



# CERTIFICATE OF ACCREDITATION

**The ANSI National Accreditation Board**

Hereby attests that

**Techmaster Electronics Joint Stock Company**  
169/1/5 Luong Dinh Cua Street, An Khanh Ward, Thu Duc City  
Ho Chi Minh City, Vietnam  
(and satellite location as shown on scope)

Fulfills the requirements of

**ISO/IEC 17025:2017**

and national standards

**ANSI/NCSL Z540-1-1994 (R2002)**

In the fields of

**CALIBRATION and DIMENSIONAL MEASUREMENT**

This certificate is valid only when accompanied by a current scope of accreditation document.  
The current scope of accreditation can be verified at [www.anab.org](http://www.anab.org).

Jason Stine, Vice President

Expiry Date: 29 October 2025

Certificate Number: AC-1868



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory  
quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017**

**AND**

**ANSI/NCSL Z540-1-1994 (R2002)**

**TECHMASTER ELECTRONICS JOINT STOCK COMPANY**

169/1/5 Luong Dinh Cua Street, An Khanh Ward, Thu Duc City,  
Ho Chi Minh City, Vietnam (Primary Laboratory).

Website: [www.techmaster.com.vn](http://www.techmaster.com.vn)

Authorized Leadership for Techmaster in Vietnam  
Tri Nguyen, Vietnam General Director; Email: [tri.nguyen@techmaster.com.vn](mailto:tri.nguyen@techmaster.com.vn)  
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Nghiep Le, Vietnam Technical Manager; Email: [nghip.le@techmaster.com.vn](mailto:nghip.le@techmaster.com.vn)

Services performed at satellite locations as indicated  
D1 Phu Dien UZ, Dong Nguyen Ward, Tu Son City, Bac Ninh Province, Viet Nam

**CALIBRATION AND DIMENSIONAL MEASUREMENT**

Valid to: **October 29, 2025**

Certificate Number: **AC-1868**

**CALIBRATION**

**Acoustics and Vibration**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meters <sup>1</sup>	94 dB, 1 kHz 114 dB, 1 kHz 94 dB, 250 Hz 114 dB, 250 Hz	0.21 dB	Sound Calibrator  Ho Chi Minh City Bac Ninh Province
Sound Calibrator	Sound pressure level (94, 104, 114) dB Sound Frequency 31.5 Hz to 16 kHz Sound Distortion: Up to 10 % Distortion	0.12 dB  0.02 % of reading  0.2 % Distortion	Standard Microphone, Precision Multimeter  Ho Chi Minh City
Vibration Meters <sup>1</sup> Acceleration, Velocity	Up to 10 g Up to 1 000 Hz (1 to 2) kHz (10 to 200) mV/g Up to 1 000 Hz (1 to 2) kHz	1.4 % of reading + 0.01 g 1.6 % of reading + 0.01 g  1.6 % of reading 2.1 % of reading	Vibration Calibration System  Ho Chi Minh City Bac Ninh Province

### Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters <sup>1,5</sup>	4.00 pH 7.00 pH 10.00 pH	0.008 pH 0.008 pH 0.012 pH	Aqueous Solutions Ho Chi Minh City
pH meters <sup>1,5</sup>	4.00 pH 7.00 pH 10.00 pH	0.013 pH 0.013 pH 0.015 pH	Aqueous Solutions Solutions Bac Ninh Province
Conductivity meters <sup>1,5</sup>	2 $\mu$ S/cm 10 $\mu$ S/cm 84 $\mu$ S/cm 1 413 $\mu$ S/cm	0.14 $\mu$ S/cm 0.11 $\mu$ S/cm 0.9 $\mu$ S/cm 8.2 $\mu$ S/cm	Aqueous Solutions Solutions Ho Chi Minh City Bac Ninh Province
Refractometers	Up to 40 % Brix (40 to 80) % Brix Up to 25% Salinity	0.03 % Brix 0.12 % Refraction 0.09 % Refraction	Analytical Balance, Volumetric Flask, Digital Thermometer Ho Chi Minh City Bac Ninh Province
Viscosity Meters <sup>1</sup>	Up to 1 000 mPa.s (cP) (1000 to 17 000) mPa.s (cP)	0.61 mPa.s + 0.74 % of reading 1.14% of reading	Viscosity Reference Solutions, Water Bath, Digital Thermometer Ho Chi Minh City Bac Ninh Province
Viscosity cup	100 mm <sup>2</sup> /s 240 mm <sup>2</sup> /s 720 mm <sup>2</sup> /s 2 470 mm <sup>2</sup> /s	1.8 mm <sup>2</sup> /s 3.3 mm <sup>2</sup> /s 8.6 mm <sup>2</sup> /s 30 mm <sup>2</sup> /s	Viscosity Reference Solutions, Stop watch, Water Bath Ho Chi Minh City Bac Ninh Province
Glass capillary kinematic viscometer	(20 to 1 000) mm <sup>2</sup> /s (1 000 to 3 500) mm <sup>2</sup> /s (3 500 to 19 000) mm <sup>2</sup> /s	1.2 % of reading 1.3 % of reading 1.7 % of reading	Viscosity Reference Solutions, Stop watch, Water Bath, Digital Thermometer Ho Chi Minh City

### Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gas Detectors <sup>1</sup>	H <sub>2</sub> S Up to 50 ppm Concentration CO Up to 100 ppm Concentration CH <sub>4</sub> Up to 50 % LEL O <sub>2</sub> Up to 20.9 % Volume CO <sub>2</sub> Up to 5 000 ppm Concentration SF <sub>6</sub> Up to 100 %Volume	2.5 parts in 10 <sup>6</sup> Concentration 2.1 parts in 10 <sup>6</sup> Concentration 1.2 % LEL 0.7 % Volume 1.4 parts in 10 <sup>6</sup> concentration + 2 % of reading 1.5 %Volume	Standard Gases Ho Chi Minh City Bac Ninh Province
Total Volatile Organic Compounds (TVOC) <sup>1</sup>	Up to 100 ppm Concentration	0.8 parts in 10 <sup>6</sup> Concentration	Standard Gas Ho Chi Minh City Bac Ninh Province
Turbidity Meter <sup>1</sup>	(0 to 1 000) NTU (1 000 to 4 000) NTU	0.011 NTU + 0.57 % of reading 66 NTU	Turbidity Calibration Standards Solution Ho Chi Minh City Bac Ninh Province
Alcohol meter <sup>1</sup>	Up to 100 % Vol / Vol	0.24 % Vol / Vol	Reference Alcohol meter Ho Chi Minh City Bac Ninh Province
Liquid Particle Counter (3 to 25) mm	Up to 10 000 Particles/ml	1.5 Particles/ml + 6.3 % reading	Particle Suspension Standard Ho Chi Minh City
Karl Fischer titration	0.1 mg/g 1 mg/g	0.016 mg/g 0.031 mg/g	Water Standard Ho Chi Minh City
Gas Chromatograph FID detector	Up to 100 µg/mL	0.006 9 µg/mL + 1.2 % concentration	Tetradecane Standard solution, micropipette, flask, test weights Ho Chi Minh City



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source <sup>1</sup>	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V 220 V to 1.1 kV	8.1 $\mu$ V/V + 0.8 $\mu$ V 7.1 $\mu$ V/V + 1 $\mu$ V 8.1 $\mu$ V/V + 3.5 $\mu$ V 7.1 $\mu$ V/V + 6.5 $\mu$ V 8.1 $\mu$ V/V + 80 $\mu$ V 11 $\mu$ V/V + 0.5 $\mu$ V	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
DC Voltage – Source <sup>1</sup>	(1 to 6) kV	0.21 % of reading + 0.003 5 kV	Digital High Voltage Meter  Ho Chi Minh City
DC Voltage – Measure <sup>1</sup>	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	11 $\mu$ V/V + 1.2 $\mu$ V 9.5 $\mu$ V/V + 1.2 $\mu$ V 9.5 $\mu$ V + 2.6 $\mu$ V 12 $\mu$ V/V + 36 $\mu$ V 118 $\mu$ V/V + 12 $\mu$ V/V	Precision Multimeter  Ho Chi Minh City Bac Ninh Province
DC Voltage – Measure <sup>1</sup>	(1 to 10) kV	0.21 % of reading + 0.0035 kV	Digital High Voltage Meter  Ho Chi Minh City
DC Voltage – Measure <sup>1</sup>	(1 to 10) kV	12 $\mu$ V/V + 0.12 mV	Kikusui Digital High Voltage Meter  Bac Ninh Province
DC Voltage - Measure <sup>1</sup>	(10 to 200) kV	0.68 % of reading + 0.3 kV	High voltage precision divider with Multimeter  Ho Chi Minh City
DC Voltage – Measure <sup>1</sup>	(10 to 40) kV	1 mV/V + 4 V	High Voltage Probe  Bac Ninh Province
DC Current – Measure <sup>1</sup>	Up to 100 nA 100 nA to 1 $\mu$ A (1 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	35 $\mu$ A/A + 0.05 nA 24 $\mu$ A/A + 0.05 nA 24 $\mu$ A/A + 0.95 nA 24 $\mu$ A/A + 5.9 nA 24 $\mu$ A/A + 5.9 nA 41 $\mu$ A/A + 0.6 nA 0.13 $\mu$ A/A + 0.01 mA	Precision Multimeter  Ho Chi Minh City Bac Ninh Province
DC Current – Measure <sup>1</sup>	(1 to 10) A (10 to 300) A (300 to 1 000) A (1 000 to 2 000) A	0.58 $\mu$ A/A 0.14 $\mu$ A/A 6.8 mA/A 4.1 A	Multimeter with Current Shunt, Clamp Meter  Ho Chi Minh City Bac Ninh Province

