



CERTIFICATE OF ACCREDITATION

This is to attest that

CSA GROUP TESTING & CERTIFICATION INC.

178 REXDALE BOULEVARD
TORONTO, ONTARIO M9W 1R3, CANADA

Calibration Laboratory CL-227

has met the requirements of AC204, *IAS Accreditation Criteria for Calibration Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date October 16, 2022

Expiration Date September 1, 2024



A handwritten signature in black ink that reads 'Raj Nathan'.

President

SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

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CSA GROUP TESTING & CERTIFICATION INC.

www.csagroup.org

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Accredited to ISO/IEC 17025:2017

Effective Date October 16, 2022

CALIBRATION AND MEASUREMENT CAPABILITY (CMC)*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY ^{1,2} (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
<i>Dimensional</i>			
Outside Micrometers	0 mm to 25 mm 0 inch to 1 inch	0.58 µm 30 µinch	Direct measurement method using gauge blocks
Calipers	0 mm to 1000 mm	0.012 mm	Direct measurement method using gauge blocks
Tape Measures	0 mm to 2000 mm 0 inch to 84 inches	0.58 mm 0.018 inch	Direct measurement method using: Tape measure calibration tool Gauge blocks
Thickness Gauge/Dial Indicator	0 mm to 30.4 mm	0.90 µm	Direct measurement method using gauge blocks
Jigs and Fixtures	Length Measurement: 0 mm to 150 mm 0 mm to 25 mm 0 mm to 300 mm 250 mm to 2000 mm	 0.0038 mm 0.021 mm 0.063 mm 0.63 mm	Direct measurement method using: Measuring Microscope Micrometer Caliper Tape Measure Ruler
	Radius Measurements (2-dimensional items or profiles only): 0.5 mm to 50 mm	 0.0076 mm	Direct measurement method using Measuring Microscope
	Sphere Diameter Measurement: 10 mm to 150 mm	 0.011 mm	Direct measurement method using Micrometer and/or Caliper

* If information in this CMC is presented in non-SI units, the conversion factors stated in NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" apply.

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY ^{1,2} (\pm)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Digital Protractors / Levels	Angle Measurements: 0° to 359°	0.11°	Direct measurement method using Measuring Microscope
	0° to 90°	0.07°	Direct measurement method using Sine Bar and Gauge Blocks
Mechanical			
Linear Speed – Measure ⁴	2000 mm/s	12 mm/s	Indirect measurement method using: Tachometer for rotational speed measurement Caliper and Measuring Microscope for radius measurement
Density – Measure (Calibration of Hardwood Test Floor)	700 kg/m ³	14 kg/m ³	Indirect measurement method using: Caliper & Tape Measure for dimensional volume, weigh scale for weight
Pressure Gauges	100 psi to 500 psi 200 psi to 1000 psi 1000 psi to 5000 psi 3000 psi to 15000 psi 0 psi to 100 psi 0 psia to 15 psia -14.5 psi to 0 psi 4 inH ₂ O to 200 inH ₂ O	0.009 % + 0.14 psi 0.0075 % + 0.35 psi 0.0056 % + 2.0 psi 0.0077 % + 4.5 psi 0.030 psi 0.010 psi 0.010 psi 0.12 inH ₂ O	Direct measurement method using: Fluke E-DWT-H Crystal XP2i-100 Crystal 15PSIXP2i-S5 Crystal 16PSIBXP2i-S5 Ametek RK-1100WC
	Pressure Ramp: 0 mbar to 50 mbar @ 60 mbar/min	3.3 mbar/min	Indirect measurement method using: Crystal 15PSIXP2i-S5 pressure gauge with time logging capability
Weights	10 mg to 220 g 41 g to 4.1 kg 4 kg to 24 kg 24 kg to 300 kg	0.00065 g 0.068 g 0.0025 kg 0.27 kg	Direct measurement method using: Mettler Toledo XPE206DR Mettler DM4600 Mettler Toledo PE24 Mettler-Toledo PBA220-CC300B
Torque (Dynamometer)	10 ozf in to 440 ozf in 10 lbf in to 100 lbf in 5 N m to 60 N m	0.052 % + 0.023 ozf in 0.13 % + 0.018 lbf in 0.053 % + 0.038 N m	Direct measurement method using: Weights Weigh Scale Protractor Torque Beam

