502 Thermometer, Constant Temperature Circulating Bath, Kaye LTR -25/140 Dry Well ASME B40.200
	0.002 °C to 100 °C	0.022 % of reading	
	100 °C to 300 °C	0.29 % of reading	Hart Scientific 1502 Thermometer, Jofra 601 Dry Well ASME B40.200
	300 °C to 500 °C	0.021 % of reading	
Chambers and Ovens of Temperature ^{FO}	0.1 °C to 500 °C	0.15 % of reading	Hart Scientific 1502 w/PRT PT100 Sensor ASME B40.200
High Temperature Thermometers, Chambers and Ovens -Direct comparison ^{FO}	300 °C to 500 °C	0.021 % of reading	Hart Scientific 1502 w/PRT PT100 Sensor and Jafra 601 Dry Well ASME B40.200
	420 °C to 930 °C	0.19 % of reading	
	400 °C to 1 300 °C	0.19 % of reading	Fluke 754 w/TC "Type K" Sensor ASME B40.200
Temperature Measurement Calibration of RTD Sensors ^{FO} Pt 385, 100 Ω Pt 3 926, 100 Ω Pt 385, 1 000 Ω	-25 °C to 0 °C	(0.017 + 2.7 x 10 ⁻⁴ T) °C	Hart Scientific 1502 Precision Thermometer, Kaye -25/140 Dry Well ASME B40.200
	0 °C to 140 °C	(0.018 + 6.7 x 10 ⁻⁵ T) °C	Hart Scientific 1502 Precision Thermometer, Jofra 601 Dry Well ASME B40.200
	140 °C to 500 °C	(0.002 + 1.5 x 10 ⁻⁴ T) °C	
IR Temperature - Calibrate IR Temperature Meters ^{FO}	35 °C to 500 °C	(0.97 + 7 x 10 ⁻⁴ T) °C	Hart Scientific 9132 IR Calibrator, Hart Scientific 1502 Precision Thermometer JIS C 1612



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High Temperature Sensors (Thermocouple) Measure ^F	200 °C to 950 °C	0.57 °C	Isotech Dry Block Temperature Calibrator Calibrated Thermocouple 6.5-Digit Multimeter ASME B40.200
	950 °C to 1 200 °C	0.67 °C	

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
Equipment to Measure DC Voltage ^{FO}	0.33 mV to 330 mV	11 μ V/V + 0.71 μ V	Fluke 5520A CENAM Technical Guide
	0.33 V to 3.3 V	3.5 μ V/V + 0.46 μ V	
	3.3 V to 33 V	1.8 μ V/V + 66 μ V	
	33 V to 330 V	3.8 μ V/V + 0.9 μ V	
	100 V to 1 000 V	7.7 μ V/V + 11 μ V	
Equipment to Output DC Voltage ^{FO}	0.01 mV to 100 mV	0.008 4 μ V/V + 0.017 μ V	HP 3458A Technical Guide CENAM
	0.1 V to 1 V	3.1 μ V/V + 0.7 μ V	
	1 V to 10 V	22.5 μ V/V + 5.3 μ V	
	10 V to 100 V	3.5 μ V/V + 36.8 μ V	
	100 V to 1 000 V	4.7 μ V/V + 0.58 mV	
Equipment to Measure DC Current ^{FO}	0.33 μ A to 330 μ A	0.031 nA + 0.7 nA	Fluke 5520A CENAM Technical Guide
	330 μ A to 3.3 mA	0.002 4 μ A/A + 0.7 μ A	
	3.3 mA to 33 mA	0.035 μ A/A + 0.007 7 μ A	
	33 mA to 330 mA	0.003 6 μ A/A + 0.006 9 μ A	
	330 mA to 1.1 A	3.2 μ A/A + 0.006 mA	
	1.1 A to 3 A	0.042 mA/A + 0.037 mA	
	3 A to 11 A	0.008 1 mA/A + 0.017 mA	
	11 A to 20.5 A	0.005 4 mA/A + 0.64 mA	
Equipment to Output DC Current ^{FO}	10 μ A to 100 μ A	0.028 nA/ μ A + 0.24 nA	HP 3458A Technical Guide CENAM
	100 μ A to 1 mA	0.04 nA/ μ A + 1 nA	
	1 mA to 10 mA	0.036 μ A/mA + 0.003 8 μ A	
	10 mA to 100 mA	0.033 μ A/mA + 0.31 μ A	
	100 mA to 1 A	0.036 μ A/mA + 0.01 μ A	
DC / AC (45 to 65 Hz) Current Clamp on Meters ^{FO}	16.5 A to 1 000 A	0.11 mA/A + 3.4 mA	Fluke 5520A Fluke 5500-COIL CENAM Technical Guide



