National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Transcat - Rochester	**Fields of Calibration**
35 Vantage Point Drive Rochester, NY 142624 Mr. Dusty Tank Phone: 585-352-9720 Fax: 800-395-0543 E-mail: ftank@transcat.com URL: www.transcat.com	Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Electromagnetics – RF/Microwave Thermodynamic This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	**Range**	**Uncertainty (*k*=2)** Note 3,9	**Remarks**
DIMENSIONAL			
ANGULAR (20/D01)			
Angle Measuring Equipment	0º to 89º 90º	4.4” 1.1”	Angle Blocks Granite Square
LENGTH & DIAMETER; STEP GAGES (20/D05)			
Micrometers & Calipers – Outside, Inside, Depth Field calibrations Available Note 4	0 in to 0.4 in 0.4 in to 1 in 1 in to 4 in 4 in to 15 in 15 in to 24 in	9.1 µin + 0.7 µin/in 8.7 µin + 1.5 µin/in 5.7 µin + 4.3 µin/in 12 µin + 4.6 µin/in 17 µin + 4.4 µin/in	Comparison to Gage Blocks
Anvil Flatness Field calibrations Available Note 4	0 in to 4 in	5.0 µin	Optical Flats
Anvil Parallelism Field calibrations Available Note 4	0 in to 1 in	6.6 µin	Optical Parallels
Digital & Dial Indicators Field calibrations Available Note 4	0 in to 6 in	6.3 µin + 3.2 µin/in	Gage Blocks/ Surface Plate

2014-10-01 through 2015-09-30

Effective dates

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,9	Remarks
Single Axis – Outside	0 in to 1 in 1 in to 2 in 2 in to 6 in 6 in to 12 in 12 in to 24 in	3.9 µin + 0.5 µin/in 2.9 µin + 1.5 µin/in 1.0 µin + 2.5 µin/in 4.5 µin + 1.9 µin/in 53 µin + 3.0 µin/in	P & W Labmaster P & W U304393
Single Axis – Inside	0.06 in to 2 in 2 in to 6 in 6 in to 12 in	6.2 µin to 2.0 µin/in 6.9 µin + 1.5 µin/in 24 µin + 1.1 µin/in	P & W Labmaster
Height Measuring Equipment Field calibrations Available Note 4	0 in to 4 in 4 in to 24 in	26 µin + 0.5 µin/in 16 µin + 3 µin/in	Comparison to Gage Blocks
Height Measure	0 in to 12 in	28 µin + 3.2 µin/in	Gage Blocks & Amplifier
Squareness	0 in to 18 in	5.9 µin/in	Comparison to Master Square
Length Measuring Equipment – Linear Displacement	0 ft to 12 ft	1.0 µin + 2.1 µin/in	Laser Interferometer
Optical Comparator Length	0 in to 6 in	212 µin + 19 µin/in	Calibration Grids
Squareness	0.04 in to 0.5 in 0.5 in to 1 in	245.8 µin + 1.5 µin/in 244.8 µin + 3.5 µin/in	
Magnification	10X to 50X	240 µin + 21 µin/in	Magnification Checker Scale
MEASURING WIRES (20/D07)			
Thread Wires	2 TPI to 120 TPI	13 µin	P & W Labmaster
SPHERICAL DIAMETER; PLUG/RING GAGES (20/D11)			
Plug Gage – Outer Diameter	0 in to 6 in	7.4 µin + 1.3 µin/in	P & W Labmaster
Plain Rings – Inner Diameter	0 in to 2 in 2 in to 6 in	6.2 µin + 2.0 µin/in 6.9 µin + 1.5 µin/in	P & W Labmaster