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Thermal			
Temperature - Generate ³	0 °C to 90 °C	0.16 °C	Direct measurement method using: Fluke 7312 Fluke 5616 Fluke 1529
	-30 °C to 50 °C 50 °C to 150 °C	0.14 °C 0.22 °C	
Simulated Temperature - Generate ³			Direct measurement method using Fluke 5522A or 5520A
Thermocouple Type J	-210 °C to -100 °C	0.22 °C	
	-100 °C to 30 °C	0.12 °C	
	30 °C to 150 °C	0.13 °C	
	150 °C to 760 °C	0.14 °C	
	760 °C to 1200 °C	0.15 °C	
Thermocouple Type K	-200 °C to -100 °C	0.26 °C	
	-100 °C to -25 °C	0.15 °C	
	-25 °C to 120 °C	0.14 °C	
	120 °C to 1000 °C	0.21 °C	
	1000 °C to 1372 °C	0.21 °C	
Thermocouple Type T	-250 °C to -150 °C	0.49 °C	
	-150 °C to 0 °C	0.20 °C	
	0 °C to 120 °C	0.14 °C	
	120 °C to 400 °C	0.12 °C	
Temperature - Measure ⁴	-50 °C to 90 °C	0.30 °C	Direct measurement method using Vaisala HMT337
	90 °C to 150 °C	0.49 °C	
Relative Humidity - Measure ⁴	10 %RH to 90 %RH (15 °C to 25 °C)	1.3 %RH	Direct measurement method using Vaisala HMT337
	90 %RH to 95 %RH (15 °C to 25 °C)	2.3 %RH	
	10 %RH to 95 %RH (25 °C to 40 °C)	1.5 %RH	
	10 %RH to 95 %RH (40 °C to 95 °C)	2.0 %RH	

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Electrical – DC/LF			
DC Voltage - Measure ⁴	20 mV to 200 mV	5.6 μ V/V	Direct measurement method using: Fluke 8508A
	200 mV to 2 V	3.7 μ V/V	
	2 V to 20 V	3.7 μ V/V	
	20 V to 200 V	5.3 μ V/V	Direct measurement method using: Ross Eng. VD195-7.7-CD-LB-NV Fluke 8846A
	200 V to 1050 V	6.4 μ V/V	
	10 kV to 150 kV	0.40 %	
	1 kV to 10 kV	0.70 %	Direct measurement method using: Fluke 80E Fluke 8846A
DC Current - Measure ⁴	2 μ A to 200 μ A	12 μ A/A + 0.0002 μ A	Direct measurement method using: Fluke 8508A
	200 μ A to 2 mA	12 μ A/A + 0.003 μ A	
	2 mA to 20 mA	12 μ A/A + 0.035 μ A	
	20 mA to 200 mA	36 μ A/A + 0.4 μ A	
	200 mA to 2 A	160 μ A/A + 13 μ A	
	2 A to 20 A	370 μ A/A + 160 μ A	
DC Resistance - Measure ⁴	Normal Mode (4-wire)		Direct measurement method using: Fluke 8508A
	0 Ω to 2 Ω	35 μ Ω / Ω	
	2 Ω to 20 Ω	11 μ Ω / Ω	
	20 Ω to 200 Ω	8.8 μ Ω / Ω	
	200 Ω to 2 k Ω	9.3 μ Ω / Ω	
	2 k Ω to 20 k Ω	8.8 μ Ω / Ω	
	20 k Ω to 100 k Ω	9.4 μ Ω / Ω	
	Normal Mode (2-wire)		
	20 k Ω to 200 k Ω	9.6 μ Ω / Ω	
	200 k Ω to 2 M Ω	12 μ Ω / Ω	
2 M Ω to 20 M Ω	41 μ Ω / Ω		
20 M Ω to 200 M Ω	0.18 %		
200 M Ω to 1 G Ω	0.16 %		
AC Voltage - Measure ⁴	2 mV to 200 mV	150 μ V/V	Direct measurement method using: Fluke 8508A
	(10 Hz to 40 Hz)	120 μ V/V	
	(40 Hz to 2 kHz)	120 μ V/V	
	(2 kHz to 10 kHz)	120 μ V/V	
	(10 kHz to 30 kHz)	130 μ V/V	
	200 mV to 2 V	340 μ V/V	
	(30 Hz to 100 Hz)	92 μ V/V	
	(10 Hz to 40 Hz)	77 μ V/V	
(40 Hz to 100 Hz)	77 μ V/V		
(100 Hz to 2 kHz)	77 μ V/V		