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Equipment to Measure DC Power At the listed Voltage ^{FO} (33 mV to 1 020 V)	0.33 to 330 mA	0.021 % of reading	Fluke 5520A (Main & Aux Outputs) *Settling Time 30 s, add +/- 0.02 % CENAM Technical Guide
	0.33 A to 3 A	0.036 % of reading	
	3 A to 20.5 A	0.088 % of reading	
Power Supply AC/DC Current (100 Hz to 5 kHz) ^{FO}	1 A to 10 A	9.5×10^{-6} A/A +0.005 8 A	Precision Current Shunt Resistor and HP 3458A Multimeter CENAM Technical Guide
	10 A to 60 A	1.3×10^{-5} A/A +0.023 A	
	60 A to 300 A	1.1×10^{-3} A/A - 0.002 5 A	
Equipment to Measure ESD Charge Ionizers DC Voltage ^{FO}	100 V to 5 000 V	0.04 V/kV + 7×10^{-4} kV	ION Systems 91-0210 CENAM Technical Guide
Equipment to Measure Capacitance ^{FO}	0.19 nF to 3.3 nF	0.1 pF/nF + 0.7 pF	Fluke 5520A CENAM Technical Guide
	3.3 nF to 11 nF	0.003 pF/nF + 1 pF	
	11 nF to 33 nF	0.0002 pF/nF + 1 pF	
	33 nF to 330 nF	0.019 pF/nF + 0.37 pF	
	0.33 μ F to 1.1 μ F	0.027 nF/ μ F + 0.062 nF	
	1.1 μ F to 3.3 μ F	0.002 nF/ μ F + 0.1 nF	
	3.3 μ F to 11 μ F	0.046 nF/ μ F + 0.55 nF	
	11 μ F to 33 μ F	0.015 nF/ μ F + 1.2 nF	
	33 μ F to 330 μ F	0.072 nF/ μ F + 7.7 nF	
	0.33 mF to 3.3 mF	0.15 μ F/mF + 0.057 μ F	
	3.3 mF to 11 mF	0.14 μ F/mF + 0.46 μ F	
	11 mF to 33 mF	0.24 μ F/mF + 1.7 μ F	
Equipment to Measure Resistance ^{FO}	100 μ Ω to 100 m Ω	0.002 μ Ω /m Ω + 0.000 2 μ Ω	Precision High Power Calibration Resistors Precision Decade Resistor CENAM Technical Guide
	0.1 Ω to 11 Ω	0.009 m Ω / Ω + 0.039 m Ω	
	11 Ω to 33 Ω	0.007 m Ω / Ω + 0.41 m Ω	
	33 Ω to 330 Ω	0.006 m Ω / Ω + 0.44 m Ω	
	0.33 k Ω to 3.3 k Ω	0.001 Ω /k Ω + 0.7 Ω	
	3.3 k Ω to 11 k Ω	0.007 6 Ω /k Ω + 0.05 Ω	
	11 k Ω to 33 k Ω	0.006 6 Ω /k Ω + 0.033 Ω	
Equipment to Output Resistance ^{FO}	33 k Ω to 330 k Ω	0.014 Ω /k Ω + 0.17 Ω	Fluke 5520A CENAM Technical Guide
	0.33 M Ω to 3.3 M Ω	0.002 k Ω /M Ω + 65 Ω	



