



# PERRY JOHNSON LABORATORY ACCREDITATION, INC.

## *Certificate of Accreditation*

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

### ***Metrosmart, S.A. de C.V. / Metrokal***

*Alcatraz 23, Paseo del Pedregal Salitre  
El Salitre, Querétaro, México. C.P. 76223*

*(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):

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

December 3, 2022

*Issue Date:*

December 03, 2022

*Expiration Date:*

December 31, 2024

*Revision Date:*

October 13, 2023

*Accreditation No.:*

74050

*Certificate No.:*

L22-818-4-R1

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.pjlabs.com](http://www.pjlabs.com)*



# Certificate of Accreditation: Supplement

## Metrosmart, S.A. de C.V. / Metrokal

Alcatraz 23, Paseo del Pedregal Salitre  
 El Salitre, Querétaro, México. C.P. 76223  
 Contact Name: Efrain Calva Gomez Phone: 442-220-7054

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

### 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
Melt Flow Index Time <sup>FO</sup>	1 min to 10 min	0.84 s	Stopwatch ASTM D1238
Impact Tester Time <sup>FO</sup>	1 min to 10 min	0.84 s	Stopwatch ASTM D256
Speed - Force Test Machines <sup>FO</sup>	1 mm/min to 600 mm/min	0.84 s	Stopwatch ASTM E2658
Tachometer Rate of Rotation, Rotational Frequency Measuring Machines <sup>FO</sup>	112 rpm to 99 999 rpm	0.6 rpm	AS432-B Tachometer Mitutoyo Stroboscopic Lamp OMEGA Optical Tachometer Adapter TRANSMILLE CENAM Technical Guide
	0.01 rad/s to 10 472 rad/s	0.006 rad/s	
Stopwatch Fixed Point <sup>FO</sup>	15 s	0.072 s	Chronometer, Control Company Model: 1021 NIST Recommended Practice Guide, Special Publication 960-12
	86 400 s	3 s	

### 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
Impact Tester and Notch <sup>FO</sup> Height Impact	Up to 300 mm	0.01 mm	Rule Mitutoyo 300 mm ASTM E 256
Force Test Machines Displacement <sup>O</sup>	Up to 600 mm	0.011 mm	Digital Caliper 600 mm ASTM E 2309/ E 2309M
Melt Flow Index <sup>FO</sup> (Plastometer)	Up to 25 mm	2 $\mu$ m	Micrometer (Piston Foot Diameter, Piston Foot Length) Gage Go -No Go (Capillary Diameter) ASTM D 1238
Laser Micrometer <sup>FO</sup>	Up to 25.4 mm	(0.19 + 3 x 10 <sup>-3</sup> L) $\mu$ m	Cylindric Patterns, Mahr; NMX-CH-99-SCFI
Measurement Horizontal Systems and Benches of only One Axes <sup>FO</sup>	Up to 10 m	(1.1 + 0.01L) $\mu$ m	Laser Measurement System, Renishaw, Mod: XL-80 ISO 10360-2



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Handheld Laser Distance Meters <sup>FO</sup>	Up to 100 m	$(0.61 + 0.012L)$ mm	Measuring Tape, Lufkin Mod: N250M BS ISO 16331-1
Numerically Controlled Machine Tool (CNC)- X, Y, Z (Linear Displacement Accuracy) <sup>FO</sup>	Up to 15 000 mm	$(0.25 + 8.4 \times 10^{-4}L)$ $\mu$ m	Laser Measurement System, Renishaw Mod: XL-80 ISO 230-2
Length Measure Instruments <sup>FO</sup>	Up to 3 000 mm (Res.= 0.000 1 mm)	$(0.81 + 5 \times 10^{-3}L)$ $\mu$ m	Gage Blocks Master K MTK-LAB-TEC-64 Horizontal Measurement System Direct Comparison ISO 10360-2
Digital Scale Ruler <sup>FO</sup>	Up to 1 000 mm (Res.= 0.01 mm)	$(6.8 + 4.4 \times 10^{-3}L)$ $\mu$ m	Gage Blocks Master Grade 0 and Grade 1 JIS B 7507 Direct Comparison
Microscopes X and Y Axis <sup>FO</sup>	Up to 300 mm	$(0.52 + 4.6 \times 10^{-3}L)$ $\mu$ m	Glass Rule (Res.= 0.1 mm) Master Blocks Grade 1 JIS-B-7153 Direct Comparison
Vision System X, Y and Z axis <sup>F</sup>	Up to 800 mm	$(0.58 + 0.007 8L)$ $\mu$ m	Glass scale 1 000 mm ASME Y 14.5
Welding Gauge <sup>FO</sup>	Up to 360°	0.6°	Gage Block Set
Angle, Distance, Radio and Depth	Up to 300 mm	60 $\mu$ m	Angle Gage Block set Vision System NMX-CH-002-IMNC NMX-CH-151-IMNC ASME Y 14.5
PCMM Volumetric Performance <sup>O</sup>	Up to 4 000 mm	$(5 + 1L)$ $\mu$ m	2 000 mm Ball Bar ISO ANSI/ASME B89.422-R
PCMM Effective Diameter Fixed Point Calibration <sup>O</sup>	Sphere Diameter 25.4 mm	0.02 $\mu$ m	Calibrated Sphere ISO 3290-1
Vertical Measurement Systems <sup>O</sup>	Up to 100 mm (Res.= 0.01 $\mu$ m)	$(0.2 + 0.3L)$ $\mu$ m	Laser Interferometer ISO 230-2



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Block Gauges <sup>F</sup>	125 mm to 127 mm	0.36 $\mu$ m	Gage Blocks Master Grade 0 NMX-CH-3650 Direct Comparison
	150 mm to 152.4 mm	0.38 $\mu$ m	
	175 mm to 177.8 mm	0.41 $\mu$ m	
	200 mm to 203.2 mm	0.45 $\mu$ m	
	250 mm to 254 mm	0.52 $\mu$ m	
	300 mm to 304.8 mm	0.59 $\mu$ m	
	400 mm to 406.4 mm	0.75 $\mu$ m	
500 mm to 508 mm	0.94 $\mu$ m		
Pi Tapes <sup>F</sup>	50.8 mm to 3 048 mm (Res.= 0.01 mm)	(0.105 + 0.020 6L) mm	Linear Scale (Horizontal Measurement System) SINO SDS6-2V MTK-LAB-TEC-69 Pi tapes SOP 23 NIST CENAM Technical Guide

#### Mechanical

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Direct Calibration of Testing Machines, Force Instruments and Force Transducer (Tension) <sup>FO</sup>	0.1 N to 588.39 kN	0.12 % of reading	Reference Force Transducer ISO-7500-1 NMX-CH-7500-1- INMC ISO-376 NMX-CH-376-INMC
Direct Calibration of Testing Machines, Force Instruments and Force Transducer (Compression) <sup>FO</sup>	0.1 N to 588.39 kN	0.12 % of reading	
Indirect Verification of Rockwell Hardness Tester HREW <sup>FO</sup>	70 HREW to 83 HREW	0.55 HREW	ASTM E-18 Hardness Reference Test Block
	84HREW to 92 HREW	0.44 HREW	
	93 HREW to 105 HREW	0.7 HREW	
Indirect Verification of Rockwell Hardness Tester HRBW <sup>FO</sup>	20 HRBW to 59 HRBW	0.61 HRBW	
	60 HRBW to 84 HRBW	0.56 HRBW	
	85 HRBW to 100 HRBW	0.59 HRBW	