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AC Voltage - Measure ⁴ continued	200 mV to 2 V (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz)	92 µV/V 230 µV/V 620 µV/V 2.6 % 2.6 %	Direct measurement method using: Fluke 8508A	
	2 V to 20 V (10 Hz to 40 Hz) (40 Hz to 100 Hz) (100 Hz to 2 kHz) (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz)	110 µV/V 77 µV/V 77 µV/V 77 µV/V 92 µV/V 230 µV/V 610 µV/V 0.42 %		
	20 V to 200 V (10 Hz to 40 Hz) (40 Hz to 100 Hz) (100 Hz to 2 kHz) (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 0.5 MHz) (0.5 MHz to 1 MHz)	110 µV/V 77 µV/V 77 µV/V 77 µV/V 92 µV/V 230 µV/V 620 µV/V 0.49 % 4.9 %		
	200 V to 1000 V (40 Hz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz)	120 µV/V 120 µV/V 430 µV/V		
	1 kV to 7 kV (60 Hz)	0.70 %		Direct measurement method using: Fluke 80E Fluke 8846A
	7 kV to 70 kV (60 Hz)	0.36 %		Direct measurement method using: Ross Eng. VD195-7.7- CD-LB-NV & Fluke 8846A
	AC Current -Measure ⁴	2 µA to 200 µA (20 Hz to 10 kHz)		650 µA/A
200 µA to 20 mA (20 Hz to 10 kHz)		450 µA/A		

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AC Current -Measure ⁴ continued	20 mA to 200 mA (20 Hz to 10 kHz)	420 μ A/A	Direct measurement method using: Fluke 8508A
	200 mA to 2 A (20 Hz to 1 kHz) (1 kHz to 10 kHz)	730 μ A/A 730 μ A/A	
	2 A to 20 A (20 Hz to 1 kHz) (1 kHz to 5 kHz)	800 μ A/A 800 μ A/A	
AC High Current - Measure ⁴ at 60 Hz	20 A to 200 A	0.40 mA/A +0.18 A	Indirect measurement method using: Resistive Shunt Fluke 8508A
	200 A to 600 A 600 A to 2000 A	0.63 mA/A + 1.5 A 0.45 mA/A + 3.0 A	Indirect measurement method using: Step-down current transformer Fluke 8508A
DC Voltage - Generate ³	0 mV to 329.9999 mV 0 V to 3.299999 V 0 V to 32.99999 V 30 V to 329.9999 V 100 V to 1020.000 V	15 μ V/V + 0.80 μ V 8.7 μ V/V + 1.6 μ V 9.5 μ V/V + 15 μ V 14 μ V/V + 110 μ V 14 μ V/V + 1100 μ V	Direct measurement method using: Fluke 5522A
DC Current - Generate ³	0 A to 10.00 A 10.00 A to 500.00 A 500.00 A to 999.9 A	79 mA 2.3 A 3.9 A	Direct measurement method using: Fluke 5522A, 5500A 50-turn current coil
	-329.9999 μ A to 329.9999 μ A 0 mA to 3.299999 mA 0 mA to 32.99999 mA 0 mA to 329.9999 mA 0 A to 1.099999 A 1.1 A to 2.999999 A 0 A to 10.99999 A -20.5 A to 20.5 A	110 μ A/A +0.017 μ A 77 μ A/A +0.039 μ A 77 μ A/A +0.020 μ A 77 μ A/A +0.020 μ A 155 μ A/A + 31 μ A 290 μ A/A + 32 μ A 380 μ A/A + 410 μ A 770 μ A/A + 590 μ A	
	0.2000 A to 2.0000 A 2.0000 A to 20.000 A 20 A to 32.99999 A 33 A to 120 A	0.02 % 0.03 % 0.03 % 0.26 %	Direct measurement method using: Fluke 52120A Fluke 5522A

