

# Scope of Accreditation For Alteq de México S.A. de C.V.

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In recognition of a successful assessment to ISO/IEC 17025:2005, accreditation is granted to **Alteq de México S.A. de C.V.** to perform the following Calibrations:

Accreditation granted through: **November 17, 2011**

## Calibration

### Length - Dimensional Metrology – Hand Tools and Precision Gages 1D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2,3</sup>	Remarks
Internal Micrometers	(1 to 600) mm	(2.83 + 0.004L) mm	Gage Blocks
Hole Gages	(0 to 300) mm	12.7 μm	
Micrometer Heads	(0 to 50) mm (0 to 2) in	0.59 μm	Gage Blocks and Digital Indicator
Digital Caliper	(1 to 1 000) mm	(15.25 + 0.03L) μm	Gage Blocks
Dial Caliper	(0 to 1 000) mm	(17 + 0.03 L) μm	
Height Gage	(1 to 1 000) mm	(15.25 + 0.03L) μm	
Thickness Gages	(0 to 12.5) mm	0.5 μm	Block and Film Gages
Measuring Tapes	(0 to 5) m	142 μm	Steel rule and Optical Mini Comparator
	(5 to 40) m	208 μm	
Digital Indicators	(0 to 100) mm	0.9 μm	Micrometric Head and Gage Blocks
Dial Test Indicators	(0 to 3) mm	0.9 μm	
Digital Outside Micrometer	(0 to 1000) mm	(2.35 + 0.02 L) μm	Gage Blocks, Optical Parallels and Load Cell
Outside Micrometers	(0 to 900) mm	(2.4 + 0.02L) μm	
	(900 to 1 370) mm	(16.1 + 0.007L) μm	
Depth Micrometers	(1 to 150) mm	(1.7 + 0.007L) μm	Gage Blocks
	(150 to 508) mm	(1.7 + 0.003 L) μm	Height Master
Protractors	0° to 180°	0.06 °	Angle Blocks

**Length - Dimensional Metrology – Hand Tools and Precision Gages 2D**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Profile Projectors	(0 to 500) mm	0.59 μm	Rectangular and Angle Gage Blocks
Microscopes	(0 to 300) mm	0.59 μm	

**Length - Dimensional Metrology – Artifacts and Standards 1D**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Thread Plug Gages	M12x1 to M150x2	0.92 μm	Digital Micrometer
Pin Gages	(0.01 to 150) mm	0.92 μm	Digital Micrometer
Precision Levels	1.57 mm/m	0.9 μm	Micrometer Head
Precision Rules	(0 to 1 820) mm	59 μm	Steel Rule and Optical Mini Comparator

**Length - Dimensional Metrology – Artifacts and Standards 2D**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Squares	0° to 90°	0.11 °	Digital Protractor and Angle Blocks
Surface Plates (flatness only)	(215 to 1 000) mm (Diagonal Length)	0.6 μm	Digital Indicator, Parallel Set and Gage Blocks

**Mass – Scale and Balances**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Balances			Standard Weights Class OIML E2 and NOM-010-SCFI-1994
Resolution: 0.0001g	1 mg to 100 g	0.058 mg	
Resolution: 0.01g	1 g to 5 kg	0.0057 g	
Balance			Standard Weights Class OIML F1 and NOM-010-SCFI-1994
Resolution: 0.5g	(5 to 20) kg	0.57 g	
Scale			Standard Weights Class OIML M2 and NOM-010-SCFI-1994
Resolution: 10 g	(20 to 500) kg	6.7 g	

**Mass – Mass Standards**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Weights	20 mg	0.059 mg	Standard Weight Class OIML E2 and OIML R 111-14
	50 mg	0.059 mg	
	100 mg	0.061 mg	
	200 mg	0.062 mg	
	500 mg	0.065 mg	
	1 g	0.067 mg	
	2 g	0.074 mg	
	5 g	0.082 mg	
	10 g	0.090 mg	
	20 g	0.109 mg	
Weights	50 g	0.129 mg	Standard Weight Class OIML E2 and F1 and OIML R 111-1
	100 g	0.19 mg	
	200 g	5.78 mg	
	500 g	5.85 mg	
	1 000 g	6.06 mg	
	2 000 g	6.73 mg	
	5 000 g	10.89 mg	
	10 000 g	289.27 mg	
	20 000 g	290.75 mg	
50 000 g	584.69 mg		

**Mass – Pressure**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Positive Pressure: Water Columns	(0 to 0.25) inH <sub>2</sub> O	0.0025 inH <sub>2</sub> O	Water column
	(0 to 90) inH <sub>2</sub> O	0.182 inH <sub>2</sub> O	
Positive Pressure: Pressure Gages	(0 to 72.51) psi	0.059 psi	Manometer/Calibrator
	(0 to 30) psi	0.144 psi	Fluke Calibrator
	(0 to 0.25) inH <sub>2</sub> O	0.0025 inH <sub>2</sub> O	Water column