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Equipment to Output Resistance ^{FO}	3.3 M Ω to 33 M Ω	0.014 k Ω /M Ω + 0.03 k Ω	Fluke 5520A CENAM Technical Guide	
	33 M Ω to 110 M Ω	0.001 4 k Ω /M Ω + 455 Ω		
	110 M Ω to 330 M Ω	0.001 6 k Ω /M Ω + 0.65 k Ω		
	0.33 G Ω to 1.1 G Ω	4.4 k Ω /G Ω + 90 k Ω		
	Equipment to Output Resistance ^{FO}	100 $\mu\Omega$ to 100 m Ω	0.002 $\mu\Omega$ /m Ω + 0.000 2 $\mu\Omega$	HP 3458A CENAM Technical Guide
		0.1 Ω to 1 Ω	20 $\mu\Omega$ / Ω + 6 $\mu\Omega$	
		1 Ω to 10 Ω	0.02 m Ω / Ω + 6 $\mu\Omega$	
		10 Ω to 100 Ω	0.008 m Ω / Ω + 133 $\mu\Omega$	
		0.1 k Ω to 1 k Ω	0.007 Ω /k Ω + 18 $\mu\Omega$	
		1 k Ω to 10 k Ω	0.007 Ω /k Ω + 0.15 m Ω	
		10 k Ω to 100 k Ω	0.06 Ω /k Ω + 194 m Ω	
		0.1 M Ω to 1 M Ω	0.01 k Ω /M Ω + 18 Ω	
		1 M Ω to 10 M Ω	0.03 k Ω /M Ω + 18 Ω	
		10 M Ω to 100 M Ω	0.1 k Ω /M Ω + 56 Ω	
0.1 G Ω to 1 G Ω	0.1 M Ω /G Ω + 1.9 Ω			
Temperature Calibration Indication and Control Equipment used with Thermocouple Type B ^{FO}	600 $^{\circ}\text{C}$ to 800 $^{\circ}\text{C}$	0.44 $^{\circ}\text{C}$	Fluke 5520A Equipment Simulation of Thermocouple Output ITS-90 CENAM Technical Guide	
	800 $^{\circ}\text{C}$ to 1 000 $^{\circ}\text{C}$	0.34 $^{\circ}\text{C}$		
	1 000 $^{\circ}\text{C}$ to 1 550 $^{\circ}\text{C}$	0.3 $^{\circ}\text{C}$		
	1 550 $^{\circ}\text{C}$ to 1 820 $^{\circ}\text{C}$	0.33 $^{\circ}\text{C}$		
Temperature Calibration Indication and Control Equipment used with Thermocouple Type E ^{FO}	-250 $^{\circ}\text{C}$ to -100 $^{\circ}\text{C}$	0.5 $^{\circ}\text{C}$	Fluke 5520A Equipment Simulation of Thermocouple Output ITS-90 CENAM Technical Guide	
	-100 $^{\circ}\text{C}$ to -25 $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$		
	-25 $^{\circ}\text{C}$ to 350 $^{\circ}\text{C}$	0.14 $^{\circ}\text{C}$		
	350 $^{\circ}\text{C}$ to 650 $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$		
Temperature Calibration Indication and Control Equipment used with Thermocouple Type J ^{FO}	650 $^{\circ}\text{C}$ to 1 000 $^{\circ}\text{C}$	0.21 $^{\circ}\text{C}$	Fluke 5520A Equipment Simulation of Thermocouple Output ITS-90 CENAM Technical Guide	
	-210 $^{\circ}\text{C}$ to -100 $^{\circ}\text{C}$	0.27 $^{\circ}\text{C}$		
	-100 $^{\circ}\text{C}$ to -30 $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$		
	-30 $^{\circ}\text{C}$ to 150 $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$		
	150 $^{\circ}\text{C}$ to 760 $^{\circ}\text{C}$	0.14 $^{\circ}\text{C}$		
Temperature Calibration Indication and Control Equipment used with Thermocouple Type K ^{FO}	760 $^{\circ}\text{C}$ to 1 200 $^{\circ}\text{C}$	0.17 $^{\circ}\text{C}$	Fluke 5520A Equipment Simulation of Thermocouple Output ITS-90 CENAM Technical Guide	
	-200 $^{\circ}\text{C}$ to -100 $^{\circ}\text{C}$	0.33 $^{\circ}\text{C}$		
	-100 $^{\circ}\text{C}$ to -25 $^{\circ}\text{C}$	0.18 $^{\circ}\text{C}$		
	-25 $^{\circ}\text{C}$ to 120 $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$		
	120 $^{\circ}\text{C}$ to 1 000 $^{\circ}\text{C}$	0.26 $^{\circ}\text{C}$		
1 000 $^{\circ}\text{C}$ to 1 372 $^{\circ}\text{C}$	0.4 $^{\circ}\text{C}$			