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DC Resistance -Generate ³	(4-wire method) 0 Ω to 10.9999 Ω 11 Ω to 32.9999 Ω 33 Ω to 109.9999 Ω 110 Ω to 329.9999 Ω 330 Ω to 1.099999 k Ω 1.1 k Ω to 3.299999 k Ω 3.3 k Ω to 10.99999 k Ω 11 k Ω to 32.99999 k Ω 33 k Ω to 109.9999 k Ω	31 $\mu\Omega/\Omega$ + 0.77 m Ω 25 $\mu\Omega/\Omega$ + 1.1 m Ω 22 $\mu\Omega/\Omega$ + 1.0 m Ω 21 $\mu\Omega/\Omega$ + 1.6 m Ω 21 $\mu\Omega/\Omega$ + 1.8 m Ω 21 $\mu\Omega/\Omega$ + 16 m Ω 21 $\mu\Omega/\Omega$ + 18 m Ω 21 $\mu\Omega/\Omega$ + 160 m Ω 21 $\mu\Omega/\Omega$ + 160 m Ω	Direct measurement method using: Fluke 5522A
	(2-wire method) 110 k Ω to 329.99999 k Ω 330 k Ω to 1.099999 M Ω 1.1 M Ω to 3.299999 M Ω 3.3 M Ω to 10.99999 M Ω 11 M Ω to 32.99999 M Ω 33 M Ω to 109.9999 M Ω 110 M Ω to 329.9999 M Ω 330 M Ω to 1100 M Ω	24 $\mu\Omega/\Omega$ + 1.6 m Ω 24 $\mu\Omega/\Omega$ + 1.8 m Ω 46 $\mu\Omega/\Omega$ + 23 m Ω 100 $\mu\Omega/\Omega$ + 38 m Ω 190 $\mu\Omega/\Omega$ + 1.9 Ω 380 $\mu\Omega/\Omega$ + 2.5 Ω 2.3 m Ω/Ω + 77 Ω 11 m Ω/Ω + 670 Ω	
	1 m Ω 10 m Ω 100 m Ω 1 Ω 10 Ω 100 Ω	0.47 $\mu\Omega$ 3.4 $\mu\Omega$ 11 $\mu\Omega$ 90 $\mu\Omega$ 180 m Ω 84 m Ω	Direct measurement method using: Yokogawa Type 2792
AC Voltage -Generate ³	1 mV to 32.99999 mV (10 Hz to 45 Hz) (45 Hz to 10 kHz) (10 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 500 kHz)	620 $\mu\text{V}/\text{V}$ + 4.6 μV 120 $\mu\text{V}/\text{V}$ + 4.6 μV 160 $\mu\text{V}/\text{V}$ + 4.6 μV 780 $\mu\text{V}/\text{V}$ + 4.5 μV 2700 $\mu\text{V}/\text{V}$ + 9.4 μV 6500 $\mu\text{V}/\text{V}$ + 44 μV	Direct measurement method using: Fluke 5522A (sine wave)
	33 mV to 329.999 mV (10 Hz to 45 Hz) (45 Hz to 10 kHz) (10 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 500 kHz)	230 $\mu\text{V}/\text{V}$ + 6.3 μV 110 $\mu\text{V}/\text{V}$ + 6.3 μV 120 $\mu\text{V}/\text{V}$ + 6.5 μV 270 $\mu\text{V}/\text{V}$ + 6.2 μV 620 $\mu\text{V}/\text{V}$ + 24 μV 1500 $\mu\text{V}/\text{V}$ + 58 μV	
	0.33 V to 3.29999 V (10 Hz to 45 Hz) (45 Hz to 10 kHz) (10 kHz to 20 kHz) (20 kHz to 50 kHz)	230 $\mu\text{V}/\text{V}$ + 39 μV 120 $\mu\text{V}/\text{V}$ + 42 μV 140 $\mu\text{V}/\text{V}$ + 53 μV 230 $\mu\text{V}/\text{V}$ + 39 μV	