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Positive Pressure: Pressure Gages	(0 to 300) psi	0.867 psi	Fluke Transducer Pressure
	(0 to 1 500) psi	2.891 psi	
	(0 to 5 000) psi	2.93 psi	
	(0 to 10 000) psi	28.90 psi	Digital Manometer
Positive Pressure: Transducers	(0 to 72.51) psi	0.012 psi	Manometer/Calibrator
	(0 to 30) psi	0.0040 psi	
	(0 to 300) psi	0.031 psi	
	(0 to 1 500) psi	0.170 psi	
	(0 to 5 000) psi	0.50 psi	
	(0 to 10 000) psi	1.42 psi	
Positive Pressure: Recorders	(0 to 100) psi	0.578 psi	
	(0 to 150) psi	0.867 psi	
	(0 to 300) psi	1.444 psi	
	(0 to 400) psi	2.315 psi	
	(0 to 500) psi	1.452 psi	
	(0 to 1 000) psi	5.776 psi	
	(0 to 3 000) psi	14.44 psi	
	(0 to 10 000) psi	57.75 psi	
Positive Pressure: Transmitters	(0 to 200) psi	0.031 psi	

**Mass – Vacuum**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Vacuum Gages	(0 to -10) psi	0.031 psi	Manometer/Calibrator

**Mass – Torque**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Digital, Dial, Click and Preset Torque Meters (Clockwise and Counter Clockwise)	(0.56 to 5.65) N·m (5 to 50) lbf · in	0.01175 N·m (0.1040 lbf · in)	Torque Analyzer

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Digital, Dial, Click and Preset Torque Meters (Clockwise and Counter Clockwise)	(2.83 to 28.25) N·m (25 to 250) lbf·in	0.5% of the reading	Torque Analyzer
	(33.9 to 339.0) N·m (25 to 250) lbf·ft	0.25% full scale	
Torque Analyzer and Calibrators (Clockwise and Counter Clockwise)	(33.9 to 339.0) N·m (25 to 250) lbf·ft	0.25% full scale	Standard Weights Set
	(0 to 813.6) N·m (0 to 600) lbf·ft	0.5% full scale	

**Mass – Force**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Dynamometers	(0 to 49.03) N	0.00058 N	Standard Weights Set and Load Cell
	(0 to 98.06) N	0.00567 N	
	(0 to 245.16) N	0.0567 N	
	(0 to 490.33) N	0.0568 N	
	(0 to 980.66) N	0.283 N	
	(0 to 2 451.66) N	0.566 N	
	(0 to 8 904.43) N	0.567 N	

**Mass – Hardness**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Direct verification of Durometer Hardness Tester types A, B, C, D, E, O and DO:  Indenter Shape: Indenter Diameter Indenter tip Radius Indenter tip Angle	(2.46 to 25.4) mm	3.06 μm 3.06 μm 0.08 grades ( ° )	Digital Microscope and ASTM D2240
Durometrer Indentor Spring:  Types A, B, E and O Types C, D and DO	(0.55 to 8.05) N (4.445 to 44.45) N	0.58 N 0.58 N	Electronic Balance and ASTM D2240

**Fluid Properties and Quantities – pH / Conductivity**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
pH Meters, Controllers, Recorders and Simulators	4.01 pH @ 25°C 7.00 pH @ 25°C 10 pH @ 25°C	0.006 pH	Buffer Solution

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
pH Meters, Controllers, Recorders and Simulators	(0 to 14) pH	0.008 pH	pH Simulator
	(-500 to 500) mV 50 μS/cm @ 25°C	0.58 mV 0.116 μS/cm	DDM
Conductivity Meters, Controllers and Recorders	84 μS/cm @ 25°C 100 μS/cm @ 25°C 1 413 μS/cm @ 25°C 5 000 μS/cm @ 25°C 12 880 μS/cm @ 25°C	0.100 μS/cm 0.116 μS/cm 5 μS/cm 20 μS/cm 50 μS/cm	Conductivity Standards

**Fluid Properties and Quantities – Viscosity**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Viscosity Cups (ISO, Zahn, Ford, Shell)	33.97 cSt @ 25°C 119.1 cSt @ 25°C 462.8 cSt @ 25°C	0.151 cSt 0.345 cSt 2 cSt	Viscosity Solutions
	100 cSt @ 15°C to 45°C 1 000 cSt @ 15°C to 45°C 5 000 cSt @ 15°C to 45°C 12 500 cSt @ 15°C to 45°C	0.41 cSt 2.91 cSt 19 cSt 55 cSt	