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure <sup>1</sup>	(1 000 to 2 000) A	4.1 A	Clamp Meter Bac Ninh Province
DC Current – Source <sup>1</sup>	Up to 220 $\mu$ A 220 $\mu$ A to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 80 nA 60 $\mu$ A/A + 0.8 $\mu$ A 80 $\mu$ A/A + 25 $\mu$ A	Multiproduct Calibrator Ho Chi Minh City Bac Ninh Province
DC Current – Source <sup>1</sup>	330 $\mu$ A to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 20) A	0.15 mA/A + 0.06 $\mu$ A 0.11 mA/A + 0.46 $\mu$ A 0.1 $\mu$ A/A + 8.8 $\mu$ A 0.32 $\mu$ A/A + 0.12 mA 0.66 $\mu$ A/A + 0.81 mA	Multiproduct Calibrator Ho Chi Minh City Bac Ninh Province
DC Current – Source <sup>1</sup>	(20 to 120) A	0.012 % of reading + 0.026 A	DC Power Supply with Shunt & Multimeter Ho Chi Minh City
DC Current – Source <sup>1</sup>	(20 to 150) A (150 to 1 000) A	0.58 % of reading + 0.17 A 0.59 % of reading + 0.61 A	Multiproduct Calibrator w Fluke Coil Ho Chi Minh City Bac Ninh Province
DC Current – Source <sup>1</sup>	(20 to 1 000) A	5.4 mA/A	Multiproduct Calibrator w Fluke Coil Bac Ninh Province





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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	Up to 2.2 mV		Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
	(10 to 20) Hz	0.55 mV/V + 4.5 μV	
	(20 to 40) Hz	0.21 mV/V + 4.5 μV	
	40 Hz to 20 kHz	0.11 mV/V + 4.5 μV	
	(20 to 50) kHz	0.37 mV/V + 4.5 μV	
	(50 to 100) kHz	0.85 mV/V + 7 μV	
	(100 to 300) kHz	1.1 mV/V + 13 μV	
	(300 to 500) kHz	1.7 mV/V + 25 μV	
	500 kHz to 1 MHz	3.4 mV/V + 25 μV	
	(2.2 to 22) mV		
	(10 to 20) Hz	0.55 mV/V + 5 μV	
	(20 to 40) Hz	0.21 mV/V + 5 μV	
	40 Hz to 20 kHz	0.11 mV/V + 5 μV	
	(20 to 50) kHz	0.37 mV/V + 5 μV	
	(50 to 100) kHz	0.85 mV/V + 7 μV	
	(100 to 300) kHz	1.1 mV/V + 12 μV	
	(300 to 500) kHz	1.7 mV/V + 25 μV	
	500 kHz to 1 MHz	3.4 mV/V + 25 μV	
	(22 to 220) mV		
	(10 to 20) Hz	0.55 mV/V + 13 μV	
	(20 to 40) Hz	0.21 mV/V + 8 μV	
	40 Hz to 20 kHz	0.11 mV/V + 8 μV	
	(20 to 50) kHz	0.37 mV/V + 8 μV	
	(50 to 100) kHz	0.85 mV/V + 25 μV	
(100 to 300) kHz	1.1 mV/V + 25 μV		
(300 to 500) kHz	1.7 mV/V + 35 μV		
500 kHz to 1 MHz	3.4 mV/V + 80 μV		
220 mV to 2.2 V			
(10 to 20) Hz	0.5 mV/V + 80 μV		
(20 to 40) Hz	0.16 mV/V + 25 μV		
40 Hz to 20 kHz	80 μV/V + 6 μV		
(20 to 50) kHz	0.13 mV/V + 16 μV		
(50 to 100) kHz	0.26 mV/V + 70 μV		
(100 to 300) kHz	0.44 mV/V + 0.13 mV		
(300 to 500) kHz	1.8 mV/V + 35 mV		
500 kHz to 1 MHz	2.6 mV/V + 8.5 mV		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	(2.2 to 22) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 220 V to 1.1 kV (15 to 50) Hz 50 Hz to 1 kHz	0.55 mV/V + 0.8 mV 0.16 mV/V + 0.25 mV 80 μV/V + 0.06 mV 0.13 mV/V + 0.16 mV 0.27 mV/V + 0.35 mV 0.5 mV/V + 1.5 mV 1.9 mV/V + 4.3 mV 3.1 mV/V + 8.5 mV 0.5 mV/V + 8 mV 0.16 mV/V + 2.5 mV 80 μV/V + 0.8 mV 0.22 mV/V + 3.5 mV 0.5 mV/V + 8 mV 2 mV/V + 90 mV 0.4 mV/V + 16 mV 80 μV/V + 3.5 mV	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
AC Voltage – Source <sup>1</sup>	1 kV to 6 kV (50 to 60) Hz	0.45 % of reading + 0.000 51 kV	Digital High Voltage Meter, High Voltage Probe  Ho Chi Minh City
AC Voltage – Measure <sup>1</sup>	Up to 10 mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (10 to 100) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.36 mV/V + 3.5 μV 0.24 mV/V + 1.3 μV 0.35 mV/V + 1.3 μV 1.2 mV/V + 1.3 μV 5.9 mV/V + 1.3 μV 47 mV/V + 2.4 μV 0.008 mV/V + 2.4 μV 0.017 mV/V + 2.4 μV 0.035 mV/V + 2.4 μV 0.095 mV/V + 2.4 μV 0.35 mV/V + 12 μV 1.2 mV/V + 12 μV 1.8 mV/V + 12 μV 18 mV/V + 12 μV	Precision Multimeter  Ho Chi Minh City Bac Ninh Province





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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure <sup>1</sup>	100 mV to 1 V		Precision Multimeter  Ho Chi Minh City Bac Ninh Province
	(1 to 40) Hz	0.08 mV/V + 48 μV	
	40 Hz to 1 kHz	0.08 mV/V + 24 μV	
	(1 to 20) kHz	0.17 mV/V + 24 μV	
	(20 to 50) kHz	0.35 mV/V + 24 μV	
	(50 to 100) kHz	0.95 mV/V + 24 μV	
	(100 to 300) kHz	0.36 mV/V + 0.12 mV	
	300 kHz to 1 MHz	12 mV/V + 0.12 mV	
	(1 to 2) MHz	18 mV/V + 0.12 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.08 mV/V + 0.47 mV	
	40 Hz to 1 kHz	0.08 mV/V + 0.24 mV	
	(1 to 20) kHz	0.17 mV/V + 0.24 mV	
	(20 to 50) kHz	0.35 mV/V + 0.24 mV	
	(50 to 100) kHz	0.95 mV/V + 0.24 V	
	(100 to 300) kHz	3.6 mV/V + 1.2 mV	
	300 kHz to 1 MHz	12 mV/V + 1.2 mV	
	(1 to 2) MHz	18 mV/V + 1.2 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.24 mV/V + 4.7 mV	
40 Hz to 1 kHz	0.24 mV/V + 2.4 mV		
(1 to 20) kHz	0.24 mV/V + 2.4 mV		
(20 to 50) kHz	0.43 mV/V + 2.4 mV		
(50 to 100) kHz	0.43 mV/V + 2.4 mV		
(100 to 300) kHz	4.7 mV/V + 12 mV		
300 kHz to 1 MHz	4.7 mV/V + 12 mV		
100 V to 1 kV			
(1 to 40) Hz	0.47 mV/V + 47 mV		
40 Hz to 1 kHz	0.47 mV/V + 47 mV		
(1 to 20) kHz	0.71 mV/V + 24 mV		
(20 to 50) kHz	1.5 mV/V + 24 mV		
(50 to 100) kHz	3.6 mV/V + 2.4 mV		
AC Voltage – Measure <sup>1</sup>	(1 to 10) kV (50 to 60) Hz	0.45 % of reading + 0.000 51 kV	Digital High Voltage Meter, High Voltage Probe  Ho Chi Minh City
AC Voltage – Measure <sup>1</sup>	(1 to 30) kV (50 to 60) Hz	0.38 kV	Digital High Voltage Meter High Voltage Probe  Bac Ninh Province