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Electrical

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Temperature Calibration Indication and Control Equipment used with Thermocouple Type N ^{FO}	-200 °C to -100 °C	0.4 °C	Fluke 5520A Equipment Simulation of Thermocouple Output ITS-90 CENAM Technical Guide
	-100 °C to -25 °C	0.22 °C	
	-25 °C to 120 °C	0.19 °C	
	120 °C to 410 °C	0.18 °C	
	410 °C to 1 300 °C	0.27 °C	
Temperature Calibration Indication and Control Equipment used with Thermocouple Type R ^{FO}	0 °C to 250 °C	0.48 °C	
	250 °C to 400 °C	0.28 °C	
	400 °C to 1 000 °C	0.33 °C	
	1 000 °C to 1 767 °C	0.4 °C	
Temperature Calibration Indication and Control Equipment used with Thermocouple Type S ^{FO}	0 °C to 250 °C	0.47 °C	
	250 °C to 1 000 °C	0.36 °C	
	1 000 °C to 1 400 °C	0.37 °C	
	1 400 °C to 1 767 °C	0.46 °C	
Temperature Calibration Indication and Control Equipment used with Thermocouple Type T ^{FO}	-250 °C to -150 °C	0.63 °C	
	-150 °C to 0 °C	0.24 °C	
	0 °C to 120 °C	0.16 °C	
	120 °C to 400 °C	0.14 °C	
Temperature Calibration Indication and Control Equipment used with Thermocouple Type U ^{FO}	-200 °C to 0 °C	0.56 °C	
	0 °C to 600 °C	0.27 °C	
Temperature Calibration Indication and Control Equipment used with RTD Pt 385, 100 Ω ^{FO}	630 °C to 800 °C	0.08 °C	Fluke 5520A Electrical Simulation of RTD Output CENAM Technical Guide
Temperature Calibration Indication and Control Equipment used with Pt 385, 100 Ω Pt 3926, 100 Ω ^{FO}	-200 °C to -80 °C	0.01 °C	
	-80 °C to 0 °C	0.01 °C	
	0 to °C 100 °C	0.02 °C	
	100 °C to 300 °C	0.02 °C	
	300 °C to 400 °C	0.07 °C	
	400 °C to 630 °C	0.07 °C	



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Temperature Calibration Indication and Control Equipment used with RTD Pt 3916, 100 Ω ^{FO}	-200 °C to -190 °C	0.02 °C	Fluke 5520A Electrical Simulation of RTD Output CENAM Technical Guide
	-190 °C to -80 °C	0.02 °C	
	-80 °C to 0 °C	0.02 °C	
	0 to °C 100 °C	0.02 °C	
	100 °C to 260 °C	0.02 °C	
	260 °C to 300 °C	0.02 °C	
	300 °C to 400 °C	0.07 °C	
	400 °C to 600 °C	0.07 °C	
Temperature Calibration Indication and Control Equipment used with Pt 385, 500 Ω ^{FO}	-200 °C to -80 °C	0.02 °C	Fluke 5520A Electrical Simulation of RTD Output CENAM Technical Guide
	-80 °C to 0 °C	0.01 °C	
	0 °C to 100 °C	0.02 °C	
	100 °C to 260 °C	0.02 °C	
	260 °C to 300 °C	0.02 °C	
	300 °C to 400 °C	0.07 °C	
	400 °C to 600 °C	0.07 °C	
	600 °C to 630 °C	0.07 °C	
Temperature Calibration Indication and Control Equipment used with Pt 385, 1 000 Ω ^{FO}	-200 °C to -80 °C	0.01 °C	Electrical Simulation of RTD Fluke 5520A (1-Yr cal. Interval) ASTM E 644-11 RTD CENAM Technical Guide
	-80 °C to 0 °C	0.01 °C	
	0 °C to 100 °C	0.02 °C	
	100 °C to 260 °C	0.02 °C	
	260 °C to 300 °C	0.02 °C	
	300 °C to 400 °C	0.07 °C	
	400 °C to 630 °C	0.07 °C	
	600 °C to 630 °C	0.08 °C	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			Fluke 5520A (Sinewave Output) CENAM Technical Guide
10 Hz to 45 Hz	1 mV to 33 mV	0.8 mV/V + 6 μ V	
10 Hz to 45 Hz	33 mV to 330 mV	0.3 mV/V + 8 μ V	
10 Hz to 45 Hz	0.33 V to 3.3 V	0.3 mV/V + 50 μ V	
10 Hz to 45 Hz	3.3 V to 33 V	0.3 mV/V + 650 μ V	