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Indirect Verification of Rockwell Hardness Tester HRC <sup>FO</sup>	20 HRC to 34 HRC	0.32 HRC	ASTM E-18 Hardness Reference Test Block
	35 HRC to 59 HRC	0.31 HRC	
	60 HRC to 70 HRC	0.28 HRC	
Indirect Verification of Rockwell Hardness Tester HRA <sup>FO</sup>	20 HRA to 65 HRA	0.36 HRA	
	70 HRA to 78 HRA	0.35 HRA	
	80 HRA to 84 HRA	0.23 HRA	
Indirect Verification of Rockwell Hardness Tester HRF <sup>FO</sup>	57 HRF to 75 HRF	0.53 HRF	
	80 HRF to 90 HRF	0.65 HRF	
	94 HRF to 100 HRF	0.64 HRF	
Indirect Verification of Rockwell Hardness Tester HR30N <sup>FO</sup>	42 HR30N to 50 HR30N	0.26 HR30N	
	55 HR30N to 73 HR30N	0.37 HR30N	
	77 HR30N to 82 HR30N	0.29 HR30N	
Indirect Verification of Rockwell Hardness Tester HR30T <sup>FO</sup>	43 HR30T to 56 HR30T	0.54 HR30T	
	57 HR30T to 69 HR30T	0.55 HR30T	
	70 HR30T to 83 HR30T	0.5 HR30T	
Indirect Verification of Brinell Hardness tester HBW 10/3 000 <sup>FO</sup>	95.5 HBW to 250 HBW	2.9 HBW	Hardness Reference Blocks ASTM E-10
	250 HBW to 450 HBW	6.8 HBW	
	450 HBW to 600 HBW	8.9 HBW	
Indirect Verification of Brinell Hardness tester HBW 2.5/187.5 <sup>FO</sup>	95.5 HBW to 250 HBW	2.4 HBW	
	250 HBW to 450 HBW	5.1 HBW	
	450 HBW to 600 HBW	9.2 HBW	
Verification of Vickers Micro Hardness Tester HV 0.5 <sup>FO</sup>	100 HV to 240 HV	4.4 HV	Hardness Reference Blocks ASTM E-384
	240 HV to 600 HV	7.6 HV	
	600 HV to 999 HV	11 HV	
Indirect verification of Rockwell hardness tester HR15N <sup>FO</sup>	70 HR15N to 77 HR15N	0.44 HR15N	Indirect Verification per using Hardness Test Blocks ASTM E18
	78 HR15N to 88 HR15N	0.46 HR15N	
	90 HR15N to 92 HR15N	0.53 HR15N	
Indirect verification of Rockwell hardness tester HR15TW <sup>FO</sup>	74 HR15TW to 80 HR15TW	0.57 HR15TW	
	81 HR15TW to 86 HR15TW	0.55 HR15TW	
	87 HR15TW to 93 HR15TW	0.64 HR15TW	



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#### Mechanical

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Direct Verification of Durometer Hardness Tester Types: A, B, C, D, E, O, OO & DO  Extension at zero reading  Indenter Shape (Not all parameters apply to all of Durometer Types) Indenter Diameter Indenter Tip Diameter Indenter Tip Radius Indenter Tip Angle	2.46 mm to 2.54 mm	6 $\mu$ m	ASTM D2240 Mahr, MarVision MM320 Vision Equipment
Durometers Indenter Spring Types A, B, E & O Types C, D, & DO <sup>FO</sup>	0.55 N to 8.05 N 4.445 N to 44.45 N	0.045 N 1.4 N	Mahr, MarVision MM320 Vision Equipment  Load Cell Interfase (Res.= 0.001 N)
Vacuum Gauge <sup>FO</sup>	-82 kPa to -6 kPa	0.016 kPa	Vacuum Meter Brand: Additel Model: ADT681-02-CP30-PSI-N Direct Comparison CENAM Technical Guide
	-6 kPa to -0.138 kPa	0.069 kPa	Vacuum Meter Brand: Additel Model: ADT681-02-GP10K-PSI-N Direct Comparison CENAM Technical Guide
Pressure Gauge <sup>FO</sup>	2 Pa to 496 Pa	0.4 Pa	Pressure Gauge Brand: Additel Model: ADT681-05-DP30-H <sub>2</sub> O & ADT681-02-GP10K-PSI-N Direct Comparison CENAM Technical Guide
	5 kPa to 69.95 MPa	0.018 MPa	
Pressure Gauge and Pressure Transmitter <sup>FO</sup>	496 Pa to 1 245 Pa	1.3 Pa	Pressure Gauge Brand: Additel Model: ADT681-05-DP30-H <sub>2</sub> O Direct Comparison CENAM Technical Guide





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Pressure Gauge and Pressure Transmitter <sup>FO</sup>	1 245 Pa to 28 kPa	1.3 kPa	Pressure Gauge Brand: Additel Model: ADT681-05-DP30-H2O & ADT681-02-GP300-PSI-N Direct Comparison CENAM Technical Guide
	34.47 kPa to 3.44 MPa	0.059 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-GP300-PSI-N & ADT681-02-GP5K-PSI-N Direct Comparison CENAM Technical Guide
	3.44 MPa to 20.68 MPa	2 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-GP5K-PSI-N Direct Comparison CENAM Technical Guide
	20.68 MPa to 68.94 MPa	12 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-GP5K-PSI-N & ADT681-02-GP5K-PSI-N Direct Comparison CENAM Technical Guide
	68.94 MPa to 137.88 MPa	16 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-GP5K-PSI-N & ADT681ADT681-05-GP20K-PSI-AM Direct Comparison CENAM Technical Guide
Pressure Gauge Differential <sup>FO</sup>	2 Pa to 496 Pa	0.4 Pa	Pressure Gauge Brand: Additel Model: ADT681-05-DP30-H2O Direct Comparison CENAM Technical Guide
	496 Pa to 1 245 Pa	11 Pa	
	1 245 Pa to 9 972 Pa	19 Pa	Pressure Gauge Brand: Additel Model: ADT681-02-DP150-H2O Direct Comparison CENAM Technical Guide