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure <sup>1</sup>	(10 to 300) kV (50 to 60) Hz	0.68 % of reading +0.3 kV	High voltage precision divider with Multimeter  Ho Chi Minh City
AC Current – Source <sup>1</sup>	Up to 220 $\mu$ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 220 $\mu$ A to 2.2 mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 220 mA to 2.2 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.9 mA/A 0.5 mA/A 0.3 mA/A 0.8 mA/A 2 mA/A 0.9 mA/A 0.6 mA/A 0.3 mA/A 2.5 mA/A 5.3 mA/A 2.6 mA/A 2 mA/A 1.8 mA/A 19 mA/A 38 mA/A 0.7 mA/A 0.4 mA/A 0.2 mA/A 0.8 mA/A 1.9 mA/A 0.8 $\mu$ A/A 1.1 mA/A 8.8 mA/A	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
AC Current – Source <sup>1</sup>	(2.2 to 11) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.8 mA/A+0.002 4 A 1.2 mA/A+ 0.002 5 A 3.4 mA/A+ 0.006 1 A  1.1 mA/A+0.02 A 1.4 mA/A+ 0.018 A 3.5 mA/A+ 0.035 A	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source <sup>1</sup>	(20 to 50) A (50 Hz to 60 Hz)	0.088 % of reading + 0.015 A	AC Voltage Current Standard Ho Chi Minh City Bac Ninh Province
AC Current – Source <sup>1</sup>	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.34 % of reading + 0.043 A 0.91 % of reading + 0.043 A 0.33 % of reading + 0.3 A 0.91 % of reading + 0.25 A	Multiproduct Calibrator with Coil  Ho Chi Minh City Bac Ninh Province
AC Current – Measure <sup>1</sup>	(5 to 100) $\mu$ A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz 100 $\mu$ A to 10 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	4.8 mA/A + 24 nA 1.8 mA/A + 24 nA 0.7 mA/A + 24 nA 0.7 mA/A + 24 nA 4.7 mA/A + 2.4 nA 1.8 mA/A + 2.4 nA 0.7 mA/A + 2.4 nA 0.4 mA/A + 2.4 nA 0.7 mA/A + 2.4 nA 4.7 mA/A + 4.7 nA 6.5 mA/A + 18 $\mu$ A 4.7 mA/A + 24 $\mu$ A 1.8 mA/A + 24 $\mu$ A 0.7 mA/A + 24 $\mu$ A 0.4 mA/A + 24 $\mu$ A 0.7 mA/A + 24 $\mu$ A 4.7 mA/A + 47 $\mu$ A 6.5 mA/A + 0.18 mA	Precision Multimeter  Ho Chi Minh City Bac Ninh Province
AC Current – Measure <sup>1</sup>	100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	1.9 mA/A + 0.24 mA 0.9 mA/A + 0.24 mA 1.2 mA/A + 0.24 mA 3.5 mA/A + 0.24 mA 12 mA/A + 0.47 mA 47 mA/A + 0.47 mA	Precision Multimeter, Precision Shunt  Ho Chi Minh City Bac Ninh Province

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure <sup>1</sup>	(1 to 10) A (3 to 300) kHz (10 to 300) A (50 to 400) Hz	0.007 1 A + 0.01 mA  0.14 A	Clamp Meter w Flexible Probe  Ho Chi Minh City Bac Ninh Province
AC Current – Measure <sup>1</sup>	(50 to 60) Hz (10 to 50) A (50 to 500) A (500 to 5 000) A	0.09 % of reading + 0.000 21 A 0.09 % of reading + 0.002 1 A 0.08 % of reading + 0.021 A	Standard Current Transformer with Multimeter  Ho Chi Minh City
DC Power – Generate 33 mV to 1 020 V	0.33 mA to 330 mA 10 μW to 330 W 0.33 A to 3 A 10 mW to 3 kW 3 A to 20.5 100 mW to 21 kW	0.01 % of reading + 1.5 nW  0.11 W +0.012 nW  1.1 W + 0.031 μW	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
AC Active Power - Measure	(0.07 to 2 000) W	0.45 % of reading	Power meter  Ho Chi Minh City Bac Ninh Province
AC Reactive Power - Measure	(0.07 to 2 000) VAR	0.45 % of reading	Power meter  Ho Chi Minh City Bac Ninh Province
AC Apparent Power - Measure	(0.07 to 2 000) VA	0.45 % or reading	Power meter  Ho Chi Minh City Bac Ninh Province
Phase angle - Measure	Up to 360°	0.3°	Power meter  Ho Chi Minh City Bac Ninh Province
Transformer Ratio Meter <sup>4</sup>	100 V @ 50 Hz Up to 20 000	0.01 %	Inductive Voltage Divider  Ho Chi Minh City
Oil Breakdown Tester	Up to 100 kV 50 Hz	0.6 % of reading + 0.041 kV	Digital Voltage Meter  Ho Chi Minh City
Partial Discharge – Generate	(1 to 100) pC (100 to 1000) pC (1000 to 7000) pC	1.5 % of reading + 1 pC 1.1 % of reading + 2 pC 1.1 % of reading + 5 pC	IEC 60270  Ho Chi Minh City



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Partial Discharge – Measure	(-7 000 to -1000) pC (-1 000 to -100) pC (-100 to 100) pC (100 to 1 000) pC (1000 to 7 000) pC	1 % of reading + 1 pC 1 % of reading + 0.2 pC 1.5 % of reading + 0.03 pC 1 % of reading + 1 pC 1 % of reading + 0.2 pC	( $\Delta T/R$ ) * $\Sigma V_i$ technique using long scale multimeter and digital oscilloscope $\Delta T$ is the time interval $R$ is the resistance value $\Sigma V_i$ is the sum of the voltage measurements taken at each time interval  Ho Chi Minh City
AC Power – Generate PF = 1 (10 to 45) Hz 33 mV to 32.9999 V 3.3 mA to 2.999 99 A  (45 to 65) Hz 33 mV to 1 000 V 3.3 mA to 20.5 A	110 $\mu$ W to 99 W  110 $\mu$ W to 20 kW	0.18 % of reading  0.14 % of reading	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
Oscilloscopes <sup>1</sup> - DC Voltage Into 50 $\Omega$ Into 1 M $\Omega$  Square Wave in to 50 $\Omega$ 10 Hz to 10 kHz Into 1 M $\Omega$ 10 Hz to 10 kHz  Level Sine Amplitude Reference @ 50 kHz  Time Markers Into 50 $\Omega$  Edge Transition Time (Rise time)	(0 to $\pm$ 6.6) V (0 to $\pm$ 130) V  1 mV to 6.6 Vp-p 1 mV to 130 Vp-p  5 mV to 5.5 V  (1 to 50) ns 100 ns to 20 ms 50 ms to 5 s  < 300 ps	0.2 % of reading + 36 $\mu$ V 0.039 % of reading + 37 $\mu$ V  0.2% of reading + 65 $\mu$ V 0.19 % of reading + 39 $\mu$ V  15 mV/V + 0.49 mV  0.001 1 % of reading + 0.048 ps 0.000 2 % of reading + 7 ps 0.4 % of reading  80 ps	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1</sup> - Bandwidth (relative to 50 kHz) 5 mV to 5.5 V	50 kHz to 100 MHz (100 to 300) MHz 300 to 600) MHz (600 to 1 100) MHz (1 100 to 6 000) MHz	14 mV/V + 0.12 mV 17 mV/V + 0.14 mV 32 mV/V + 0.15 mV 40 mV/V + 0.16 mV 50 mV/V + 0.2 mV	Multiproduct Calibrator  Ho Chi Minh City
Oscilloscopes <sup>1</sup> - Bandwidth (relative to 50 kHz) 5 mV to 5.5 V	50 kHz to 100 MHz (100 to 300) MHz 300 to 600) MHz (600 to 1 100) MHz	14 mV/V + 0.12 mV 17 mV/V + 0.14 mV 32 mV/V + 0.15 mV 40 mV/V + 0.16 mV	Multiproduct Calibrator  Bac Ninh Province
LCR Meters <sup>1</sup> Resistance	0.1 Ω 20 Hz to 2 kHz 2 kHz to 4 kHz 4 kHz to 7.5 kHz 7.5 kHz to 10 kHz 1 Ω 20 Hz to 40 kHz 40 kHz to 100 kHz 10 Ω 20 Hz to 100 kHz 100 Ω 20 Hz to 100 kHz 1 kΩ 20 Hz to 100 kHz 10 kΩ 20 Hz to 100 kHz 100 kΩ 20 Hz to 20 kHz 20 kHz to 75 kHz 750 kHz to 100 kHz 1 MΩ 20 Hz to 7.5 kHz 7.5 kHz to 20 kHz 20 kHz to 75 kHz 75 kHz to 100 kHz 10 MΩ 20 Hz to 7.5 kHz 7.5 Hz to 10 kHz	0.22 % of reading 0.32 % of reading 0.52 % of reading 1.1 % of reading 0.12 % of reading 0.22 % of reading 0.06 % of reading 0.03 % of reading 0.07 % of reading 0.04 % of reading 0.04 % of reading 0.07 % of reading 0.13 % of reading 0.05 % of reading 0.07 % of reading 0.22 % of reading 0.53 % of reading 0.07 % of reading 0.26 % of reading	RLC Calibrator  Ho Chi Minh City Bac Ninh Province