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Equipment to Measure AC Voltage At the listed frequencies ^{FO}			Fluke 5520A (Sinewave Output) CENAM Technical Guide
45 Hz to 10 kHz	1 mV to 33 mV	0.15 mV/V + 6 μ V	
45 Hz to 10 kHz	33 mV to 330 mV	0.15 mV/V + 8 μ V	
45 Hz to 10 kHz	0.33 V to 3.3 V	0.15 mV/V + 60 μ V	
45 Hz to 10 kHz	3.3 V to 33 V	0.15 mV/V + 600 μ V	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			
10 kHz to 20 kHz	1 mV to 33 mV	0.2 mV/V + 6 μ V	
10 kHz to 20 kHz	33 mV to 330 mV	0.16 mV/V + 8 μ V	
10 kHz to 20 kHz	0.33 V to 3.3 V	0.19 mV/V + 60 μ V	
10 kHz to 20 kHz	3.3 V to 33 V	0.24 mV/V + 600 μ V	
10 kHz to 20 kHz	33 V to 330 V	0.25 mV/V + 6 mV	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			
20 kHz to 50 kHz	1 mV to 33 mV	1 mV/V + 6 μ V	
20 kHz to 50 kHz	33 mV to 330 mV	0.35 mV/V + 600 μ V	
20 kHz to 50 kHz	0.33 V to 3.3 V	0.3 mV/V + 50 μ V	
20 kHz to 50 kHz	3.3 V to 33 V	0.35 mV/V + 8 μ V	
20 kHz to 50 kHz	33 V to 330 V	0.3 mV/V + 6 mV	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			
50 kHz to 100 kHz	1 mV to 33 mV	3.5 mV/V + 12 μ V	
50 kHz to 100 kHz	33 mV to 330 mV	0.8 mV/V + 32 μ V	
50 kHz to 100 kHz	0.33 V to 3.3 V	0.7 mV/V + 130 μ V	
50 kHz to 100 kHz	3.3 V to 33 V	0.9 mV/V + 1.6 mV	
50 kHz to 100 kHz	33 V to 330 V	2 mV/V + 50 mV	



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Equipment to Measure AC Voltage At the listed frequencies ^{FO}			Fluke 5520A (Sinewave Output) CENAM Technical Guide
100 kHz to 500 kHz	1 mV to 33 mV	8 mV/V + 50 μ V	
100 kHz to 500 kHz	33 mV to 330 mV	2.4 mV/V + 600 μ V	
100 kHz to 500 kHz	0.33 V to 3.3 V	2 mV/V + 70 μ V	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			
45 Hz to 1 kHz	33 V to 330 V	0.19 mV/V + 2 mV	
45 Hz to 1 kHz	330 V to 1 020 V	0.3 mV/V + 10 mV	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			
1 kHz to 10 kHz	33 V to 330 V	0.2 mV/V + 6 mV	
1 kHz to 5 kHz	330 V to 1 020 V	0.25 mV/V + 10 mV	
Equipment to Measure AC Voltage At the listed frequencies ^{FO}			HP 3458A (Sinewave Output) AC Mode = SYNC AC Band = \leq 2 MHz CENAM Technical Guide
5 kHz to 10 kHz	330 V to 1 020 V	0.3 mV/V + 10 mV	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
1 Hz to 40 Hz	1 mV to 10 mV	0.035 % of reading + 3 μ V	
1 Hz to 40 Hz	10 mV to 100 mV	0.009 % of reading + 4 μ V	
1 Hz to 40 Hz	0.1 V to 1 V	0.009 % of reading + 40 μ V	
1 Hz to 40 Hz	1 V to 10 V	0.009 % of reading + 0.4 mV	
1 Hz to 40 Hz	10 V to 100 V	0.023 % of reading + 4 mV	
1 Hz to 40 Hz	100 V to 1 000 V	0.046 % of reading + 40 mV	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
40 Hz to 1 kHz	1 mV to 10 mV	0.023 % of reading + 1.1 μ V	
40 Hz to 1 kHz	10 mV to 100 mV	0.009 % of reading + 2 μ V	
40 Hz to 1 kHz	0.1 V to 1 V	0.009 % of reading + 20 μ V	
40 Hz to 1 kHz	1 V to 10 V	0.046 % of reading + 20 mV	



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Master Supply de México S. de R.L. de C.V.