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Sphygmomanometer <sup>FO</sup>	4 kPa to 40 kPa	0.038 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-CP15-PSI-N Direct Comparison CENAM Technical Guide
Pressure Gauge Absolute and Pressure Transmitter <sup>FO</sup>	5 kPa to 110.38 kPa	8.8 kPa	Pressure Gauge Brand: Additel Model: ADT681-10-AP30-PSI-N Direct Comparison CENAM Technical Guide
	110.38 kPa to 3.44 MPa	66 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-GP500-PSI-N Direct Comparison CENAM Technical Guide
	3.44 MPa to 68.94 MPa	11 kPa	Pressure Gauge Brand: Additel Model: ADT681-02-GP10K-PSI-N Direct Comparison CENAM Technical Guide
Dead Weight Tester Industrial <sup>F</sup>	68.95 kPa to 68.95 MPa (10 psi to 10 000 psi)	0.022 % of reading	Dead Weight Tester Brand: Ametek Model: DM-T-100/C Cross Floating CENAM Technical Guide
Torque Tools, Electrical and Pneumatic Screwdriver <sup>FO</sup>	0.5 N·m to 10 N·m	0.12 % of reading	ISO-6789-2 / NMX-CH-6789-IMNC Set Torque Transducer NORBAR 50673 Log Joint Simulator and Dynamic Transducer Desoutter RT5SQ75, ISO 5393
	2.5 N·m to 25 N·m	0.12 % of reading	
	20 N·m to 400 N·m	0.16 % of reading	ISO-6789-2 / NMX-CH-6789-IMNC Set Torque Transducer NORBAR 50675 Log Joint Simulator and Dynamic Transducer Desoutter, RT5SQ75, ISO 5393
	250 N·m to 2 500 N·m	0.19 % of reading	ISO-6789-2 / NMX-CH-6789-IMNC Set Torque Transducer NORBAR 50703 Log Joint Simulator and Dynamic Transducer Desoutter, RT5SQ75, ISO 5393





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Torque Transducer, Spring Tester Machines, Bottle Cap Torque tester, Analyzer of Torque <sup>F0</sup>	0.1 N·m to 100 N·m	0.1 % of reading	Lever Arm and Suspended Set Mass, Class F1 Weights. Euramet_cg-14 CENAM Technical Guide
Liquid Flow Meters <sup>F</sup>	450 L/h to 180 000 L/h	0.087 % of reading	Flow Meter Brand: Micro Motion Model: CMF050M322N2BASZZZ Type: Coriolis, Flow Meter Brand: Micro Motion Model: MF200M419NQBUEZZZ Type: Coriolis Flow Meter Brand: Micro Motion Model: MF300M426NABUSZZZ Type: Coriolis CENAM Technical Guide
Liquid Flow Meters <sup>F</sup>	6 L/h to 3 000 L/h	0.054 % of reading	Graduated Neck Volumetric Measurement 10 L, 20 L, 50 L Graduated Cylinder 100 ml CENAM Technical Guide
Gas Flow Meters: Standard Leak Leak Tester Mass Flow Meter Mass Flow Controller Laminar Flow Meter <sup>F</sup>	0.5 mL/min to 10 mL/min	0.74 % of reading	ALICAT Mass Flow Meter CEM Calibration Procedure ME-009
Gas Flow Meters: Standard Leak Leak Tester Mass Flow Meter Mass Flow Controller Laminar Flow Meter <sup>F</sup>	10 mL/min to 100 mL/min	0.53 % of reading	



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Gas Flow Meters: Standard Leak, Leak Tester Mass Flow Meter, Mass Flow Controller Laminar Flow Meter Piston Flow Meter Bubble Flow Meter <sup>F</sup>	0.1 L/min to 1 L/min	0.6 % of reading	ALICAT Mass Flow Meter CEM Calibration Procedure ME-009
Gas Flow Meters: Standard Leak, Leak Tester Mass Flow Meter, Mass Flow Controller, Laminar Flow Meter, Piston Flow Meter, Bubble Flow Meter, Wet Test Meter Diaphragm Test Meter Rotameter, Turbine Meter, Roots Meter, Differential Pressure Meter, Hot Wire Meter <sup>F</sup>	1 L/min to 10 L/min	0.5 % of reading	ALICAT Mass Flow Meter CEM Calibration Procedure ME-009
	10 L/min to 100 L/min	0.81 % of reading	
Gas Flow Meters: Mass Flow Meter, Mass Flow Controller, Laminar Flow Meter, Diaphragm Test Meter, Rotameter, Turbine Meter Roots Meter, Differential Pressure Meter, Hot Wire Meter <sup>F</sup>	100 L/min to 400 L/min	0.56 % of reading	
	100 L/min to 1 000 L/min (Res.= 0.1 L/min)	0.64 % of reading	
Piston Pipette (Micropipette) <sup>F</sup>	1 $\mu$ L to 10 000 $\mu$ L	0.23 % of reading	Analytical Scale RADWAG AS 82/220.X2 Analytical Scale and BM-20 ISO 8655-2 CENAM Technical Guide
Piston Burette <sup>F</sup>	1 mL to 1 000 mL	0.3 % of reading	Analytical Scale RADWAG AS 82/220.X2 CENAM Technical Guide
Pipettes <sup>F</sup>	1 mL to 1 000 mL	0.42 % of reading	Analytical Scale RADWAG AS 82/220.X2, METTLER TOLEDO XP1203S, OHAUS EX6202, ISO 4787



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			CENAM Technical Guide
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### Mechanical

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Cylinders Graduated, Dilutors, Dispensers, Pycnometers, Volumetric Flask, special Containers <sup>F</sup>	1 mL to 1 000 mL	0.25 % of reading	Analytical Scale RADWAG AS 82/220.X2, METTLER TOLEDO XP1203S, OHAUS EX6202, ISO 4787 CENAM Technical Guide
Volumetric Flask Cylinders Graduated, special Containers, Volumetric Measurement of Graduated Neck <sup>F</sup>	1 000 mL to 20 000 mL	0.021 % of reading	OHAUS, EX6202, Electronic Balance WA30IX, Master Volumetric Container ISO 4787, NMX-CH-049-IMNC CENAM Technical Guide
Special Containers, Volumetric Containers, Volumetric Measurement of Graduated Neck <sup>F</sup>	20 000 mL to 250 000 mL	0.025 % of reading	Electronic Balance WA30IX, Master Volumetric Container, ISO 4787 NMX-CH-049-IMNC OIML R120 CENAM Technical Guide
Volume Measurement Containers <sup>F</sup>	200 L to 30 000 L (Res.= 0.01 L)	0.11 % of reading	Flow Meter, Brand: Micro Motion Model: 00F138NABAEZZZZ Type Coriolis, OIML R120
Fixed Contain Volume Tank and Mobile <sup>O</sup>	250 L to 120 000 L	0.088 % of reading	Metric Tape with Lufkin Ballast of 15 mm and 50 mm Karl Deutsch Thickness Meter and Thermometer Fluke ISO 7507-1
Tanks on Ground "to contain" (Horizontal) <sup>O</sup>	500 L to 200 000 L	0.41 % of reading	
Tanks on The Ground "to contain(Vertical) <sup>F</sup>	5 m <sup>3</sup> to 32 000 m <sup>3</sup>	0.19 % of reading	

### Thermodynamic

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Furnaces–Mufflers <sup>O</sup>	0 °C to 420 °C	0.042 °C	RTD Brand: Bourns, Model: WPP0G1-12-5/LT40/FS03 Calibrator with Indicator ASL/WIKA CTR2000-024 Thermocouple Type S & Dry Block Fluke 9150 Procedure MTK-LAB-T-01 CENAM Technical Guide
	420 °C to 900 °C	0.33 °C	