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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
LCR Meters <sup>1</sup> Resistance	100 MΩ		RLC Calibrator  Ho Chi Minh City Bac Ninh Province
	20 Hz to 400 Hz	0.12 % of reading	
	400 Hz to 750 Hz	0.22 % of reading	
	750 Hz to 2 kHz	0.52 % of reading	
	2 kHz to 4 kHz	1.1 % of reading	
	4 kHz to 5 kHz	2.1 % of reading	
LCR Meters <sup>1</sup> Capacitance	1 pF		RLC Calibrator  Ho Chi Minh City Bac Ninh Province
	1 kHz to 1 MHz	0.043 % of reading	
	1 MHz to 5 MHz	0.11 % of reading	
	5 MHz to 13 MHz	0.41 % of reading	
	10 pF		
	20 Hz to 1 kHz	0.52 % of reading	
	1 kHz to 5 MHz	0.043 % of reading	
	5 MHz to 13 MHz	0.046 % of reading	
	100 pF		
	20 Hz to 1 kHz	0.32 % of reading	
	1 kHz to 5 MHz	0.043 % of reading	
	(5 to 13) MHz	0.066 % of reading	
	1 nF		
	20 Hz to 1 kHz	0.32 % of reading	
	1 kHz to 5 MHz	0.11 % of reading	
	(5 to 13) MHz	0.31 % of reading	
	10 nF		
20 Hz to 100 kHz	0.11 % of reading		
100 nF			
20 Hz to 100 kHz	0.14 % of reading		
1 μF			
20 Hz to 100 kHz	0.14 % of reading		
10 μF			
20 Hz to 10 kHz	0.14 % of reading		
100 μF			
20 Hz to 10 kHz	0.23 % of reading		
LCR Meters <sup>1</sup> Inductance	10 μH		RLC Calibrator  Ho Chi Minh City Bac Ninh Province
	20 Hz to 100 kHz	0.53 % of reading	
	100 μH		
	20 Hz to 100 kHz	0.53 % of reading	
	1 mH		
20 Hz to 100 kHz	0.2 % of reading		
10 mH			
20 Hz to 100 kHz	0.2 % of reading		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
LCR Meters <sup>1</sup> Inductance	100 mH 20 Hz to 100 kHz	0.2 % of reading	RLC Calibrator
	1 H 20 Hz to 10 kHz	0.24 % of reading	Ho Chi Minh City Bac Ninh Province
	10 H 20 Hz to 10 kHz	0.24 % of reading	
Mega-Ohm Meter / Insulation Testers <sup>1</sup>	Test Voltage: up to 5 kV 10 kΩ to 1 GΩ	0.21 % of reading	Insulation Tester High Resistance Box Standard  Ho Chi Minh City Bac Ninh Province
	1 GΩ to 10 GΩ	0.32 % of reading	
	10 GΩ to 100 GΩ	0.42 % of reading	
	100 GΩ to 1 TΩ	0.85 % of reading	
	1 TΩ to 10 TΩ	1.6 % of reading	
	Test Voltage: up to 10 kV 100 MΩ to 1 GΩ	0,61 % of reading	
1 GΩ to 10 GΩ	1.2 % of reading		
10 GΩ to 100 GΩ	1.8 % of reading		
100 GΩ to 1 TΩ	3.0 % of reading		
1 TΩ to 10 TΩ	3.3 % of reading		
HiPot Testers <sup>1</sup> Impulse Tester	50 Hz Up to 10 kV Up to 40 kV	0.001 2 kV + 0.012 kV	High Voltage Meter, High Voltage Probe w Multimeter, Current Calibrator Digital Oscilloscope  Ho Chi Minh City Bac Ninh Province
	50 Hz Up to 100 mA	0.015 mA + 0.000 62 mA/mA	
Earth Resistance Meter	(0.01 to 0.1) Ω	0.25 % of reading + 0.002 Ω	Decade Resistance Substituter  Ho Chi Minh City Bac Ninh Province
	(0.1 to 1) Ω	0.02 % of reading + 0.002 Ω	
	(1 to 10) Ω	0.03 % of reading + 0.002 Ω	
	(10 to 100) Ω	0.02 % of reading + 0.01 Ω	
	(100 to 1 000) Ω	0.02 % of reading + 0.1 Ω	
	(1 to 10) kΩ	0.02 % of reading + 1 Ω	
	(10 to 100) kΩ	0.02 % of reading + 0.01 kΩ	
(100 to 300) kΩ	0.02 % of reading + 0.1 kΩ		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source <sup>1</sup>	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) k (33 to 110) kΩ (110 to 330) kΩ 0.33 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	0.1 mΩ/Ω + 8 mΩ 0.1 mΩ/Ω + 17 mΩ 1 mΩ/Ω + 17 mΩ 1 mΩ/Ω + 17 mΩ 0.1 mΩ/Ω + 0.07 Ω 0.1 mΩ/Ω + 0.08 Ω 0.1 mΩ/Ω + 0.71 Ω 0.1 mΩ/Ω + 0.70 Ω 0.1 mΩ/Ω + 7 Ω 0.1 mΩ/Ω + 7 Ω 0.2 mΩ/Ω + 64 Ω 0.2 mΩ/Ω + 64 Ω 0.7 mΩ/Ω + 6.4 kΩ 1 mΩ/Ω + 6.1 kΩ 6 mΩ/Ω + 6.4 kΩ 6 mΩ/Ω + 19 kΩ	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
Resistance – Source <sup>1</sup>	(50 to 200) μΩ (0.5 to 2) mΩ (5 to 20) mΩ (50 to 200) mΩ (0.5 to 2) Ω (2 to 10) Ω (10 to 100) Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 100) kΩ (100 to 300) kΩ	0.3 % of reading + 0.02 μΩ 0.2 % of reading + 0.2 μΩ 0.2 % of reading + 0.3 μΩ 0.2 % of reading + 0.5 μΩ 0.2 % of reading + 2 mΩ 0.03 % of reading + 0.001 Ω 0.01 % of reading + 0.005 Ω 0.01 % of reading + 0.1 Ω 0.01 % of reading + 1 Ω 0.01 % of reading + 0.01 kΩ 0.01 % of reading + 0.1 kΩ	Standard Resistance Box  Ho Chi Minh City Bac Ninh Province
Resistance – Source <sup>1</sup> Fixed Points	1.9 Ω 10 Ω 10 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ	95 μΩ/Ω 28 μΩ/Ω 27 μΩ/Ω 17 μΩ/Ω 17 μΩ/Ω 20 μΩ/Ω 20 μΩ/Ω 18 μΩ/Ω 18 μΩ/Ω 19 μΩ/Ω 19 μΩ/Ω 26 μΩ/Ω	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source <sup>1</sup> Fixed Points	1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	26 μΩ/Ω 50 μΩ/Ω 50 μΩ/Ω 10 mΩ/Ω	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
Resistance – Measure <sup>1</sup>	(0 to 10) Ω (10 to 100) Ω 100 to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	16 μΩ/Ω + 81 μΩ 14 μΩ/Ω + 0.59 μΩ 12 μΩ/Ω + 0.61 μΩ 12 μΩ/Ω + 6.2 mΩ 12 μΩ/Ω + 61 mΩ 18 μΩ/Ω + 2.4 Ω 59 μΩ/Ω + 0.12 kΩ 0.59 mΩ/Ω + 1.2 kΩ 5.9 mΩ/Ω + 12 kΩ	Multiproduct Calibrator Precision Multimeter  Ho Chi Minh City Bac Ninh Province
Resistance – Measure <sup>1</sup>	(1 to 10) GΩ (10 to 100) GΩ (100 to 1 000) GΩ (1 to 10) TΩ	0.34 % of reading 0.8 % of reading 0.86 % of reading 2.2 % of reading	Picoammeter  Ho Chi Minh City
Inductance - Measure	(0 to 100) μH (100 to 1000) μH (1 to 100) mH (0.1 to 1) H	0.08 % of reading + 0.001 μH 0.08 % of reading + 0.003 μH 0.13 % of reading % + 0.001 mH 0.14 % of reading + 0.003 H	Precision LCR Meter  Ho Chi Minh City
Capacitance <sup>1</sup> 10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	(220 to 399.9) pF (0.4 to 1.099 9) nF (1.1 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.999 9) μF (11 to 32.999 9) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.58 % of reading + 12 pF 0.57 % of reading + 12 pF 0.57 % of reading + 12 pF 0.22 % of reading + 27 pF 0.29 % of reading + 0.12 nF 0.29 % of reading + 0.13 nF 0.29 % of reading + 0.35 nF 0.28 % of reading + 1.5 nF 0.29 % of reading + 3.5 nF 0.29 % of reading + 1.3 nF 0.46 % of reading + 36 nF 0.53 % of reading + 0.12 μF 0.53 % of reading + 0.35 μF 0.5 % of reading + 1.5 μF 0.52 % of reading + 3.6 μF 0.51 % of reading + 13 μF 0.86 % of reading + 35 μF 1.3 % of reading + 0.13 mF	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance - Measure	(0 to 100) pF	0.12 % + 0.002 pF	Precision LCR Meter  Ho Chi Minh City
	(100 to 1000) pF	0.12 % + 0.01 pF	
	(1 to 100) nF	0.07 % + 0.001 nF	
	(100 to 1000) nF	0.07 % + 0.02 nF	
	(1 to 100) μF	0.07 % + 0.001 μF	
Dissipation Factor (tan δ) <sup>4</sup> Capacitor 100 pF	12 kV, 50 Hz		Reference capacitor  Ho Chi Minh City
	1	0.007	
	0.5	0.004	
	0.1	0.003	
	0.05	0.002	
	0.01	0.002	
Temperature Indicator Thermocouple Simulation <sup>1</sup>	Type B		Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
	(600 to 800) °C	0.5 °C	
	(800 to 1 000) °C	0.41 °C	
	(1 000 to 1 550) °C	0.36 °C	
	(1 550 to 1 820) °C	0.4 °C	
	Type C		
	(0 to 150) °C	0.36 °C	
	(150 to 650) °C	0.32 °C	
	(650 to 1 000) °C	0.37 °C	
	(1 000 to 1 800) °C	0.59 °C	
	(1 800 to 2 316) °C	0.98 °C	
	Type E		
	(-250 to -100) °C	0.59 °C	
	(-100 to -25) °C	0.22 °C	
	(-25 to 350) °C	0.2 °C	
	(350 to 650) °C	0.23 °C	
	(650 to 1 000) °C	0.29 °C	
	Type J		
	(-210 to -100) °C	0.33 °C	
	(-100 to -30) °C	0.22 °C	
	(-30 to 150) °C	0.2 °C	
	(150 to 760) °C	0.23 °C	
	(760 to 1 200) °C	0.29 °C	
	Type K		
(-200 to -100) °C	0.41 °C		
(-100 to -25) °C	0.26 °C		
(-25 to 120) °C	0.24 °C		
(120 to 1 000) °C	0.3 °C		
(1 000 to 1 372) °C	0.47 °C		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature Indicator Thermocouple Simulation <sup>1</sup>	Type R (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.66 °C 0.43 °C 0.38 °C 0.46 °C 0.73 °C 0.32 °C 0.24 °C 0.17 °C	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
Electrical Calibration of RTD Indicating Systems <sup>1</sup>	Pt 385, 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C (630 to 800) °C Pt 3926, 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C Pt 385, 500 Ω (-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C Pt 385, 1 kΩ (-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C Pt Ni 385, 100 Ω (-80 to 100) °C (100 to 260) °C Cu 427, 10 Ω (-100 to 260) °C	0.05 °C 0.07 °C 0.1 °C 0.12 °C 0.23 °C 0.05 °C 0.07 °C 0.1 °C 0.12 °C 0.05 °C 0.06 °C 0.09 °C 0.11 °C 0.03 °C 0.05 °C 0.07 °C 0.23 °C 0.08 °C 0.14 °C 0.3 °C	Multiproduct Calibrator  Ho Chi Minh City Bac Ninh Province
Tesla Meter <sup>1</sup> (Gauss Meter)	Up to 200 mT 200 mT to 1500 mT	5.1 % of reading + 0.35 mT 5.1 % of reading + 12 mT	Reference Magnetic Field Block  Ho Chi Minh City Bac Ninh Province