Calle Uva #6121, Colonia El Granjero

Ciudad Juarez, Chihuahua, México. C.P. 32690

Contact Name: Deisy Carolina Gallegos Phone: 656-233-0828

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
Equipment to Output AC Voltage At the listed frequencies ^{FO}			HP 3458A (Sinewave Output) AC Mode = SYNC AC Band = ≤ 2 MHz CENAM Technical Guide
40 Hz to 1 kHz	10 V to 100 V	0.023 % of reading + 2 mV	
40 Hz to 1 kHz	100 V to 1 000 V	0.009 % of reading + 0.2 mV	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
1 kHz to 20 kHz	1 mV to 10 mV	0.035 % of reading + 1.1 μ V	
1 kHz to 20 kHz	10 mV to 100 mV	0.017 % of reading + 2 μ V	
1 kHz to 20 kHz	0.1V to 1 V	0.017 % of reading + 20 μ V	
1 kHz to 20 kHz	1 V to 10 V	0.07 % of reading + 20 mV	
1 kHz to 20 kHz	10 V to 100 V	0.023 % of reading + 2 mV	
1 kHz to 20 kHz	100 V to 1 000 V	0.017 % of reading + 0.2 mV	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
20 kHz to 50 kHz	1 mV to 10 mV	0.12 % of reading + 1.1 μ V	
20 kHz to 50 kHz	10 mV to 100 mV	0.035 % of reading + 2 μ V	
20 kHz to 50 kHz	0.1V to 1 V	0.035 % of reading + 0.2 mV	
20 kHz to 50 kHz	1 V to 10 V	0.14 % of reading + 20 mV	
20 kHz to 50 kHz	10 V to 100 V	0.041 % of reading + 2 mV	
20 kHz to 50 kHz	100 V to 1 000 V	0.035 % of reading + 20 μ V	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
50 kHz to 100 kHz	1 mV to 10 mV	0.58 % of reading + 1.1 μ V	
50 kHz to 100 kHz	10 mV to 100 mV	0.14 % of reading + 0.2 mV	
50 kHz to 100 kHz	0.1 V to 1 V	0.093 % of reading + 0.2 mV	
50 kHz to 100 kHz	1 V to 10 V	0.093 % of reading + 20 μ V	
50 kHz to 100 kHz	10 V to 100 V	0.013 % of reading + 2 μ V	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
100 kHz to 300 kHz	10 mV to 100 mV	4.6 % of reading + 2 μ V	
100 kHz to 300 kHz	0.1 V to 1 V	0.35 % of reading + 10 μ V	



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Equipment to Output AC Voltage At the listed frequencies ^{FO}			HP 3458A (Sinewave Output) AC Mode = SYNC AC Band = \leq 2 MHz CENAM Technical Guide
100 kHz to 300 kHz	1 V to 10 V	0.35 % of reading + 1 mV	
100 kHz to 300 kHz	10 V to 100 V	0.35 % of reading + 0.1 mV	
Equipment to Output AC Voltage At the listed frequencies ^{FO}			
0.3 MHz to 1 MHz	10 mV to 100 mV	1.2 % of reading + 0.1 mV	
0.3 MHz to 1 MHz	0.1 V to 1 V	1.2 % of reading + 1 mV	
0.3 MHz to 1 MHz	1 V to 10 V	1.2 % of reading + 10 μ V	Fluke 5520A (LCOMP off) Compliance Adder: 0.05 μ A/V CENAM Technical Guide
Equipment to Measure AC Current At the listed frequencies ^{FO}			
45 Hz to 1 kHz	29 μ A to 329.99 μ A	0.13 % of reading + 0.1 μ A	
45 Hz to 1 kHz	0.33 mA to 3.299 9 mA	0.1 % of reading + 0.15 μ A	
45 Hz to 1 kHz	3.3 mA to 32.999 mA	0.04 % of reading + 2 μ A	
45 Hz to 1 kHz	33 mA to 329.99 mA	0.04 % of reading + 20 μ A	
45 Hz to 1 kHz	0.33 A to 1.099 99 A	0.05 % of reading + 100 μ A	
45 Hz to 1 kHz	1.1 A to 2.999 99 A	0.06 % of reading + 100 μ A	
Equipment to Measure AC Current At the listed frequencies ^{FO}			
45 Hz to 100 Hz	3 A to 10.999 9 A	0.06 % of reading + 2 mA	
45 Hz to 100 Hz	11 A to 20.5 A	0.12 % of reading + 5 mA	
Equipment to Measure AC Current At the listed frequencies ^{FO}			
100 Hz to 1 kHz	3 A to 10.999 9 A	0.1 % of reading + 2 mA	
100 Hz to 1 kHz	11 A to 20.5 A	0.15 % of reading + 5 mA	
Oscilloscopes –Level Sine Amp 50 kHz (reference) ^{FO}	10 mv to 5 Vp-p	2 % of reading + 300 μ V	Fluke 5520A/SC600 CENAM Technical Guide
Oscilloscopes – Measure Levelled sine wave voltage amplitude 50 kHz ^{FO}	5 mV to 10 mV	0.56 % of reading + 15 μ V	
	10 mV to 100 mV	0.44 % of reading + 32 μ V	
	0.1 V to 1 V	0.07 % of reading + 2.6 μ V	
	1 V to 5 V	0.1 % of reading + 0.87 mV	