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#### Thermodynamic

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Radiation Thermometer <sup>FO</sup>	30 °C to 400 °C	0.7 °C	Black body, Thermocouple Type K & Dry Block Fluke 9150 Procedure MTK-LAB-T-01 CENAM Technical Guide
	400 °C to 900 °C	1.2 °C	
Humidity Meter <sup>F</sup>	10 % RH to 95 % RH	1.2 % RH	Digital Hygrometer, Vaisala MI70 Chamber of Humidity and Salts CENAM Technical Guide Procedure MTK-LAB-H-01
	97 % RH	1.2 % RH	Digital Hygrometer Vaisala MI70 Salt Certified by Vaisala CENAM Technical Guide Procedure MTK-LAB-H-01
Liquids in Glass Thermometer <sup>F</sup>	-25 °C to 420 °C	0.062 °C	RTD Brand: Bourns, Model: WPP0G1-12-5 <sup>a</sup> /LT40/FS03; Calibrator with Indicator ASL/WIKA CTR2000-024 Dry Block Kaye LTR140, Fluke 9140, Fluke 9150 Brookfield TC-500 CENAM Technical Guide Procedure MTK-LAB-T-01
Thermometer Direct Reading <sup>FO</sup>	-50 °C to 350 °C	0.11 °C	RTD Brand: Bourns, Model: WPP0G1-12-5 <sup>a</sup> /LT40/FS03 Calibrator with Indicator ASL/WIKA, CTR2000-024 Dry Block Kaye LTR140 Fluke 9140, Fluke 9150 Brookfield TC-500, Process Calibrator, RTD ACCUMAC, Dry Block ADDITEL Direct Comparison Method Platinum Resistance Thermometer with Digital Display, Brand: SIKA, Model: TF255-300-3 / P37200E.2 Procedure MTK-LAB-T-0 CENAM Technical Guide



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## Metrosmart, S.A. de C.V. / Metrokal

Alcatraz 23, Paseo del Pedregal Salitre

El Salitre, Querétaro, México. C.P. 76223

Contact Name: Efrain Calva Gomez Phone: 442-220-7054

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
Thermometer Direct Reading <sup>FO</sup>	350 °C to 420 °C	0.062 °C	RTD Brand: Bourns, Model: WPP0G1-12-5 <sup>a</sup> /LT40/FS03 Calibrator with Indicator ASL/WIKA, CTR2000-024, Dry Block Kaye LTR140, Fluke 9140, Fluke 9150 Brookfield TC-500, Process Calibrator, RTD ACCUMAC, Dry Block ADDITEL Direct Comparison Method CENAM Technical Guide Procedure MTK-LAB-T-0
	420 °C to 1 197 °C	1.8 °C	
Climatic Chambers, Refrigerating (Freezer) Chambers, Sterilizer & Incubators <sup>O</sup>	-50 °C to 420 °C	0.11 °C	RTD Brand: Bourns Model: WPP0G1-12-5/LT40/FS03 Calibrator with Indicator ASL/WIKA CTR2000-024
Water Baths, Temperature Calipers and Bain-Marie <sup>O</sup>	-40 °C to 420 °C	0.042 °C	Thermocouple Type K Process Calibrator SPMK518 with
Temperature Measurement Thermocouple Type B <sup>FO</sup>	20 °C to 420 °C	0.062 °C	Thermocouple Type "S" Dry Block, Fluke 9150, EA 10/11 Direct Comparison
	420 °C to 900 °C	0.7 °C	
Temperature Measurement Thermocouple Type E <sup>FO</sup>	-25 °C to 420 °C	0.062 °C	Platinum resistance thermometer with digital display, Brand: SIKA Model: TF255-300-3 / TP37200E.2 Identification: MTK-PT-51 Procedure MTK-LAB-T-01 CENAM Technical Guide
	420 °C to 850 °C	0.7 °C	
Temperature Measurement Thermocouple Type N, K and J <sup>FO</sup>	-25 °C to 420 °C	0.062 °C	
	420 °C to 900 °C	0.7 °C	
Temperature Measurement Thermocouple Type R <sup>FO</sup>	5 °C to 420 °C	0.062 °C	
	420 °C to 900 °C	0.7 °C	
Temperature Measurement Thermocouple Type S <sup>FO</sup>	-25 °C to 420 °C	0.062 °C	
	420 °C to 900 °C	0.7 °C	
Temperature Measurement Thermocouple Type T <sup>FO</sup>	-25 °C to 370 °C	0.062 °C	RTD Brand: Bourns Model: WPP0G1-12-5/LT40/FS03 Calibrator with Indicator ASL/WIKA CTR2000-024 Thermocouple Type K. Process Calibrator SPKM Instrument, Process Calibrator, RTD Accumac, Dry Block ADDITEL, Process Calibrator SPMK518 with Thermocouple Type "S" Procedure MTK-LAB-T-01 Direct Comparison Method ASTM E220, ASTM E230



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#### 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
Bi-Metal Thermometer <sup>F</sup>	-25 °C to 420 °C	0.062 °C	RTD Brand: Bourns Model: WPP0G1-12-5/ LT40/FS03 Calibrator with Indicator ASL/WIKA CTR2000-024 Dry Block Kaye LTR140, Fluke 9140, Fluke 9150, Direct Comparison Method CENAM Technical Guide Procedure MTK-LAB-T-01
Melt Flow Index Chamber Temperature Only <sup>FO</sup>	20 °C to 400 °C	0.1 °C	Thermometer with RTD PT 100 Industrial (Res.= 0.01 °C) Direct Comparison Method ASTM D1238

#### 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
Refractometer <sup>FO</sup>	0 °Brix to 75 °Brix	0.022 °Brix	Reference Solution INIMET CENAM Technical Guide
pH Meters <sup>FO</sup>	4 pH	0.014 pH	Reference Solution Fermont CENAM Technical Guide
	7 pH	0.011 pH	
	10 pH	0.02 pH	Sodium Carbonate and Sodium Carbonate Salts Certified in pH CENAM Technical Guide
Conductivity Meter <sup>FO</sup>	5 $\mu$ S	1 $\mu$ S	Conductivity Solutions & Aliquot Cenam, Aqueous Solution of 0.0003 mol/kg CENAM Aqueous Solution of 0.001 mol/kg Analytical Scale Mettler Toledo AT201, Mettler Toledo XP1203S CENAM Technical Guide
	10 $\mu$ S	1 $\mu$ S	
	84 $\mu$ S	1 $\mu$ S	
	1 413 $\mu$ S	5 $\mu$ S	
	12 880 $\mu$ S	50 $\mu$ S	
Gas Detector Gas Analyzer Oxygen (O <sub>2</sub> ) <sup>F</sup>	0.21 cmol/mol to 21 cmol/mol	1 % of reading	Reference Material 21 cmol/mol of O <sub>2</sub> Gas Divider (1 to 100) % MTK-LAB-FLG-01