**Electricity and Magnetism – Voltage**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Volts Source	(2 to 20) mV	57.75 μV	Fluke Calibrator 5100
	(20 to 200) mV	57.86 μV	
	200 mV to 2 V	57.74 μV	
	(2 to 20) V	57.75 μV	
	(20 to 200) V	57.86 μV	
	(200 to 1000) V	58.37 μV	
AC Volts Source 50 Hz to 400 Hz	(2 to 20) mV	57.75 μV	Fluke Calibrator 5100
	(20 to 200) mV	57.86 μV	
	200 mV to 2 V	57.74 μV	
	(2 to 20) V	57.75 μV	
	(20 to 200) V	57.86 μV	
	(200 to 1 000) V	58.18 μV	
	(0 to 3) kV	5.84 V	HiPot Tester

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
AC Volts Source 50 Hz to 1 kHz	(2 to 20) mV	57.75 $\mu$ V	Fluke Calibrator 5100
	(20 to 200) mV	57.86 $\mu$ V	
	200 mV to 2 V	57.74 $\mu$ V	
	(2 to 20) V	57.75 $\mu$ V	
	(20 to 200) V	57.86 $\mu$ V	
	(200 to 1 000) V	58.18 $\mu$ V	
	(0 to 3) kV	5.84 V	Hipot Tester
DC Volts Measure	200 mV	0.013 mV	7 ½ Digits DDM
	2 V	79 $\mu$ V	
	20 V	.83 mV	
	200 V	0.013 V	
	1 000 V	0.07 V	
AC Volts Measure 50 Hz to 100 Hz	200 mV	.58 $\mu$ V	7 ½ Digits DDM
	2 V	5.8 $\mu$ V	
	20 V	58 $\mu$ V	
	200 V	.58 mV	
	750 V	5.8 mV	
AC Volts Measure 0.1 kHz to 2 kHz	200 mV	.58 $\mu$ V	7 ½ Digits DDM
	2 V	5.8 $\mu$ V	
	20 V	58 $\mu$ V	
	200 V	.58 mV	
	750 V	5.8 mV	
AC Volts Measure 50 Hz to 60Hz	0 V to 6 kV	0.14 kV	Fluke 80K-40 and Fluke 80K-6
	0 V to 40 kV	0.92 kV	

**Electricity and Magnetism – Resistance**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Resistance Measure	20 Ω	.22 mΩ	7 ½ DMM
	200 Ω	1.3 mΩ	
	2 kΩ	8.5 mΩ	
	20 kΩ	97 mΩ	
	200 kΩ	2.6 Ω	
	2 MΩ	58 Ω	
	20 MΩ	5.8 kΩ	
	200 MΩ	0.93 MΩ	
	1 GΩ	4.7 MΩ	
Resistance Source	(0 to 999.9) Ω	1.19 Ω	Substituter RS-20
	(0 to 999,999.9) kΩ	1.19 kΩ	
	(0 to 99,999,999.9) MΩ	0.15 MΩ	

**Electricity and Magnetism – Current**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Current Source	(2 to 20) μA	0.01 μA	Fluke Calibrator 5100
	(20 to 200) μA	0.02 μA	
	200 μA to 2 mA	0.01 μA	
	(2 to 20) mA	0.01 μA	
	(20 to 200) mA	0.02 μA	
	200 mA to 2 A	0.01 μA	
AC Current Source 50 Hz to 1 kHz	(20 to 200) μA	0.19 μA	Fluke Calibrator 5100
	200 μA to 2 mA	0.0042 μA	
	(2 to 20) mA	0.02 μA	
	(20 to 200) mA	0.19 μA	
	200 mA to 2 A	0.0042 μA	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Current Measure	200 $\mu$ A	0.075 $\mu$ A	7 ½ Digits DDM
	2 mA	0.75 $\mu$ A	
	20 mA	7.5 $\mu$ A	
	200 mA	75 $\mu$ A	
	2 A	0.75 mA	
	10 A	31 mA	Fluke 45 DDM Clamp Meter
	1 000 A	29.44 A	
AC Current Measure 50 Hz to 200 Hz	200 $\mu$ A	0.014 $\mu$ A	7 ½ Digits DDM
	2 mA	.0012 $\mu$ A	
	20 mA	0.1 $\mu$ A	
	200 mA	10 $\mu$ A	
	2A	5.9 $\mu$ A	
	10 A	31 mA	Fluke 45 DDM
	1 000 A	29.44 A	Clamp Meter

**Electricity and Magnetism – Inductance**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Inductance Source	(0 to 9,999) H	0.23 H	Inductance Substituter