**Electrical – RF/Microwave**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure	0 dBm 50 MHz	0.027 dB	Power Meter, Thermistor Mount  Ho Chi Minh City Bac Ninh Province
RF Absolute Power - Measure	(-20 to 30) dBm 100 kHz to 2.6 GHz 50 MHz to 1.3 GHz (1.3 to 18) GHz (18 to 26.5) GHz	0.058 dB 0.077 dB 0.082 dB 0.09 dB	Measuring Receiver with Power Sensor  Ho Chi Minh City Bac Ninh Province
RF Absolute Power - Measure	(-70 to 20) dBm 10 MHz to 30 MHz 30 MHz to 4 GHz (4 to 10) GHz (10 to 15) GHz (15 to 18) GHz	0.089 dB 0.092 dB 0.094 dB 0.094 dB 0.096 dB	Power Meter with Power Sensor  Ho Chi Minh City Bac Ninh Province
Tuned RF Power – Measure 2.5 MHz to 26.5 MHz	(-22 to 10) dBm (-42 to -22) dBm (-50 to -42) dBm (-60 to -50) dBm (-72 to -60) dBm (-80 to -72) dBm (-92 to -80) dBm (-102 to -92) dBm (-110 to -102) dBm (-120 to -110) dBm (-127 to -120) dBm	0.15 dB 0.15 dB 0.18 dB 0.19 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.32 dB 0.37 dB	Measuring Receiver with Power Sensor  Ho Chi Minh City Bac Ninh Province
Distortion – Measure 250kHz to 26.5 GHz	(0.01 to 100) % Distortion	0.065 % Distortion	Measuring Receiver  Ho Chi Minh City Bac Ninh Province
Distortion – Measure Fundamental Frequency	(-99 to 0) dB 20 Hz to 20 kHz 20 to 100 kHz	1.2 dB 2.3 dB	Audio Analyzer  Ho Chi Minh City Bac Ninh Province

**Electrical – RF/Microwave**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure	Depths: 5 % to 99 % 150 kHz to 10 MHz Depths: 5 % to 20 % 10MHz to 3 GHz Depths: 20 % to 99 % 10 MHz to 3 GHz Depths: 5 % to 20 % 3 GHz to 26.5 GHz Depths: 20 % to 99 % 3 GHz to 26.5 GHz Depths: 5 % to 20 % 26.5 GHz to 31.15GHz Depths: 20 % to 99 % 26.5 GHz to 31.15 GHz	0.86 % Depth + 1 digit 2.9 % Depth + 1 digit 0.69 % Depth + 1 digit 5.2 % Depth + 1 digit 1.7 % Depth + 1 digit 7.8 % Depth + 1 digit 2.2 % Depth + 1 digit	Measuring Receiver with Power Sensor  Ho Chi Minh City Bac Ninh Province
Amplitude Modulation – Generate	Depths: 0 % to 95 % (11 to 13.5) MHz Rate: 20 Hz to 100 kHz Depths: 95 % to 99 % (11 to 13.5) MHz Rate: 20 Hz to 100 kHz	0.34 % Depth  0.39 % Depth	AM/FM Test Source  Ho Chi Minh City Bac Ninh Province
Frequency Modulation – Generate	10 kHz to 432 MHz Rate: DC to 100 kHz Dev.: ≤ 400 kHz peak 10 kHz to 432 MHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	0.59 % Deviation  0.63% Deviation	AM/FM Test Source  Ho Chi Minh City Bac Ninh Province
Frequency Modulation – Measure	250 kHz to 10 MHz Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak 10 MHz to 1.3 GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak 10 MHz to 1.3 GHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak (1.3 to 26.5) GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	1.7 % of reading + 5.7 Hz 1.1 % of reading + 6.6 Hz 1.8 % of reading + 5.1 Hz 1.2 % of reading + 6.1 Hz 2.9 % of reading + 4 Hz 1.2 % of reading + 6.4 Hz 4.4 % of reading + 3.8Hz 1.2 % of reading + 7.6 Hz	Measuring Receiver with Power Sensor  Ho Chi Minh City Bac Ninh Province