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#### Chemical

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Gas Detector Gas Analyzer Oxygen (O <sub>2</sub> ) <sup>F</sup>	0.1 cmol/mol to 10 cmol/mol	1 % of reading	Reference Material 10 cmol/mol of O <sub>2</sub> Gas Divider (1 to 100) % MTK-LAB-FLG-01
Gas Detector Gas Analyzer Carbon Monoxide (CO) <sup>F</sup>	10 $\mu$ mol/mol to 1 000 $\mu$ mol/mol	1 % of reading	Reference Material 1 000 $\mu$ mol/mol of CO Gas Divider (1 to 100) % MTK-LAB-FLG-01
Gas Detector Gas Analyzer Methane (CH <sub>4</sub> ) <sup>F</sup>	0.03 cmol/mol to 3 cmol/mol	1 % of reading	Reference Material 3 cmol/mol of CH <sub>4</sub> Gas divider (1 to 100) % MTK-LAB-FLG-01
Gas Detector Gas Analyzer Hydrogen Sulfide (H <sub>2</sub> S) <sup>F</sup>	0.3 $\mu$ mol/mol to 30 $\mu$ mol/mol	2.8 % of reading	Reference Material 30 $\mu$ mol/mol of H <sub>2</sub> S Gas Divider (1 to 100) % MTK-LAB-FLG-01
Gas Detector Gas Analyzer Carbon Dioxide (CO <sub>2</sub> ) <sup>F</sup>	20 $\mu$ mol/mol to 2 000 $\mu$ mol/mol	1 % of reading	Reference Material 2 000 $\mu$ mol/mol of CO <sub>2</sub> Gas divider (1 to 100) % MTK-LAB-FLG-01
	0.2 cmol/mol a 20 cmol/mol	1 % of reading	Reference Material 20 cmol/mol of CO <sub>2</sub> Gas Divider (1 to 100) % MTK-LAB-FLG-01
Gas Detector Gas Analyzer Nitric Oxide (NO) <sup>F</sup>	50 $\mu$ mol/mol to 5 000 $\mu$ mol/mol	1 % of reading	Reference Material 5 000 $\mu$ mol/mol of NO Gas Divider (1 to 100) % MTK-LAB-FLG-03
Gas Detector Gas Analyzer Sulfur Dioxide (SO <sub>2</sub> ) <sup>F</sup>	30 $\mu$ mol/mol to 3 000 $\mu$ mol/mol	1 % of reading	Reference Material 3 000 $\mu$ mol/mol of SO <sub>2</sub> Gas Divider (1 to 100) % MTK-LAB-FLG-03
Dynamic Viscosity <sup>F</sup>	0.1 Pa·s to 100 Pa·s	2.2 % of reading	Canon Certified Reference Standards Oil 25 °C ASTM D445



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#### Mass, Force and Weighing Devices

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
Balances <sup>o</sup>	2 g to 5 g (Res.= 0.000 1 mg)	$(0.019 + 2 \times 10^{-6}Wt)$ mg	Class E2 Weights 1 mg to 1 kg MTK-PM-10 Direct Comparison MTK-LAB-M-01 CENAM Technical Guide
	5 g to 110 g (Res. = 0.01 mg)	$(2.91 \times 10^{-5} + 9.1 \times 10^{-10}Wt)$ mg	
	110 g to 1 100 g (Res.= 0.01 mg)	$(0.032 + 8.8 \times 10^{-7}Wt)$ mg	
	1 100 g to 2 000 g (Res.= 0.1 mg)	$(2.2 \times 10^{-2} + 8.8 \times 10^{-7}Wt)$ mg	
	100 mg to 10 kg (Res.= 0.001 mg)	$(8.2 \times 10^{-4} + 1 \times 10^{-6}Wt)$ mg	Class E2 weights MTK-LAB-M-01 CENAM Technical Guide
	2 000 g to 6 000 g (Res.= 0.1 mg)	$(8 + 4.7 \times 10^{-6}Wt)$ mg	Class F1 Weights MTK-PM-01, MTK-PM-02, MTK-PM-03, MTK-PM-04 Direct Comparison MTK-LAB-M-01 CENAM Technical Guide
	12 000 g to 30 000 g (Res.= 20 mg)	$(1.7 + 3.27 \times 10^{-6}Wt)$ mg	Class F1 Weights MTK-PM-01, MTK-PM-02, MTK-PM-03, MTK-PM-04, MTK-PM-05, MTK-PM-06 Direct Comparison MTK-LAB-M-01 CENAM Technical Guide
	30 000 g to 60 000 g (Res.= 50 mg)	$(0.01 + 3.4 \times 10^{-6}Wt)$ mg	Class F1 Weights MTK-PM-01, MTK-PM-02, MTK-PM-03, MTK-PM-04, MTK-PM-05, MTK-PM-06, MTK-PM-14, MTK-PM-20, Direct Comparison MTK-LAB-M-01 CENAM Technical Guide
60 kg to 120 kg (Res.= 0.1 g)	$(3.7 + 6.5 \times 10^{-5}Wt)$ g	Class F1 Weights MTK-PM-01, MTK-PM-02, MTK-PM-03, MTK-PM-04, MTK-PM-05, MTK-PM-06, MTK-PM-14, MTK-PM-20, Class M1 MTK-PM-07, MTK-PM-08. Direct Comparison MTK-LAB-M-01 CENAM Technical Guide	



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### Mass, Force and Weighing Devices

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Analytical Balance <sup>o</sup>	100 mg to 22 g (Res.= 0.001 mg)	$(3.11 \times 10^{-3} + 1.39 \times 10^{-4}Wt)$ g	Class E2 weights MTK-PM-10
Scale Balance <sup>o</sup>	100 mg to 10 kg (Res.= 1 mg)	$(8.2 \times 10^{-4} + 1 \times 10^{-6}Wt)$ g	MTK-LAB-M-01 CENAM Technical Guide
Scale <sup>o</sup>	120 kg to 200 kg (Res.= 2 g)	$(0.51 + 3.8 \times 10^{-5}Wt)$ g	Class M1 Weights MTK-PM-07, MTK-PM-08 Direct Comparison MTK-LAB-M-01 CENAM Technical Guide
	200 kg to 500 kg Res.= 5 g	$(0.6 + 3.23 \times 10^{-5}Wt)$ g	
	500 kg to 1 000 kg (Res.= 10 g)	$(0.1 + 33.4 \times 10^{-5}Wt)$ g	
	1 000 kg to 2 000 kg (Res.= 20 g)	$(4.4 + 3.79 \times 10^{-5}Wt)$ g	
	2 000 kg to 3 000 kg (Res.= 50 g)	$(20.6 + 2.54 \times 10^{-5}Wt)$ g	Class M1 Weights MTK-PM-08, MTK-PM-09, MTK-PM-16 Direct Comparison MTK-LAB-M-01 CENAM Technical Guide
	3 000 kg to 4 000 kg (Res.= 50 g)	$(40.9 + 4.59 \times 10^{-5}Wt)$ g	Class M1 Weights MTK-PM-08, MTK-PM-09, MTK- PM-16, MTK-PM-17 Direct comparison MTK-LAB-M-01 CENAM Technical Guide
	4 000 kg to 5 000 kg (Res.= 100 g)	$(43.1 + 2.49 \times 10^{-5}Wt)$ g	
	Up to 200 kg (Res.= 100 g)	$(0.029 + 2.65 \times 10^{-4}Wt)$ kg	Direct Comparison Substitution Loads, Class M1 Weights MTK-PM-08 MTK-LAB-M-01 CENAM Technical Guide
	200 kg to 400 kg (Res.= 100 g)	$(0.024 + 2.9 \times 10^{-4}Wt)$ kg	
	400 kg to 600 kg (Res.= 100 g)	$(0.06 + 2 \times 10^{-4}Wt)$ kg	
	600 kg to 800 kg (Res.= 100 g)	$(0.06 + 2 \times 10^{-4}Wt)$ kg	
	800 kg to 1 000 kg (Res.= 100 g)	$(0.1 + 1.5 \times 10^{-4}Wt)$ kg	
	Up to 2 000 kg (Res.= 1 kg)	$(0.29 + 1.04 \times 10^{-5}Wt)$ kg	Direct Comparison Substitution Loads Class M1 Weights MTK-PM-08, MTK-PM-09 MTK-LAB-M-01 CENAM Technical Guide