**Electricity and Magnetism – Capacitance**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Capacitance Source	(0 to 99,9999) $\mu$ F	1.15 $\mu$ F	Capacitance Substituter
Capacitance Measure	(4 to 40) nF	1.22 nF	Extech DDM
	(40 to 1 000) nF	27.72 nF	
	99,9999 $\mu$ F	3.81 $\mu$ F	

**Electricity and Magnetism – Electrical Millivolt Simulation**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
T Thermocouple	(-190 to 400) $^{\circ}$ C	0.30 $^{\circ}$ C	Dry Block Source and 422 Altek Calibrator
J Thermocouple	(-190 to 750) $^{\circ}$ C	0.34 $^{\circ}$ C	Type K Thermocouple and 422 Altek Calibrator
K Thermocouple	(-190 to 1200) $^{\circ}$ C	0.34 $^{\circ}$ C	
E Thermocouple	(-190 to 900) $^{\circ}$ C	0.34 $^{\circ}$ C	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
B Thermocouple	(0 to 1200) °C	0.34°C	Type K Thermocouple and 422 Altek Calibrator
R Thermocouple	(0 to 1200) °C	0.34°C	
S Thermocouple	(0 to 1200) °C	0.34°C	
N Thermocouple	(-190 to 1200) °C	0.34°C	
G Thermocouple	(0 to 1200) °C	0.34°C	
C Thermocouple	(0 to 1200) °C	0.34°C	
D Thermocouple	(0 to 1200) °C	0.34°C	
L Thermocouple	(-190 to 900) °C	0.34°C	
U Thermocouple	(-190 to 400) °C	0.34°C	

**Sound**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Decibel Source	(0 to 130) dBm	0.083 dBm	Fluke Calibrator 5100
Decibel Measure	(-80.79 to 81.48) dBm	0.1964 dBm	DDM

**Time, Frequency and Time Domain – Frequency / Period**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Tachometers	(0 to 18 000) rpm (18 001 to 96 000) rpm	1.07 rpm 4.24 rpm	Standard Digital Tachometer and Direct Comparisons
Stopwatches, Timers	36 000 s ( 10 Hours)	0.1799 s	Standard Timers
Frequency Counters	(1.1 to 2600) MHz	0.00058 MHz	Frequency Counters
Revolutions Counter	(0 to 2000) rpm	1.216 rpm	Direct Comparisons and Optical Counter
Frequency Source	50 Hz to 1 kHz	5.77 kHz	Fluke Calibrator 5100
	(1 to 10) kHz	57.74 kHz	
	(10 to 20) kHz	57.75 kHz	
Frequency Measure	1 Hz to 15 MHz	0.0078 MHz	7 ½ Digits DDM

**Thermodynamic – IR Devices**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
IR Thermometers	-25°C to 1 100°C	0.34 °C	K Thermocouple and Direct Comparison

**Thermodynamic – Humidity**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Humidity Meters and Recorders	(22.5 to 85.5) % RH	2 % RH	Thermo-hygrometer

**Thermodynamic – Thermometers**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Glass, Digital, Dial, RTD and Bimetal Thermometers	(-25 to 500) °C	0.3 °C	Dry Block Source and Calibrator
Temperature (wall thermometers)	(0 to 60) °C (32 to 140) °F	0.5 °C	Thermo-hygrometer and Direct Comparison

**Thermodynamic – Thermodynamic Sources**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Ovens, Furnaces, Baths and Incubators	(-190 to 1 200) °C	0.21°C	Calibrator

**Photometry**

<b>Calibration Parameter/Equipment</b>	<b>Range</b>	<b>Calibration and Measurement Capability(+/-) <sup>2</sup></b>	<b>Remarks</b>
Spectrophotometers	(420 to 610) nm	0.058% Abs	Absorbance Standards
	(0.5 to 0.7) % Abs		
	(420 to 610) nm	0.115% Abs	
	(1.1 to 1.3) % Abs		
	(420 to 610) nm	0.173% Abs	
	(1.7 to 1.9) % Abs		

**Amount of Substance – Chemical**

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) <sup>2</sup>	Remarks
Volume - Microsyringes	(0 to 100) µl	0.09 µl	Analytical Balance and Digital Balance
Volume - Pycnometers	(0 to 100) ml	0.12 µl	
Volume - Syringes	(0 to 200) ml	0.2 ml	
Volume - Test Tubes and Burettes	(0 to 5) ml	0.09 ml	
	(0 to 2 000) ml	5.77 ml	
Volume - Test Tubes and Jars	(0 to 5 000) ml	11.55 ml	
	(0 to 50 000) ml	115.47 ml	

**Notes:**

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
- 2) Calibration and Measurement Capability represents expanded uncertainties at approximately a 95% confidence level using a coverage factor of k=2.
- 3) *L* = length in meters.

Approved by: \_\_\_\_\_



 R. Douglas Leonard Jr.  
Chief Technical Officer

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