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AC Voltage -Generate ³ continued	0.33 V to 3.29999 V (50 kHz to 100 kHz) (100 kHz to 500 kHz)	540 μ V/V + 95 μ V 1800 μ V/V + 500 μ V	Direct measurement method using: Fluke 5522A (sine wave)
	3.3 V to 32.9999 V (10 Hz to 45 Hz) (45 Hz to 10 kHz) (10 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz)	230 μ V/V + 0.53 mV 110 μ V/V + 0.52 mV 180 μ V/V + 0.51 mV 270 μ V/V + 0.46 mV 700 μ V/V + 1.2 mV	
	33 V to 329.999 V (45 Hz to 1 kHz) (1 kHz to 10 kHz) (10 kHz to 20 kHz) (20 kHz to 50 kHz) 50 kHz to 100 kHz)	150 μ V/V + 1.2 mV 140 μ V/V + 2.2 mV 190 μ V/V + 4.9 mV 230 μ V/V + 4.7 mV 1500 μ V/V + 42 mV	
	330 V to 1020 V (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	230 μ V/V + 8.0 mV 190 μ V/V + 9.7 mV 230 μ V/V + 8.0 mV	
AC Current -Generate ³	29 μ A to 329.9999 μ A (10 Hz to 20 Hz) (20 Hz to 45 Hz) (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) (10 kHz to 30 kHz)	0.15 % + 0.081 μ A	Direct measurement method using: Fluke 5522A
		0.11 % + 0.083 μ A	
		0.09 % + 0.083 μ A	
		0.23 % + 0.11 μ A	
		0.62 % + 0.15 μ A	
	1.2 % + 0.34 μ A		
	0.33 mA to 3.29999 mA (10 Hz to 20 Hz) (20 Hz to 45 Hz) (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) (10 kHz to 30 kHz)	0.15 % + 0.15 μ A	
		0.095 % + 0.12 μ A	
		0.076 % + 0.12 μ A	
3.3 mA to 32.99999 mA (10 Hz to 20 Hz) (20 Hz to 45 Hz) (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) (10 kHz to 30 kHz)	0.15 % + 0.19 μ A		
	0.38 % + 0.27 μ A		
	0.77 % + 0.48 μ A		
	0.14 % + 1.4 μ A		
	0.069 % + 1.5 μ A		
	0.030 % + 1.6 μ A		
	0.060 % + 1.7 μ A		
	0.15 % + 2.7 μ A		
	0.31 % + 3 μ A		