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#### Mass, Force and Weighing Devices

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
Scales <sup>0</sup>	2 000 kg to 4 000 kg (Res.= 1 kg)	$(1.2 + 6.59 \times 10^{-5}Wt)$ kg	Direct Comparison Substitution Loads Class M1 Weights MTK-PM-08, MTK-PM-09 MTK-LAB-M-01 CENAM Technical Guide
	4 000 kg to 6 000 kg (Res.= 1 kg)	$(0.6 + 2 \times 10^{-5}Wt)$ kg	
	6 000 kg to 8 000 kg (Res.= 1 kg)	$(0.6 + 2 \times 10^{-5}Wt)$ kg	
	8 000 kg to 10 000 kg (Res.= 1 kg)	$(1 + 1.5 \times 10^{-5}Wt)$ kg	
	Up to 4 000 kg (Res.= 2 kg)	$(0.57 + 2.57 \times 10^{-4}Wt)$ kg	Direct Comparison Substitution Loads, Class M1 Weights MTK-PM-08, MTK-PM-09, MTK-PM-16, MTK-PM-17 MTK-LAB-M-01 CENAM Technical Guide
	4 000 kg to 8 000 kg (Res.= 2 kg)	$(0.4 + 3 \times 10^{-4}Wt)$ kg	
	8 000 kg to 12 000 kg (Res.= 2 kg)	$(1 + 2.25 \times 10^{-4}Wt)$ kg	
	12 000 kg to 16 000 kg (Res.= 2 kg)	$(1.9 + 1.5 \times 10^{-4}Wt)$ kg	
	16 000 kg to 20 000 kg (Res.= 2 kg)	$(1.9 + 1.5 \times 10^{-4}Wt)$ kg	
	Up to 5 000 kg (Res.= 5 kg)	$(1.4 + 5.4 \times 10^{-4}Wt)$ kg	
	5 000 kg to 10 000 kg (Res.= 5 kg)	$(1.1 + 6 \times 10^{-4}Wt)$ kg	
	10 000 kg to 15 000 kg (Res.= 5 kg)	$(3.1 + 4 \times 10^{-4}Wt)$ kg	Direct Comparison Substitution Loads, Class M1 Weights MTK-PM-08, MTK-PM-09, MTK-PM-16, MTK-PM-17, MTK-PM-18 MTK-LAB-M-01 CENAM Technical Guide
	15 000 kg to 20 000 kg (Res.= 5 kg)	$(3.4 + 3.8 \times 10^{-4}Wt)$ kg	
	20 000 kg to 25 000 kg (Res.= 5 kg)	$(7 + 2 \times 10^{-4}Wt)$ kg	
	Tanks on Load Cells <sup>0</sup>	0 kg to 1 000 kg (Res.= 0.1 kg)	$(0.029 + 1.17 \times 10^{-5}Wt)$ kg
1 000 kg to 2 000 kg (Res.= 0.2 kg)		$(0.1 + 1.1 \times 10^{-5}Wt)$ kg	
2 000 kg to 5 000 kg (Res.= 0.5 kg)		$(0.33 + 1.13 \times 10^{-5}Wt)$ kg	
5 000 kg to 10 000 kg (Res.= 1 kg)		$(0.4 + 1.06 \times 10^{-5}Wt)$ kg	
10 000 kg to 20 000 kg (Res.= 2 kg)		$(0.5 + 1.1 \times 10^{-5}Wt)$ kg	
20 000 kg to 30 000 kg (Res.= 5 kg)		$(2 + 1.2 \times 10^{-5}Wt)$ kg	



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#### Mass, Force and Weighing Devices

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
Mass Weight F <sup>F</sup>	1 mg	0.006 7 mg	Double Substitution with Air Buoyancy Correction. Class E2 OIML R111 Weigh Set MTK-PM-10 MTK-PM-23 MTK-LAB-M-03 CENAM Technical Guide
	2 mg	0.006 7 mg	
	5 mg	0.006 7 mg	
	10 mg	0.008 3 mg	
	20 mg	0.01 mg	
	50 mg	0.013 mg	
	100 mg	0.017 mg	
	200 mg	0.02 mg	
	500 mg	0.027 mg	
	1 g	0.033 mg	
	2 g	0.04 mg	
	5 g	0.053 mg	
	10 g	0.067 mg	
	20 g	0.083 mg	
	50 g	0.1 mg	
	100 g	0.17 mg	
	200 g	0.33 mg	
	500 g	0.83 mg	
	1 kg	1.7 mg	
	2 kg	3.3 mg	
5 kg	8.3 mg		
10 kg	17 mg		
Mass Weight F2 <sup>F</sup>	1 mg	0.02 mg	Double Substitution with Air Buoyancy Correction. Class F1 OIML R111 Weigh Set MTK-PM-15 MTK-PM-21 MTK-PM-12 MTK-PM-13 MTK-LAB-M-03 CENAM Technical Guide
	2 mg	0.02 mg	
	5 mg	0.02 mg	
	10 mg	0.027 mg	
	20 mg	0.033 mg	
	50 mg	0.04 mg	
	100 mg	0.053 mg	
	200 mg	0.067 mg	
	500 mg	0.083 mg	



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#### Mass, Force and Weighing Devices

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Mass Weight F2 <sup>F</sup>	1 g	0.1 mg	Double Substitution with Air Buoyancy Correction. Class F1 OIML R111 Weigh Set MTK-PM-15 MTK-PM-21 MTK-PM-12 MTK-PM-13 MTK-LAB-M-03 CENAM Technical Guide
	2 g	0.13 mg	
	5 g	0.17 mg	
	10 g	0.2 mg	
	20 g	0.27 mg	
	50 g	0.33 mg	
	100 g	0.53 mg	
	200 g	1 mg	
	500 g	2.7 mg	
	1 kg	5.3 mg	
	2 kg	10 mg	
	5 kg	27 mg	
10 kg	53 mg		
Mass Weight Class M1, M2 and M3 <sup>F</sup>	20 kg	340 mg	Double Substitution Class F1 Weight Set OIML-R111 Class MTK-PM-15, MTK-PM-21 MTK-PM-11, MTK-PM-12 and MTK-PM-13 MTK-LAB-M-03 CENAM Technical Guide
	10 kg	170 mg	
	5 kg	84 mg	
	2 kg	34 mg	
	1 kg	17 mg	
	500 g	8.4 mg	
	200 g	3.4 mg	
	100 g	1.7 mg	
	50 g	1 mg	
	20 g	0.83 mg	
	10 g	0.67 mg	
	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		