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks <sup>1</sup>	Up to 100 mm (100 to 500) mm	$(0.16 + 0.84L) \mu\text{m}$ $(0.18 + 2.9L) \mu\text{m}$	Universal Length Measuring System, Gage Block Set  Ho Chi Minh City Bac Ninh Province
Protractors	Up to 360°	0.015°	Angle Gauge Block Set, Granite Surface Plate  Ho Chi Minh City Bac Ninh Province
Calipers <sup>1</sup>	Up to 500 mm (500 to 2 000) mm	9.3 $\mu\text{m}$ $(12 + 0.004 l) \mu\text{m}$	Gage Block Set  Ho Chi Minh City Bac Ninh Province
Micrometers <sup>1</sup> External, Internal, Depth	Up to 25 mm (25 to 100) mm (100 to 1000) mm	0.46 $\mu\text{m}$ 1.4 $\mu\text{m}$ $(0.81 + 0.007 5l) \mu\text{m}$	Gage Block Set, Surface Plate, Ring Gauges, Pin Gauge, Universal Length Measuring System  Ho Chi Minh City Bac Ninh Province
Height Gages <sup>1</sup>	Up to 1 000 mm	$(1.1 + 0.003 3l) \mu\text{m}$	Gage Block Set  Ho Chi Minh City Bac Ninh Province
Steel Ruler <sup>1,2</sup>	Up to 1 000 mm (1 000 to 5 000) mm	0.028 mm $(0.0085 + 0.016 L) \text{ mm}$	Tape and scale calibration unit  Ho Chi Minh City Bac Ninh Province
Steel Ruler <sup>1,2</sup>	Up to 5 000 mm	0.037L mm	Standard Steel Ruler & Scale Loupe  Bac Ninh Province
Tape Ruler <sup>1,2</sup>	(0 to 1 000) mm (1 000 to 50 000) mm	0.043 mm $(0.019 + 0.017 L) \text{ mm}$	Tape and scale calibration unit  Ho Chi Minh City Bac Ninh Province

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Laser Distance Meter	Up to 50 m	2.1 mm	Laser Distance Meter Ho Chi Minh City Bac Ninh Province
Glass Scales <sup>1,2</sup>	Up to 100 mm (100 to 500) mm	$(1 + 0.004 2l) \mu\text{m}$ $(0.78 + 0.006 4l) \mu\text{m}$	Universal Length Measuring System Ho Chi Minh City Bac Ninh Province
Thickness Gages <sup>1</sup>	Up to 25 mm	0.81 $\mu\text{m}$	Gage Block Set Ho Chi Minh City Bac Ninh Province
Feeler Gauge / Thickness Gauge, Block, Foil	Up to 50 mm	$(0.14 + 0.005 4 l) \mu\text{m}$	Universal Length Measuring System Ho Chi Minh City Bac Ninh Province
Digimatic, Dial Indicators <sup>1</sup> , Dial Test Indicators <sup>1</sup> , Lever Different Indicator, Linear Indicator	Up to 5 mm (5 to 25) mm	0.7 $\mu\text{m}$ 1.1 $\mu\text{m}$	Dial Gage Tester Ho Chi Minh City Bac Ninh Province
Digimatic, Dial Indicators <sup>1</sup> , Dial Test Indicators <sup>1</sup> , Lever Different Indicator, Linear Indicator	Up to 100 mm	$(0.27 + 0.005 7l) \mu\text{m}$	Calibration Tester Ho Chi Minh City Bac Ninh Province
Digimatic, Dial Indicators <sup>1</sup> , Dial Test Indicators <sup>1</sup> , Lever Different Indicator, Linear Indicator	Up to 100 mm	$(0.27 + 0.006 1l) \mu\text{m}$	Universal Length Measuring System Ho Chi Minh City Bac Ninh Province
Laser Micro-Diameter	Up to 30 mm	2.2 $\mu\text{m}$	Pin Gauge Set Ho Chi Minh City Bac Ninh Province
Pin Gages, Plug Gages <sup>1</sup>	Up to 300 mm	$(0.15+0.007 6 l) \mu\text{m}$	Universal Length Measuring System, Gauge Block Set Ho Chi Minh City Bac Ninh Province

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calibration tester Resolution: 1 $\mu\text{m}$ 0.2 $\mu\text{m}$	(0 to 100) mm (0 to 5) mm	(0.76 + 0.003 4 l) $\mu\text{m}$ 0.35 $\mu\text{m}$	Gauge Block Set  Ho Chi Minh City Bac Ninh Province
Thread Plug Gauge Pitch Diameter Major Diameter	Up to 150 mm Up to 150 mm	2.4 $\mu\text{m}$ (0.6+0.005 1 l) $\mu\text{m}$	Universal Length Measuring System, Thread Wire Set , Gauge Block Set, Master Ring  Ho Chi Minh City Bac Ninh Province
Thread Ring Gauge Pitch Diameter Minor Diameter	Up to 150 mm Up to 150 mm	2 $\mu\text{m}$ (1+0.003 7 l) $\mu\text{m}$	Universal Length Measuring System, Thread Wire Set , Gauge Block Set, Master Ring  Ho Chi Minh City Bac Ninh Province
Dial Bore Gages Indicator Setting Rods	Up to 10 mm Up to 500 mm	0.8 $\mu\text{m}$ (1+0.006 2 l) $\mu\text{m}$	Universal Length Measuring System  Ho Chi Minh City Bac Ninh Province
Ring Gauge	Up to 150 mm	(0.45+0.005 7 l) $\mu\text{m}$	Universal Length Measuring System  Ho Chi Minh City Bac Ninh Province
Coordinate Measuring Machines (CMM) <sup>1,2</sup>	Axis X: 1 000 mm Axis Y: 1 000 mm Axis Z: 1 000 mm  Probe Performance	(0.72+ 0.007 5l) $\mu\text{m}$  1.2 $\mu\text{m}$	Gauge Block Set, Check Master  Sphere  Ho Chi Minh City Bac Ninh Province
Surface Roughness Tester	2.97 $\mu\text{m}$ Ra 3.17 $\mu\text{m}$ Ra 9.40 $\mu\text{m}$ Ry	0.062 $\mu\text{m}$	Standard Roughness Specimen  Ho Chi Minh City Bac Ninh Province

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Roundness Testing Machines	Roundness (10, 50) mm	0.021 $\mu$ m	Master Roundness Standard  Ho Chi Minh City Bac Ninh Province
Master Ball <sup>2</sup>	Up to 50 mm	(0.25 + 0.006 6 <i>l</i> ) $\mu$ m	Universal Length Measuring System, Gauge Block Set  Ho Chi Minh City Bac Ninh Province
Contour Measuring Machine <sup>2</sup>	X axis: up to 100 mm Z axis: up to 30 mm	(0.7 + 0.005 <i>l</i> ) $\mu$ m 0.9 $\mu$ m	Gauge Block Set Pin Gauge Set, Master Ball  Ho Chi Minh City Bac Ninh Province
Measuring Microscopes / Profile Projectors	Up to 400 mm	(2.2 + 0.004 7 <i>l</i> ) $\mu$ m	Standard Glass Scale  Ho Chi Minh City Bac Ninh Province
Length Counter <sup>2</sup>	0 to 30 km	0.035 m + 0.036 % reading	Digimatic Caliper, Digital Tachometer  Ho Chi Minh City Bac Ninh Province
Precision Levels / Digital Levels	Up to 1mm/m (1 to 10) mm/m	0.005 mm/m 0.01 mm/m + 0.02 % reading	Sine Bar, Gauge Block Set, Surface Plate  Ho Chi Minh City Bac Ninh Province
Length Bar / Micrometer Standard Bar <sup>2</sup>	Up to 1 000 mm	(0.21 + 0.007 4 <i>l</i> ) $\mu$ m	Universal Length Measuring System, Gauge Block Set  Ho Chi Minh City Bac Ninh Province
Surface Flatness – Local Area Flatness Up to (78 X 156) in	Up to 0.05 in	44 $\mu$ in	Repeat-o-Meter  Ho Chi Minh City Bac Ninh Province



### Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Coating Thickness Meters <sup>1</sup>	Up to 3000 $\mu\text{m}$ Up to 25 mm	1 $\mu\text{m}$ + 0.21 % of reading 4.4 $\mu\text{m}$	Coating Thickness Standards  Ho Chi Minh City Bac Ninh Province
Sieves	Up to 5 mm	4 $\mu\text{m}$	Profile Projector  Ho Chi Minh City Bac Ninh Province
Sieves	(5 to 125) mm	14 $\mu\text{m}$	Digital Caliper  Ho Chi Minh City Bac Ninh Province
Needle Detector	(0.5 to 3.5) mm	0.02 mm	Ferrous and Non-Ferrous Dimensional Reference Standards  Ho Chi Minh City Bac Ninh Province
Universal Length Measuring System	Up to 100 mm (100 to 1 000) mm	(0.16 + 0.002 2l) $\mu\text{m}$ (0.25 + 0.003 5l) $\mu\text{m}$	Gauge Block Set  Ho Chi Minh City Bac Ninh Province

### Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Wrench, Torque Tools	Up to 0.28 N·m (0.113 to 1.13) N·m (0.45 to 5.65) N·m (3.39 to 45.2) N·m (9.04 to 113) N·m (27.1 to 339) N·m (81.3 to 813) N·m (271 to 2700) N·m	0.58 % of reading + 0.04 cN·m 0.71 % of reading + 0.11 cN·m 0.54 % of reading + 0.005 N·m 0.55 % of reading + 0.0021 N·m 0.61 % of reading 0.61 % of reading + 0.005 N·m 0.61 % of reading 0.61 % of reading	Torque analyzer with transducer, Torque calibrator  Ho Chi Minh City
Torque Wrench <sup>1</sup>	(100 to 1 000) N·m	1.2 % of reading + 0.085 N·m	Torque Wrench Tester  Bac Ninh Province



ANSI National Accreditation Board

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Wrench, Torque Tools <sup>1</sup>	(1 to 10) lbf.in (2 to 25) lbf.in (5 to 50) lbf.in (10 to 100) lbf.in (5 to 50) lbf.ft (25 to 250) lbf.ft	0.7 % of reading + 0.008 lbf.in 0.7 % of reading + 0.02 lbf.in 0.7 % of reading + 0.04 lbf.in 0.7 % of reading + 0.07 lbf.in 0.7 % of reading + 0.04 lbf.ft 0.7 % of reading + 0.19 lbf.ft	Torque Testers with Transducers  Bac Ninh Province
Torque Testers/Transducers/ Sensor <sup>1</sup>	Up to 1 N·m (1 to 10) N·m (10 to 100) N·m (100 to 500) N·m (500 to 2 700) N·m	0.000 3 N·m 0.003 N·m 0.022 N·m 0.005 3 % of reading + 0.02 N·m 0.006 4 % of reading + 0.17 N·m	Torque wheel, Torque Arm & Standard Weight Set  Ho Chi Minh City Bac Ninh Province
Mass	(1 to 100) mg (100 to 500) mg 500 mg to 2 g (2 to 10) g (10 to 50) g (50 to 200) g (200 to 500) g 500 g to 5 kg 5 kg to 20 kg	0.010 mg 0.013 mg 0.015 mg 0.01 mg + 0.000 7 mg/g 0.01 mg + 0.001 1 mg/g 0.04 mg + 0.001 2 mg/g 0.07 mg + 0.001 1 mg/g 0.01 g + 0.001 g/kg 0.077 g + 0.000 3 g/kg	Standard Weight Set, Analytical Balance, Precision Balances  Ho Chi Minh City Bac Ninh Province



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances / Scales <sup>1,3</sup>	(1 to 20) mg (20 to 200) mg 200 mg to 1g (1 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 150) g (150 to 200) g (200 to 300) g (300 to 500) g (500 to 1 000) g (1 000 to 2 000) g (2 000 to 5 000) g (5 000 to 10 000) g (10 to 20) kg (20 to 35) kg (35 to 60) kg (60 to 100) kg (100 to 300) kg (300 to 1 000) kg (1 000 to 2 000) kg (2 000 to 5 000) kg	0.004 mg 0.008 mg 0.012 mg 0.021 mg 0.027 mg 0.048 mg 0.000 1 g 0.000 2 g 0.000 3 g 0.000 4 g 0.000 6 g 0.001 g 0.002 2 g 0.004 g 0.033 g 0.047 g 0.000 15 kg 0.000 5 g 0.001 kg 0.008 kg 0.016 kg 0.08 kg 0.37 kg 0.8 kg	OIML111-1 Standard Weight Set E1 and OIML R76-1 for calibration of balance, scale  Ho Chi Minh City Bac Ninh Province
Force Gauge, Loadcell, Universal Testing Machine (Compression and Tension)	Up to 1 kgf (1 to 10) kgf (10 to 100) kgf (100 to 5000) kgf (50 to 100) kN	0.24 gf 0.002 kgf 0.02 kgf 0.5 kgf + 0.3 % reading 1.2 % reading	Load cell & Indicator Standard Weight  Ho Chi Minh City Bac Ninh Province
Pressure measure <sup>1</sup> Vacuum, Absolute, Pressure Transmitter, Pressure Transducer	-1 to 0 bar (0 to 6) bar (6 to 60) bar (60 to 700) bar (700 to 1400) bar 1400 bar to 2000 bar	0.002 3 bar 0.002 4 bar 0.001 4 bar + 0.007 9% reading 0.023 bar + 0.008 2 % reading 0.26 bar + 0.004 1 % reading 5 bar	Digital Pressure Calibrator, Dead Weight Tester  Ho Chi Minh City Bac Ninh Province
Differential Pressure, Manometer	Up to 12.5 mbar 12.5 mbar to 7 bar (7 to 20) bar	0.008 mbar 2.4 mbar 0.009 bar	Differential Pressure Calibrator, Digital Pressure Calibrator, Barometer  Ho Chi Minh City Bac Ninh Province



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**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Air Velocity measure <sup>1</sup>	Up to 40 m/s	0.01 m/s + 1 % reading	Standard Anemometer Ho Chi Minh City Bac Ninh Province
Air Velocity measuring equipment	Up to 40 m/s	0.03 m/s + 1.7 % reading	Wind Tunnel and Standard Anemometer Ho Chi Minh City Bac Ninh Province
Pneumatic Volume Flow Meters <sup>1</sup>	Up to 500 SCCM Up to 50 LPM 50 to 250 LPM	1 SCCM + 0.78 %reading 0.11 LPM + 0.77 %reading 0.54 LPM + 0.78 %reading	Flow Calibrator Unit Ho Chi Minh City Bac Ninh Province
Hardness Testers <sup>1</sup>	HRC		ASTM E18 Indirect Verification using Standard Blocks Ho Chi Minh City Bac Ninh Province
	Low	0.5 HRC	
	Middle	0.5 HRC	
	High	0.5 HRC	
	HRBW		
	Low	0.81 HRB	
Middle	0.81 HRB		
High	0.81 HRB		
HBW			
Low	0.6 HBW		
Middle	1.3 HBW		
High	4.1 HBW		
Hardness Testers <sup>1</sup>	HV		ASTM E92 Indirect Verification using Standard Blocks Ho Chi Minh City Bac Ninh Province
	Low	4.2 HV	
	Middle	10 HV	
	High	14 HV	
	HMV		
	Low	6.6 HMV	
Middle	10 HMV		
High	14 HMV		
Hardness Blocks	Up to 63.2 HRC	0.56 HRC	Hardness Tester w Hardness Blocks Ho Chi Minh City Bac Ninh Province
	Up to 84.4 HRB	1.5 HRB	
	Up to 774 HV	1.2 HV + 1.9% HV	
	Up to 500 HMV	1.2 HMV + 1.9% HMV	
	Up to 83.2 HRBS	1.5 HRBS	