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Oscilloscopes –Level Sine Wave Frequency ^{FO}	50 kHz to 500 kHz	0.001 8 % of reading + 7.1 μ Hz	Fluke 5520A/SC600 CENAM Technical Guide
	500 kHz 5 MHz	0.002 2 % of reading + 1.9 mHz	
	5 MHz to 500 MHz	0.019 % of reading+ 4.9 mHz	
Oscilloscopes - Input Z (Impedance) Resistance ^{FO}	41.29 Ω to 60.315 Ω	0.000 7 % of reading + 1.4 m Ω	
	60.315 Ω to 610 510 Ω	0.000 02 % of reading + 1.2 Ω	
	610 510 Ω to 1 522 915 Ω	0.006 9 % of reading + 34 Ω	
Oscilloscopes – Level Sine Flatness LF ^{FO}	500 kHz to 10 MHz	0.18 % of reading	
Calibrate Oscilloscopes – Level Sine Flatness HF (7.5 mV to 5.5 V) ^{FO}	30 MHz to 300 MHz	0.56 % of reading	
Calibrate Oscilloscopes – Level Sine Flatness HF (7.5 mV to 5.5 V) ^{FO}	300 MHz to 600 MHz	0.56 % of reading	
AC Clamp-On Meters (45 Hz to 1 kHz) ^{FO}	16.5 A to 1 000 A	0.45 % of reading + 0.5 A	Fluke 5520A Fluke 5500-COIL CENAM Technical Guide
Equipment to Measure AC Current At the listed frequencies ^{FO}			HP 3458A (Sinewave Output) CENAM Technical Guide
45 Hz to 5 kHz	0 A to 100 μ A	0.072 % of reading + 30 nA	
Equipment to Measure AC Current At the listed frequencies ^{FO}			HP 3458A (Sinewave Inputs) CENAM Technical Guide
100 Hz to 5 kHz	0.1 mA to 1 mA	0.042 % of reading + 0.2 μ V	
100 Hz to 5 kHz	1 mA to 10 mA	0.04 % of reading + 2 μ A	
100 Hz to 5 kHz	10 mA to 100 mA	0.041 % of reading + 20 μ A	
100 Hz to 5 kHz	0.1 A to 1 A	0.15 % of reading + 200 μ A	
NDT Electrical Meter Relativity Conductivity Electrolytic Measuring Equipment- Eddy-Current ^F	4.6 x 10 ⁶ S/m	9.2 x 10 ⁴ S/m	Conductivity Standard Centurion NDT CENAM Technical Guide
	2.7 x 10 ⁷ S/m	2 x 10 ⁵ S/m	
	5.9 x 10 ⁷ S/m	4.9 x 10 ⁵ S/m	
Electrical Patient Simulator Fetal Simulator ^F	50 μ V to 2.5 mV	1 μ V + 0.09 μ V/V	Oscilloscope Digital Agilent 34401A Multimeter, A-M Systems 3 000 Differential Amplifier CENAM Technical Guide
	1 T Ω	0.81 T Ω	



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Equipment to Source DC/AC - High Voltage ^{FO}	50 V to 6 kV	4.3×10^{-6} V/V + 0.007 6 V	3458A and High Prove-Voltage CENAM Technical Guide
AC/DC Current Shunt Resistance (DC to 5 kHz) ^{FO}	100 $\mu\Omega$ to 10 Ω	0.001 1 Ω / Ω + 1×10^{-7} Ω	Fluke 5520A calibrator, Agilent 6672A DC Power Supply and Agilent 3458A Digital Multimeter CENAM Technical Guide
Equipment to Measure Resistance Fixed Point ^{FO}	101.3 M Ω	0.006 M Ω	Keithley 5155 Resistance Standard CENAM Technical Guide
	1 G Ω	7.2×10^{-4} G Ω	
	10 G Ω	0.007 G Ω	
	100 G Ω	0.006 G Ω	
	1 T Ω	8.1×10^{-3} T Ω	