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#### Mass, Force and Weighing Devices

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Mass Weight Class M1, M2 and M3 <sup>F</sup>	20 mg	0.1 mg	Double Substitution Class F1 Weight Set OIML-R111 Class MTK-PM-15, MTK-PM-21 MTK-PM-11, MTK-PM-12 and MTK-PM-13 MTK-LAB-M-03 CENAM Technical Guide
	10 mg	0.08 mg	
	5 mg	0.067 mg	
	2 mg	0.067 mg	
	1 mg	0.067 mg	
Weight Class 3 <sup>F</sup>	1 mg	0.008 3 mg	Double Substitution with Air Buoyancy Correction. Class E2 ASTM E617 Weigh Set MTK-PM-10 MTK-PM-23 MTK-LAB-M-03 CENAM Technical Guide
	2 mg	0.008 3 mg	
	3 mg	0.008 7 mg	
	5 mg	0.009 3 mg	
	10 mg	0.01 mg	
	20 mg	0.012 mg	
	30 mg	0.013 mg	
	50 mg	0.014 mg	
	100 mg	0.017 mg	
	200 mg	0.02 mg	
	300 mg	0.023 mg	
	500 mg	0.027 mg	
	1 g	0.033 mg	
	2 g	0.043 mg	
	3 g	0.05 mg	
	5 g	0.06 mg	
	10 g	0.083 mg	
	20 g	0.12 mg	
	30 g	0.15 mg	
	50 g	0.2 mg	
100 g	0.33 mg		
200 g	0.67 mg		
300 g	1 mg		
500 g	1.7 mg		



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#### Mass, Force and Weighing Devices

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
Weight Class 3 <sup>F</sup>	1 kg	3.3 mg	Double Substitution with Air Buoyancy Correction Class E2 ASTM E 617 Weigh Set MTK-PM-10 MTK-PM-23 MTK-LAB-M-03 CENAM Technical Guide
	2 kg	6.7 mg	
	3 kg	10 mg	
	5 kg	17 mg	
	10 kg	33 mg	
Weight Class 4 <sup>F</sup>	1 mg	0.017 mg	
	2 mg	0.017 mg	
	3 mg	0.017 mg	
	5 mg	0.018 mg	
	10 mg	0.02 mg	
	20 mg	0.023 mg	
	30 mg	0.025 mg	
	50 mg	0.028 mg	
	100 mg	0.033 mg	
	200 mg	0.04 mg	
	300 mg	0.046 mg	
	500 mg	0.053 mg	
	Weight Class 4 <sup>F</sup>	1 g	0.067 mg
		2 g	0.087 mg
3 g		0.1 mg	
5 g		0.12 mg	
10 g		0.17 mg	
20 g		0.23 mg	
30 g		0.3 mg	
50 g		0.4 mg	
100 g		0.67 mg	
200 g		1.3 mg	
300 g	2 mg		
500 g	3.3 mg		
1 kg	6.7 mg		



# Certificate of Accreditation: Supplement

## Metrosmart, S.A. de C.V. / Metrokal

Alcatraz 23, Paseo del Pedregal Salitre  
 El Salitre, Querétaro, México. C.P. 76223  
 Contact Name: Efrain Calva Gomez Phone: 442-220-7054

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

### Mass, Force and Weighing Devices

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
Weight Class 4 <sup>F</sup>	2 kg	13 mg	Double Substitution Class F1 Class E2 ASTM E 617 Weights Set MTK-PM-15, MTK-PM-21 MTK-PM-12 and MTK-PM-13 ASTM E 617 MTK-LAB-M-03 CENAM Technical Guide
	3 kg	20 mg	
	5 kg	33 mg	
	10 kg	67 mg	
Weight Class 5, 6 and 7 <sup>F</sup>	25 kg	400 mg	Double Substitution Class F1 OIML-R111 Weights Set MTK-PM-15, MTK-PM-21 MTK-PM-11, MTK-PM-12 and MTK-PM-13 ASTM E617
	20 kg	350 mg	
	10 kg	170 mg	
	5 kg	84 mg	
	3 kg	50 mg	
	2 kg	34 mg	
	1 kg	17 mg	
	500 g	10 mg	
	300 g	7 mg	
	200 g	5 mg	
	100 g	3 mg	
	50 g	1.9 mg	
	30 g	1.3 mg	
	20 g	1 mg	
	10 g	0.7 mg	
	5 g	0.43 mg	
	3 g	0.32 mg	
	2 g	0.25 mg	
	1 g	0.17 mg	
	500 mg	0.13 mg	
	300 mg	0.1 mg	
	200 mg	0.087 mg	
	100 mg	0.067 mg	
	50 mg	0.053 mg	
30 mg	0.047 mg		
20 mg	0.04 mg		



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Weight Class 5, 6 and 7 <sup>F</sup>	10 mg	0.033 mg	Double Substitution Class F1 Weights Set MTK-PM-15, MTK-PM-21 MTK-PM-11, MTK-PM-12 and MTK-PM-13 ASTM E 617
	5 mg	0.027 mg	
	3 mg	0.023 mg	
	2 mg	0.02 mg	
	1 mg	0.017 mg	
Solid Objects Not Normalized <sup>O</sup>	100 mg to 200 g	0.52 mg	Scale 6.1 kg with (Res.= 0.01 g) Direct Measure MTK-BAS-05 MTK-BAL-03 MTK-BAS-05 MTK-LAB-M-04 OIML-D28
	200 g to 1 200 g	3.9 mg	
	1 200 g to 6 100 g	89 mg	
	6 100 g to 10 kg	77 mg	
	6 100 g to 25 kg	780 mg	Scale 25 kg with (Res.= 0.1 g) Direct Measure MTK-BAL-01, MTK-BAL-02 OIML-D28
25 kg to 1 000 kg	450 mg		

### 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
Luxmeter <sup>F</sup>	20.6 lux to 4 400 lux	2 % of reading	Luxmeter Lutron Comparison CNM-MFO-PT-004 MTK-LAB-MO-01 CENAM Technical Guide

### 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>	-100 °C to 0 °C	0.9 °C	Electrical Simulation of Thermocouple Output Process Calibrator SPKM Instrument Procedure MTK-LAB-T-01
	0 °C to 1 700 °C	0.7 °C	
Temperature Calibration Indication and Control Equipment Used with Thermocouple Type J <sup>FO</sup>	-100 °C to 0 °C	0.12 °C	Direct Comparison Method ASTM E220 ASTM E230
	0 °C to 1 100 °C	0.18 °C	