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AC Current Generate ³ continued	33.00 mA to 329.9999 mA (10 Hz to 20 Hz) (20 Hz to 45 Hz) (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) (10 kHz to 30 kHz)	0.14 % + 14 µA 0.070 % + 14 µA 0.031 % + 15 µA 0.078 % + 38 µA 0.15 % + 81 µA 0.31 % + 150 µA	Direct measurement method using: Fluke 5522A
	0.33 A to 1.099999 A (10 Hz to 45 Hz) (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	0.14 % + 70 µA 0.038 % + 80 µA 0.046 % + 770 µA 1.9 % + 4.0 mA	
	1.1 A to 2.999999 A (10 Hz to 45 Hz) (45 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	0.14 % + 60 µA 0.046 % + 78 µA 0.046 % + 780 µA 1.9 % + 4.2 mA	
	3.0 A to 10.99999 A (45 Hz to 100 Hz) (100 Hz to 1 kHz) (1 kHz to 5 kHz)	0.047 % + 1.4 mA 0.078 % + 1.4 mA 2.3 % + 5 mA	
	11 A to 20 A (45 Hz to 100 Hz) (100 Hz to 1 kHz) (1 kHz to 5 kHz)	0.093 % + 3.7 mA 0.11 % + 4.8 mA 2.3 % + 5.0 mA	
	(60 Hz) 0.2000 A to 32.99999 A 33 A to 120 A	0.06 % 0.60 %	
Clamp-on Current Meter	(50 Hz) 10 A to 100 A 100 A to 500 A 500 A to 900 A	0.15 % + 73 mA 0.67 % + 450 mA 0.43 % + 730 mA	Direct measurement method using: Fluke 5522A 5500A 50-turn current Coil
	(440 Hz) 300 A	3.0 A	
	(50 Hz) 900.0 A to 1000.0 A 1000.0 A to 2000.0 A 2000.0 A to 2500.0 A	0.68 A 0.80 A 0.85 A	
			Direct measurement method using: Fluke 5522A 5500A 50-turn current Coil (Simulated current from voltage input)

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DC Power - Generate ³	0 W to 60.000 W 60.000 W to 100.000 W 100.000 W to 600.000 W	5.9 mW 20 mW 0.11 W	Direct measurement method using: Fluke 5522A
AC Power - Generate ³	(60 Hz, PF = 1) 500 mW to 2 W 2 W to 300 W 300 W to 600 W 600 W to 1000 W 1000 W to 2000 W 2000 W to 4800 W (1 kHz, PF = 1) 1.00000 W 100.00 W (10 kHz, PF = 1) 100.00 mW 2.0000 W (20 kHz) 2.0000 W	350 μ W/W +0.13 mW 500 μ W/W - 0.2 mW 570 μ W/W - 23 mW 800 μ W/W - 170 mW 1.6 mW/W - 970 mW 1.6 mW/W + 0.75 W 0.50 mW 50 mW 0.51 mW 6.8 mW 24 mW	Direct measurement method using: Fluke 5522A
Electrical AC Energy Consumption – Generate ³	300 W·h	13 mW·h	Direct measurement method using: Fluke 5522A
Ampere Hour Verification	1 A·h	0.65 mA·h	Direct measurement method using: Fluke 5522A
Time Integration Verification	\geq 24 h	0.59 s	Direct measurement method using: Fluke 5522A + Fluke 53220A
Power Factor Calibration PF=0, Range: 5 A, 15 V & 150 V @ 60 Hz Lead & Lag	50 VA to 500 VA	0.04 VA	Direct measurement method using: Fluke 5522A

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Power Factor Calibration continued Power Factor Test (Source) Range: 5 A, 150 V @ 60 Hz Lead Range: 5 A, 150 V @ 60 Hz Lag	 1.00000 0.80000 0.60000 0.40000 0.30000 0.80000 0.60000 0.40000 0.30000	 0.0058 % 0.1 % 0.18 % 0.31 % 0.43 % 0.1 % 0.18 % 0.31 % 0.43 %	Direct measurement method using: Fluke 5522A
Phase Calibration Lead/Lag Test 90.0° Lead, 1 A, 150 V @ 1 kHz -90.0° Lead, 1 A, 150 V @ 1 kHz	 90.00° -90.00°	 0.06° 0.06°	Direct measurement method using: Fluke 5522A
Harmonics Measurement Verification Voltage Harmonics 1 st order to 15 th order @ 60 Hz Current Harmonics 1 st order to 25 th order @ 50 Hz to 400 Hz	 150.000 V 1.0000 A	 24 mV 0.74 mA	Direct measurement method using: Fluke 5522A
Capacitance – Measure ⁴	0.015 µF to 0.022 µF 0.022 µF to 0.15 µF 0.15 µF to 0.22 µF	0.95 % 0.15 % 0.10 % (at 1 V _{rms} , 1 kHz)	Direct measurement method using: GenRad 1693
Capacitance – Generate ^{3,5}	3.3 nF to 10.9999 nF 33 nF to 109.999 nF 0.33 µF to 1.09999 µF 1.1 µF to 3.29999 µF 3.3 µF to 10.9999 µF 33 µF to 109.999 µF 110 µF to 329.999 µF 0.33 mF to 1.09999 mF 3.3 mF to 10.9999 mF	18 pF 5.8 pF 2.3 nF 4.5 nF 18 nF 0.40 µF 1.1 µF 4.0 µF 43 µF	Direct measurement method using: Fluke 5522A