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,9]	Remarks
	6 in to 12 in	23 µin + 1.2 µin/in	
SURVEYING RODS AND TAPES (20/D13)			
Tapes and Rulers	0 ft to 6 ft 6 ft to 12 ft 12 ft to 100 ft	400 µin + 2 µin/in 400 µin + 7 µin/in 400 µin + 6 µin/in	Accu-Gage
THREADED PLUG & RING GAGES (20/D14)			
Thread Plug			
Pitch Diameter	0 in to 7 in	79 µin	Labmaster with thread wires
Major Diameter	0 in to 7 in	7.4 µin + 1.3 µin/in	
Tapered Thread Plug			
Pitch Diameter	0 in to 3 in	90 µin	Labmaster with thread wires
Standoff	0 in to 1 in	31 µin	Gage Blocks & Amplifier
Ring			
Inner Pitch Diameter	0 in to 2 in	79 µin	Uncertainty derived from Master Plugs.
Two Dimensional Gages (20/D15)			
Two Axis (X-Y)	0.00005 in to 1 in 1 in to 2 in 2 in to 3 in 3 in to 4 in 4 in to 5 in 5 in to 6 in 6 in to 9 in 9 in to 12 in	84 µin 90 µin 96 µin 0.0001 in 0.00011 in 0.00012 in 0.00014 in 0.00016 in	Starrett Galileo
Z Axis	0.1 in to 1 in 1 in to 2 in 2 in to 4 in 4 in to 5 in	0.00015 in 0.00015 in 0.00016 in 0.00017 in	

2014-10-01 through 2015-09-30

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Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) [Note 3,5]	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
AC/DC Difference (to 100 MHz) (20/E01)				
Sinewave Flatness Field calibrations Available [Note 4]	0 V to 3 V	10 Hz to 1 MHz 1 MHz to 10 MHz 10 MHz to 30 MHz 30 MHz to 50 MHz 50 MHz to 80 MHz 80 MHz to 100 MHz	0.06 % 0.10 % 0.18 % 0.41 % 0.71 % 0.84 %	Thermal Converter/HP3458A
AC RESISTORS and CURRENT (20/E02)				
ACI Measuring Equipment Field calibrations Available [Note 4]	0 µA to 220 µA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.031 % + 16 nA 0.019 % + 10 nA 0.015 % + 8.0 nA 0.030 % + 12 nA 0.11 % + 65 nA	Fluke 5700
	220 µA to 2.2 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.030 % + 40 nA 0.018 % + 35 nA 0.014 % + 35 nA 0.021 % + 0.11 µA 0.11 % + 0.65 µA	
	2.2 mA to 22 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.039 % + 0.40 µA 0.019 % + 0.35 µA 0.014 % + 0.35 µA 0.021 % + 0.55 µA 0.11 % + 5.0 µA	
	22 mA to 220 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.033 % + 4.0 µA 0.018 % + 3.5 µA 0.014 % + 2.5µA 0.021 % + 3.5 µA 0.11 % + 10 µA	
	220 mA to 2.2 A	0.02 kHz to 1 kHz 1 kHz to 5 kHz	0.027 % + 35 µA 0.046 % + 80 µA	