Optical

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
Luminance Meters and Sources Wave Length ^F	1 Lux to 3 999 Lux	1 % of reading	Visible Light Meter Sonel LXP-10 Class A Sensor (425 nm to 700 nm) NIST SP250-37
	4 000 Lux to 7 000 Lux	1.6 % of reading	
Gloss Meters ^F	20° 60° 85°	0.32 GU 0.31 GU 0.32 GU	Gloss Standards: GU Represents Gloss Units ASTM D-523
UV Irradiance - Calibration of UV Light Meters and UV Dosimeters Wave Length ^F	0.1 mW/cm ² to 1 999.9 mW/cm ²	3.5 % of reading	UV Intensity and Power Meter, High Intensity Mercury Lamp UV Light Source (220 nm to 540 nm) ASTM E824, ASTM G138 ASTM G130
	1.999 W/cm ² to 20 W/cm ²	3.5 % of reading	

Time and 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
Calibrate -Time Marker Output ^{FO}	2 ns to 20 ms	2.5 μ s/s	Philips 6669 Timer/Counter NIST 960



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Time and Frequency

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Timers, Counters and Stopwatches ^O	1 s to 86 400 s	$(0.6 + 3.4 \times 10^{-7}t)$ ms	Philips 6669 Timer/Counter Agilent 33220A Func. Generator NIST 960
Time & Frequency Generators ^F	1 Hz to 120 MHz	0.08 μ Hz/Hz	Agilent 53131A
	120 MHz to 3 GHz	0.08 μ Hz/Hz	Philips 6669 Timer/Counter NIST 960
Optical Tachometer and Tachometer Contact ^{FO}	0.1 rad/s to 10 470 rad/s	$(0.008 6 + 6.6 \times 10^{-9}\omega)$ rad/s	Monarch digital tachometer and Monarch Palm Strobe Technical Guide CENAM
Optical Non-Contact Tachometer ^{FO}	1 309 rad/s to 10 470 rad/s	0.06 rad/s	Agilent 53131A Philips 6669 Timer/ Counter Agilent 33220A Function Generator Technical Guide CENAM
Rotation Measurement Speed, Line Speed, Centrifuges Rotation Speed ^{FO}	0.1 rad/s to 2 094 rad/s	$(0.011 + 9.2 \times 10^{-6}\omega)$ rad/s	Tachometer Monarch PLT200 MVR01 Technical Guide CENAM
Rotation Velocity Measurement and Centrifuges Rotation Speed ^{FO}	0.1 rad/s to 2 094 rad/s	0.017 rad/s	Monarch Digital tachometer and Monarch Palm Strobe MVR01 Technical Guide CENAM

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^F would mean that the laboratory performs this calibration at its fixed location.



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

4. The presence of a superscript O means that the laboratory performs calibration of the indicated parameter onsite at customer locations. Example: Outside Micrometer^O 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^{FO} 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 T represents temperature in °C or °F as appropriate to the uncertainty statement.
8. The term Q represents flow in cm³/min or mL/min (including SI multiple and submultiple units) appropriate to the uncertainty statement.
9. The term F represents force in Newton (N) or lbf grams (including SI multiple and submultiple units) appropriate to the uncertainty statement.
10. The term L represents length in inches or millimeters as appropriate to the uncertainty statement.
11. The term P represents a specific pressure in units appropriate to the uncertainty statement.
12. The term H represent Relative Humidity in units of RH as appropriate to the uncertainty statement.
13. The term Wt represents weight in pounds or grams (including SI multiple and submultiple units) appropriate to the uncertainty statement.
14. The term ω represents rotational speed in radian per second (including SI multiple and submultiple units) appropriate to the uncertainty statement.
15. The term E represents Illuminance in lux (lm/m²) (including SI multiple and submultiple units) appropriate to the uncertainty statement.
16. The term t represents time in seconds (s) or millisecond (ms) as appropriate to the uncertainty statement.
17. The term v represents speed in m/s as appropriate to the uncertainty statement.