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY ^{1,2} (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Duty Cycle Measurement	15 % @ 50 kHz 15.000 V @ 100 kHz	0.06 % 12 mV	Direct measurement method using: Fluke 5522A
Inductance – Measure ⁴	1 mH to 95 mH	0.4 µH (at 1 Vrms, 1 kHz)	Direct measurement method using: GenRad 1693
Oscilloscope Calibration Trigger Level or Threshold Accuracy	0 V to 10 V (@ 1 mV/div to 100 mV/div, Main Trigger Level, DC Coupled, Positive & Negative Slope)	3.9 mV	Direct measurement method using: Fluke 5522A SC1100 GHz Oscilloscope Option)
Oscilloscope Calibration DC Voltage Gain Accuracy	(50 Ω, 20 MHz Bandwidth) 1 mV to 1.0 V 14.00 V	58 µV 7.0 mV	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration DC Voltage	0 V to ± 6.6 V into 50 Ω 0 V to ± 150 mV 150 mV to 300 mV 300 mV to 600 mV 600 mV to 3.00 V 0 V to ± 130 V into 1 MΩ 0 mV to 6.00 mV 6.00 mV to 15 mV 15 mV to 30 mV 30 mV to 150 mV 150 mV to 300 mV 300 mV to 600 mV 600 mV to 3.00 V 3.00 V to 10.00 V 18.0 V	34 µV 0.11 mV 0.27 mV 1.3 mV 100 µV 37 µV 43 µV 0.11 mV 0.16 mV 0.27 mV 1.3 mV 3.9 mV 7.0 mV	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration DC Gain Accuracy 1 MΩ, 20 MHz Bandwidth, Analogue	1 mV to 1.0 V 11.6 V, 10 V Offset 18.0 V, 10 V Offset 1.04 V, 1 V Offset	58 µV 4.5 mV 7.0 mV 0.44 mV	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration Sample Rate and Delay Time Accuracy	1.000000 ms	2.0 ns	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)

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Oscilloscope Calibration Time Base Accuracy	10.000000 MHz	25 Hz	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration Delta Time Accuracy	4.0 ns/div to 400 μ s/div (2.4 kHz to 240 MHz, 5 mV/div to 1.0 V/div)	0.58 ps	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration Input Impedance	50 Ω 1 M Ω 50 Ω 1 M Ω	39 m Ω 970 Ω 70 m Ω 5.8 k Ω	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration External Leakage Current Test	(DC, 50 Ω and 1 M Ω) -0.00997 mV	6.4 μ V	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Oscilloscope Calibration Offset Accuracy 50 Ω	1 mV/div 2 mV/div 10 mV/div 50 mV/div 100 mV/div	1.8 mV 1.0 mV 1.0 mV 0.33 mV 9.7 mV	Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
1 M Ω	1 mV/div 2 mV/div 10 mV/div 50 mV/div 1.0 V/div	0.38 mV 1.0 mV 1.0 mV 0.33 mV 69 mV	
Oscilloscope Probes Calibration			Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
Attenuation Test	1.000 V @ 10 V & 100 V	16 μ V	
Input Resistance Test	10.00 M Ω 20.2 M Ω 100 M Ω 50 M Ω 67 M Ω	3.2 k Ω 130 k Ω 630 k Ω 180 k Ω 13 k Ω	