2014-10-01 through 2015-09-30

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) [Note 3,5]	Remarks
		5 kHz to 10 kHz	0.70 % + 0.16 mA	
	2.2 A to 11 A	0.04 kHz to 1 kHz	0.048 % + 0.17 mA	Fluke 5700A/EP w/5725A
		1 kHz to 5 kHz	0.096 % + 0.38 mA	
		5 kHz to 10 kHz	0.36 % + 0.75 mA	
	11 A to 20.5 A	10 Hz to 100 Hz	0.097 % + 3.9 mA	Fluke 5520A
		100 Hz to 1 kHz	0.12 % + 3.9 mA	
		1 kHz to 5 kHz	2.3 % + 3.9 mA	
	20.5 A to 40 A	10 Hz to 100 Hz	0.14 % + 11mA	2 Fluke 5520As in Parallel
		100 Hz to 1 kHz	0.17 % + 11mA	
		1 kHz to 5 kHz	3.3 % + 11 mA	
Extended Frequency Ranges Field calibrations Available [Note 4]	29 µA to 330 µA	10 kHz to 30 kHz	1.2 % + 0.31 µA	Fluke 5520A
	330 µA to 3.3 mA	10 kHz to 30 kHz	0.78 % + 0.47 µA	
	3.3 mA to 33 mA	10 kHz to 30 kHz	0.31 % + 3.1 µA	
	33 mA to 330 mA	10 kHz to 30 kHz	0.31 % + 0.16 mA	
Clamp-on Ammeter Toroidal Type Field calibrations Available [Note 4]	20 A to 150 A	45 Hz to 65 Hz	0.30 % + 0.026 A	Fluke 5520A w/5500A/Coil
	20 A to 150 A	65 Hz to 440 Hz	0.83 % + 0.047 A	
	150 A to 1000 A	45 Hz to 65 Hz	0.35 % + 0.12 A	
	150 A to 1000 A	65 Hz to 440 Hz	1.1 % + 0.22 A	
Clamp-on Ammeter Non-Toroidal Type Field calibrations Available [Note 4]	20 A to 150 A	45 Hz to 65 Hz	0.57 % + 0.25 A	Fluke 5520A w/5500A/Coil
	20 A to 150 A	65 Hz to 440 Hz	1.0 % + 0.25 A	
	150 A to 1000 A	45 Hz to 65 Hz	0.60 % + 0.90 A	
	150 A to 1000 A	65 Hz to 440 Hz	1.3 % + 0.92 A	
AC Current – Measure Field calibrations Available [Note 4]	0 µA to 100 µA	10 Hz to 20 Hz	0.46 % + 35 nA	Agilent 3458A opt 002
		20 Hz to 45 Hz	0.18 % + 35 nA	
		45 Hz to 100 Hz	0.072 % + 35 nA	
		100 Hz to 1 kHz	0.072 % + 35 nA	
	100 µA to 1 mA	10 Hz to 20 Hz	0.46 % + 0.23 µA	

2014-10-01 through 2015-09-30

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
		20 Hz to 45 Hz	0.17 % + 0.23 µA	
		45 Hz to 100 Hz	0.071 % + 0.23 µA	
		0.1 kHz to 5 kHz	0.038 % +0.23 µA	
	1 mA to 10 mA	10 Hz to 20 Hz	0.46 % + 2.3 µA	
		20 Hz to 45 Hz	0.17 % + 2.3 µA	
		45 Hz to 100 Hz	0.071 % + 2.3 µA	
		100 Hz to 5 kHz	0.038 % + 2.3 µA	
	10 mA to 100 mA	10 Hz to 20 Hz	0.46 % + 23 µA	
		20 Hz to 45 Hz	0.17 % + 23 µA	
		45 Hz to 100 Hz	0.070 % + 23 µA	
		100 Hz to 5 kHz	0.037 % + 23 µA	
	100 mA to 1 A	10 Hz to 20 Hz	0.46 % + 0.23 mA	
		20 Hz to 45 Hz	0.19 % + 0.23 mA	
		45 Hz to 100 Hz	0.097 % + 0.23 mA	
		100 Hz to 5 kHz	0.12 % + 0.23 mA	
	1 A to 20 A	0.05 kHz to 5 kHz	0.10 % + 0.02 A	Valhalla 2575A
	20 A to 100 A	0.05 kHz to 5 kHz	0.11 % + 0.1 A	
Impedance – Measure Field calibrations Available [Note 4]	0 Ω to 100 kΩ 0 Ω to 100 kΩ	1 kHz 10 Hz to 1 MHz	0.06 % + 0.11 mΩ 2.3 % + 0.11 mΩ	Quadtech 7600

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
DC RESISTANCE (20/E05)			
Measuring Equipment and Measure Field calibrations Available [Note 4]	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ	18 µΩ/Ω + 58 µΩ 15 µΩ/Ω + 0.58 mΩ 12 µΩ/Ω + 0.58 mΩ 12 µΩ/Ω + 5.8 mΩ 12 µΩ/Ω + 58 mΩ 19 µΩ/Ω + 2.3 Ω	HP3458A w/Decade Resistor