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### Electrical

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Temperature Calibration Indication and Control Equipment Used with Thermocouple Type K <sup>FO</sup>	-100 °C to 0 °C	0.14 °C	Electrical Simulation of Thermocouple Output Process Calibrator SPKM Instrument Procedure MTK-LAB-T-01 Direct Comparison Method ASTM E220 ASTM E230
	0 °C to 1 200 °C	0.31 °C	
Temperature Calibration Indication and Control Equipment Used with Thermocouple Type S <sup>FO</sup>	-100 °C to 0 °C	0.36 °C	
	0 °C to 1 200 °C	0.31 °C	
Temperature Calibration Indication and Control Equipment Used with Thermocouple Type T <sup>FO</sup>	-100 °C to 0 °C	0.19 °C	
	0 °C to 350 °C	0.47 °C	
Temperature Calibration Indication and Control Equipment Used with RTD, Type Pt 100 <sup>FO</sup>	-200 °C to 0 °C	0.059 °C	Electrical Simulation of RTD Output Process Calibrator SPKM Instrument Procedure MTK-LAB-T-01 Direct Comparison Method ASTM E220, ASTM E230
	0 °C to 420 °C	0.059 °C	
Equipment to Measure DC Voltage <sup>FO</sup>	1 mV to 100 mV	6.5 $\mu$ V/V	Multifunctional Calibrator 1 000A Transmille Euramet-cg-15 EA 10/15
	0.1 V to 1 V	3.9 $\mu$ V/V	
	1 V to 10 V	4 $\mu$ V/V	
	10 V to 100 V	5.8 $\mu$ V/V	
	100 V to 1 000 V	9.1 $\mu$ V/V	
Equipment to Measure AC Voltage <sup>FO</sup> At the listed frequency @ 10 Hz to 2 kHz <sup>FO</sup>	30 mV to 100 mV	0.02 % of reading	Multifunctional Calibrator 1 000A Transmille Euramet cg-15, EA 10/15 Turn Clamp Coil 2, 10, 50
	100 mV to 1 V	0.013 % of reading	
	1 V to 10 V	0.011 % of reading	
	10 V to 100 V	0.012 % of reading	
	100 V to 1 000 V	0.011 % of reading	
Equipment to Measure DC Current <sup>FO</sup>	10 $\mu$ A to 1 mA	25 $\mu$ A/A	
	1 mA to 10 mA	26 $\mu$ A/A	
	10 mA to 100 mA	30 $\mu$ A/A	
	100 mA to 1 A	33 $\mu$ A/A	
	1 A to 10 A	85 $\mu$ A/A	
	0.01 A to 60 A	0.2 % of reading	
	1 A to 500 A	1.2 % of reading	
	1 A to 1 500 A	1.5 % of reading	



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#### Electrical

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Equipment to Measure AC Current At the listed frequency @ 10 Hz to 2 kHz <sup>FO</sup>	0.1 mA to 1 mA	0.33 % of reading	Multifunctional Calibrator 1 000A Transmille Euramet cg-15, EA 10/15 Turn Clamp Coil 2, 10, 50
	1 mA to 10 mA	0.18 % of reading	
	10 mA to 100 mA	0.18 % of reading	
	100 mA to 1 000 mA	0.25 % of reading	
	1 A to 10 A	0.22 % of reading	
	0.001 A to 60 A	0.2 % of reading	
	0.01 A to 500 A	1.2 % of reading	
Equipment to Measure Capacitance <sup>FO</sup>	11 $\mu$ F	0.83 % of reading	Multifunctional Calibrator 1 000 A Transmille Euramet cg-15, EA 10/15
	101 $\mu$ F	0.83 % of reading	
	1.1 $\mu$ F	0.2 % of reading	
Equipment to Measure Resistance <sup>FO</sup>	0.01 $\Omega$ to 10 $\Omega$	0.033 % of reading	Multifunctional Calibrator 1 000 A Transmille Euramet cg-15, EA 10/15 Resistance Decade Tinsley
	10 $\Omega$ to 100 $\Omega$	0.013 % of reading	
	101 $\Omega$ to 1 k $\Omega$	0.002 1 % of reading	
	1.01 k $\Omega$ to 10 k $\Omega$	0.002 % of reading	
	10.1 k $\Omega$ to 100 k $\Omega$	0.001 9 % of reading	
	101 k $\Omega$ to 1M $\Omega$	0.002 2 % of reading	
	1.01 M $\Omega$ to 10 M $\Omega$	0.003 6 % of reading	
	10.1 M $\Omega$ to 100 M $\Omega$	0.002 1 % of reading	
Output DC Voltage (Hipot) <sup>FO</sup>	0.5 kV to 40 kV	1.2 % of reading Multimeter	Fluke 745 High voltage Probe CENAM Technical Guide
Output AC Voltage (Hipot) <sup>FO</sup>	0.5 kV to 28 kV	1.2 % of reading Multimeter	
Wrist Strapv	1 k $\Omega$ to 100 G $\Omega$	0.68 $\Omega$	Decade Box ANSI ESD SP9.2
Foot Wear <sup>FO</sup>	100 G $\Omega$ to 1 T $\Omega$	1.5 $\Omega$	
Equipment to Output Resistance <sup>FO</sup>	0.01 $\Omega$ to 10 $\Omega$	0.033 % of reading	Resistance Decade Tinsley Cropico RH9A-5
	10 $\Omega$ to 100 $\Omega$	0.013 % of reading	
	1 k $\Omega$ to 100 G $\Omega$	0.68 % of reading	
	100 G $\Omega$ to 1 T $\Omega$	1.5 % of reading	
Equipment to Output DC Voltage <sup>FO</sup>	20 mV to 200 mV	0.001 6 % of reading	Keythley 2002 Fluke 754, Fluke 725 CENAM Technical Guide
	200 mV to 1 V	0.002 % of reading	
	1 V to 10 V	0.001 8 % of reading	
	10 V to 200 V	0.0016 % of reading	
	100 V to 1 000 V	0.002 2 % of reading	





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Equipment to Output AC Voltage At the listed Frequencies @ 50 Hz to 1 kHz <sup>FO</sup>	100 mV to 200 mV	0.002 6 % of reading	Keythley 2002 Fluke 754, Fluke 725 CENAM Technical Guide
	200 mV to 2 V	0.003 % of reading	
	2 V to 20 V	0.003 3 % of reading	
	20 V to 200 V	0.003 6 % of reading	
	200 V to 700 V	0.004 2 % of reading	
Equipment to Output DC Current <sup>FO</sup>	2 mA to 20 mA	0.004 8 % of reading	Fluke 754, Fluke 725 Shunt 10 A @ 100 mV Shunt 100 A @ 100 mV Keythley 2002 CENAM Technical Guide
	20 mA to 200 mA	0.007 2 % of reading	
	100 mA to 2 A	0.038 % of reading	
	1 A to 10 A	0.051 % of reading	
	10 A to 100 A	0.065 % of reading	
Equipment to Output AC Current At the listed Frequencies @ 50 Hz to 1 kHz <sup>FO</sup>	2 mA to 20 mA	0.039 % of reading	
	20 mA to 200 mA	0.04 % of reading	
	200 mA to 2 A	0.045 % of reading	
	2 A to 10 A	0.058 % of reading	
	10 A to 100 A	0.075 % of reading	

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.
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.



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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.