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Volumetric Ware <sup>1</sup> (Pipet, Burette, Graduated Cylinder, Dispenser, Volumetric Flask, Beaker)	Up to 10 ml (10 to 200) ml (200 to 500) ml (500 to 5 000) ml	0.83 µl + 0.11 % of reading 0.01 ml + 0.022 % of reading 0.046 ml + 0.011 % of reading 0.075 ml + 0.0062 % of reading	Analytical Scale, Standard Weight Set, Digital thermometer  Ho Chi Minh City Bac Ninh Province
Micropipettes	Up to 1000 µl (1 to 10) ml	0.04 µl + 0.14 % of reading 0.3 µl + 0.14 % of reading	Analytical Scale, Standard Weight Set, Digital thermometer  Ho Chi Minh City Bac Ninh Province
Grain Moisture Tester <sup>1</sup>	(6 to 40) % Moisture Content	0.2 %Moisture Content	Temperature & Humidity Chamber, Analytical Balance  Ho Chi Minh City Bac Ninh Province
Wood Moisture Tester <sup>1</sup>	(up to 30) %Moisture Content	0.8 %Moisture Content	Standard Decade Resistance Temperature & Humidity Chamber Analytical Balance  Ho Chi Minh City Bac Ninh Province
Density Meter / Hydrometer <sup>1</sup>	(0.6 to 1.0) g/cm <sup>3</sup> (1.0 to 1.6) g/cm <sup>3</sup>	0.000 45 g/cm <sup>3</sup> 0.000 60 g/cm <sup>3</sup>	Reference density meter  Ho Chi Minh City Bac Ninh Province
Durometer – Shore A, B, C, D, D0, O Spring Force  Indenter Dimensions Length Angle Radius	Up to 820 gf Up to 1 533 gf  Up to 5 mm Up to 35° Up to 5 mm	4.5 gf 26 gf  1.3 mm 0.064° 8.5 mm	Direct Verification Rubber Hardness Tester Calibrator, Electronic Balance  Gauge Block Set Profile protractor Profile protractor  Ho Chi Minh City Bac Ninh Province

**Photometry and Radiometry**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Light Meters <sup>1</sup>	Up to 20 000 lx	0.03 lx + 1.3 % of reading	Light System Calibration Ho Chi Minh City Bac Ninh Province
UV-VIS Spectrophotometers <sup>1</sup>	(200 to 880) nm (0 to 2) Au	0.5 nm 0.001 2 Au + 0.58 % of reading	Standard UV-VIS Spectrophotometer Ho Chi Minh City Bac Ninh Province
Gloss Meter <sup>1</sup>	92.4 GU / 20° 94.8 GU / 60° 99.5 GU / 85°	0.7 GU 0.6 GU 0.6 GU	Standards High Gloss Ho Chi Minh City Bac Ninh Province
Light Box (D75, D65, D60, D55, D50, CWF, A, TL84/U35)	(2 000 to 7 500) K	2.3 K + 3.8 % of reading	Chroma Meter Ho Chi Minh City Bac Ninh Province
UV Meters Irradiance (200 to 400) nm	(0.05 to 100) mW/cm2	3.3 % of reading	UV Calibration System Ho Chi Minh City Bac Ninh Province
Color Meter, light source D65,A	Color Space CIE 1931: Tristimulus XYZ: X(13.77 to 94.28) Y(12.28 to 79.63) Z(2.22 to 65.37) Chromacity Coordinate xy: x(0.1992 to 0.6309) y(0.2010 to 0.4792) UCS u'v': u'(0.1420 to 0.4376) v'(0.3608 to 0.5517) CIE L*u*v* L*(41.66 to 91.52) u*(-67.54 to 128.50) v*(-75.42 to 94.64) CEI L*a*b* L*(41.66 to 91.52) a*(-38.89 to 59.50) b*(-54.37 to 93.82)	0.34  0.002 5 0.002 6  0.48  0.43	Reference Color Standard, dimensionless quantity  Ho Chi Minh City Bac Ninh Province



**Photometry and Radiometry**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Color Meter, light source D65,A	Color Space CIE 1964: Tristimulus:XYZ X(13.38 to 94.81) Y(12.45 to 77.41) Z(2.19 to 64.71) Chromaticity Coordinate x;y x(0.1961 to 0.5503) y(0.2210 to 0.4750) UCS u'v' u'(0.1430 to 0.4247) v'(0.3781 to 0.5508) CIE L*u*v* L*(41.92 to 90.51) u*(-66.67 to 116.48) v*(-67.28 to 89.12) CEI L*a*b* L*(41.92 to 90.51) a*(-38.00 to 53.78) b*(-52.50 to 95.55)	0.32  0.002 5 0.002 6  0.44  0.42	Reference Color Standard, dimensionless quantity  Ho Chi Minh City Bac Ninh Province

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity Measuring equipment and measure <sup>1</sup>	Up to 90 %RH (90 to 97) %RH	1.4 %RH 1.7 %RH	Temperature and Humidity Chamber, Temp. & Humidity Meter  Ho Chi Minh City Bac Ninh Province
Temperature – Source/ Measure <sup>1</sup>	(-45 to 150) °C (150 to 350) °C (350 to 650) °C (650 to 1 100) °C (1 100 to 1 800) °C	0.05 °C 0.18 °C 0.14 % reading 0.22 % reading 6.5 °C	Temperature Block / Furnace Calibrator w Reference Thermometer Standard  Ho Chi Minh City Bac Ninh Province

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouples (All Type)	(-45 to 150) °C (150 to 350) °C (350 to 650) °C (650 to 1 100) °C (1 100 to 1 800) °C	0.23 °C 0.23 °C 0.14 % reading 0.22 % reading 6.5 °C	Temperature Block / Furnace Calibrator w Reference Thermometer Standard, Digital Multimeter  Ho Chi Minh City Bac Ninh Province
Infrared (IR) Thermometers <sup>1</sup>	-40 °C (-40 to -15) °C (-15 to 0) °C (0 to 50) °C (50 to 120) °C (120 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C (500 to 600) °C (600 to 800) °C (800 to 1 100) °C	1.4 °C 0.76 °C 0.51 °C 0.48 °C 1.0 °C 1.7 °C 2.4 °C 3.2 °C 4.1 °C 5.2 °C 7.1 °C 10 °C	Black Body Source (flat plate) $\lambda = 8 \text{ to } 14 \mu\text{m}, \epsilon = 0.95$  Ho Chi Minh City Bac Ninh Province
Temperature & Humidity Chambers <sup>1</sup> Dry Oven, furnace, Autoclave, Incubator, Vacuum Oven	(-80 to 0) °C (0 to 140) °C (140 to 300) °C (300 to 1 100) °C (1 100 to 1 600) °C  (10 to 97) %RH	0.36 °C 0.27 °C 0.65 °C 0.1 °C + 0.3 % of reading 3.4 °C + 0.22 % of reading  1.8 %RH	Temperature Data Logger, Humidity Data Logger  Ho Chi Minh City Bac Ninh Province
Dewpoint meter	(-30 to 0) °C (0 to 35) °C	1.9 °C 0.9 °C	Humidity Chamber, Reference Humidity and Temperature meter  Ho Chi Minh City Bac Ninh Province

### Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches/Timers <sup>1</sup>	Up to 24 h	40 ms	Wave Form Generator, Frequency Counter  Ho Chi Minh City Bac Ninh Province
Frequency – Source <sup>1</sup>	1 $\mu$ Hz to 80 MHz 80 MHz to 26.5 GHz	5 pHz/Hz + floor needed 5 pHz/Hz	Wave Form Generator, Frequency Counter  Ho Chi Minh City Bac Ninh Province
Frequency – Measure <sup>1</sup>	100 $\mu$ Hz to 10 Hz 10 Hz to 3 GHz (3 to 12.4) GHz (12.4 to 26.5) GHz	5 pHz/Hz	Frequency Counter  Ho Chi Minh City Bac Ninh Province
Tachometers <sup>1</sup> Contact Non-contact	(10 to 6000) rpm (1 to 100 000) rpm	0.01 % of reading	Universal Counter  Ho Chi Minh City Bac Ninh Province
Speedometer of equipment/ machine	(1 to 99 999) rpm	0.01 % of reading	Tachometer, Universal Counter  Ho Chi Minh City Bac Ninh Province
Time Interval – Measure	Relay Timer: 0 to 100 h Circuit Breaker Analyzer: 0 to 100 s	0.01 % of reading + 0.25 ms 0.001 % of reading + 0.006 ms	Universal counter/ Timer  Ho Chi Minh City Bac Ninh Province
Stroboscope	(1 to 100 000) rpm	0.01 % of reading	Universal Counter, Tachometer  Ho Chi Minh City Bac Ninh Province

## DIMENSIONAL MEASUREMENT

### 1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional <sup>2</sup> (length, hole)	Length: Up to 500 mm Hole: Up to 100 mm	$(0.57 + 0.0069 L) \mu\text{m}$ 2.3 $\mu\text{m}$	Coordinate Measuring Machine, Gauge Block Set  Ho Chi Minh City Bac Ninh Province

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ( $k=2$ ), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope
2.  $L$  = length in meters,  $l$  = length in millimeters,  $R$  = resolution of unit under test.
3. The CMC for scales and balances are highly dependent upon the resolution of the unit under test. The uncertainty presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
4. Unitless linear measure.
5. The nominal values listed are approximate.
6. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1868.



Jason Stine, Vice President