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Oscilloscope Probes Calibration continued			Direct measurement method using: Fluke 5522A SC1100 (1.1 GHz Oscilloscope Option)
DC Voltage Test	1.000 V	29 µV	
AC Voltage Test	1.0 V @ 60 Hz to 1 kHz	0.74 mV	
DC Amplitude	0.600 V @ 6 A	25 µV	
	1.200 V @ 12 A	31 µV	
	1.800 V @ 18 A	82 µV	
	2.400 V @ 24 A	89 µV	
	3.00 A @ 30 A	97 µV	
	0.300 V @ 30 A	39 µV	
	0.600 V @ 60 A	0.30 mV	
	0.900 V @ 90 A	0.33 mV	
	1.200 V @ 120 A	0.22 mV	
	1.500 V @ 150 A	0.17 mV	
AC Amplitude	0.600 V @ 6 A/45 Hz	0.51 mV	
	1.200 V @ 12 A/50 Hz	2.9 mV	
	1.800 V @ 18 A/55 Hz	3.2 mV	
	2.400 V @ 24 A/60 Hz	3.4 mV	
	3.00 V @ 30 A/65 Hz	3.7 mV	
	0.300 V @ 30 A/45 Hz	0.38 mV	
	0.600 V @ 60 A/50 Hz	0.54 mV	
	0.900 V @ 90 A/55 Hz	0.80 mV	
	1.200 V @ 120 A/60 Hz	2.9 mV	
	1.500 V @ 150 A/65 Hz	3.1 V	
DC Output 1/10	3.500 V @ 35 V	0.14 mV	
	2.500 V @ 25 V	91 µV	
	1.500 V @ 15 V	72 µV	
	0.500 V @ 5 V	43 µV	
	-0.500 V @ 5 V	49 µV	
	-1.500 V @ 15 V	90 µV	
	-2.500 V @ 25 V	0.12 mV	
-3.500 V @ 35 V	0.16 mV		
AC Output 1/10	2.500 V @ 25 V/100 Hz	3.5 mV	
DC Output 1/100	3.500 V @ 350 V	0.12 mV	
	2.500 V @ 250 V	93 µV	
	1.500 V @ 150 V	71 µV	
	-1.500 V @ 150 V	98 µV	
	-2.500 V @ 250 V	0.10 mV	
	-3.500 V @ 250 V	0.15 mV	
1000x Gain	0.100 V @ 100 V/70 Hz	79 µV	
100x Gain	1.00 V @ 100 V/70 Hz	0.72 mV	

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<i>Time and Frequency</i>			
Frequency - Generate ³	1 Hz to 90.0000 kHz	0.58 mHz	Direct measurement method using: Fluke 5522A
Frequency - Measure ⁴ (Mechanical Rotation) (Non-contact)	200 rpm to 1000 rpm 1000 rpm to 8000 rpm	1.4 rpm 2.6 rpm	Direct measurement method using: Tachometer
Digital Stopwatches /Timer	>= 24 h	0.68 s	Direct measurement method using: GPS Synchronized Clock
Sample Rate and Delay Time Accuracy	0 ms to 100.000000 ms	0.10 µs	Direct measurement method using: Agilent 33250A

¹The uncertainty covered by the Calibration and Measurement Capability (CMC) is expressed as the expanded uncertainty having a coverage probability of approximately 95 %. It is the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing calibrations of a best existing device. The measurement uncertainty reported on a calibration certificate may be greater than that provided in the CMC due to the behavior of the calibration item and other factors that may contribute to the uncertainty of a specific calibration.

²When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.

³Capability is suitable for the calibration of measuring devices in the stated ranges.

⁴Capability is suitable for the calibration of devices intended to generate the indicated quantity in the stated ranges.