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	1 MΩ to 10 MΩ	62 µΩ/Ω + 0.12 kΩ	
	10 MΩ to 100 MΩ	0.059 % + 1.2 kΩ	
	100 MΩ to 1 GΩ	0.58 % + 12 kΩ	
Measuring Equipment	1 mΩ	0.05 %	L & N Shunt
Field calibrations Available [Note 4]	10 mΩ	0.01 %	Guildline 9200
	100 mΩ	0.01 %	
	1 GΩ	0.58 %	Biddle Megadek
	10 GΩ	1.2 %	
Applied Voltage:	100 GΩ	1.8 %	
500 V to 5 kV	1 TΩ	0.60 %	IET Standard Resistor
5 kV	10 TΩ	1.0 %	
2.5 kV	10 TΩ	1.0 %	
1 kV	10 TΩ	1.5 %	
500 V	10 TΩ	0.86 %	
DC Current – Measuring Equipment	0 mA to 0.22 mA	36 µA/A + 6.0 nA	Fluke 5700A/EP
Field calibrations Available [Note 4]	0.22 mA to 2.2 mA	36 µA/A + 7.0 nA	
	2.2 mA to 22 mA	35 µA/A + 40 nA	
	22 mA to 220 mA	48 µA/A + 0.7 µA	
	220 mA to 2.2 A	0.02 % + 12 µA	
	2.2 A to 11 A	0.04 % + 0.48 mA	Fluke 5700A/EP w/5725A
	11 A to 100 A	0.047 %	L&N 4360 Shunt w/source
DC Current – Measure	0 to 100 µA	26 µA/A + 0.9 nA	Agilent 3458A Opt 002
Field calibrations Available [Note 4]	100 µA to 1 mA	26 µA/A + 5.8 nA	
	1 mA to 10 mA	26 µA/A + 58 nA	
	10 mA to 100 mA	43 µA/A + 0.58 µA	
	100 mA to 1 A	0.013 % + 10 µA	
	1 A to 10 A	0.047 %	L&N 4361 Shunt
	10 A to 100 A	0.047 %	L&N 4360 Shunt

2014-10-01 through 2015-09-30

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Clamp-on Ammeter Non-Toroidal Type Field calibrations Available [Note 4]	20 A to 150 A 150 A to 1000 A	0.51 % + 0.14 A 0.52 % + 0.5 A	Fluke 5520A w/ 5500A/Coil
DC VOLTAGE (20/E06)			
Measure Field calibrations Available [Note 4]	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 500 V 500 V to 800 V 800 V to 1 kV	7.1 µV/V + 0.58 µV 5.0 µV/V + 0.58 µV 5.1 µV/V + 0.58 µV 7.6 µV/V + 35 µV 11 µV/V + 0.12 mV 16 µV/V + 0.12 mV 21 µV/V + 0.12 mV	3458A Opt 002
	1 kV to 10 kV 10 kV to 20 kV 20 kV to 35 kV 15 kV to 30 kV 30 kV to 45 kV 45 kV to 70 kV 25 kV to 100 kV	0.049 % + 0.62 V 0.08 % + 0.35 V 0.14 % + 1 V 0.065 % + 1 V 0.09 % + 3 V 0.17 % + 1 V 0.11 % + 0.5 V	Vitrek 4700A 4700A w/HVP-35 4700A w/HVL-70 4700A w/HVL-100
Measuring Equipment Field calibrations Available [Note 4]	0 V to 0.22 V 0.22 V to 2.2 V 2.2 V to 11 V 11 V to 22 V 22 V to 220 V 220 V to 1100 V	8.5 µV/V + 0.4 µV 5.1 µV/V + 0.7 µV 4.0 µV/V + 2.5 µV 3.9 µV/V + 4 µV 6.2 µV/V + 40 µV 7.6 µV/V + 0.40 mV	Fluke 5700A/EP Fluke 5700A/EP w/5725A

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
LF AC VOLTAGE (20/E09)				
AC Voltage – Measure	0 mV to 10 mV	1 Hz to 40 Hz	0.039 % + 3.5 µV	Agilent 3458A/002

2014-10-01 through 2015-09-30

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Field calibrations Available [Note 4]		40 Hz to 1 kHz	0.028 % + 1.2 µV	
		1 kHz to 20 kHz	0.038 % + 1.2 µV	
		20 kHz to 50 kHz	0.15 % + 1.2 µV	
		50 kHz to 100 kHz	0.59 % + 1.2 µV	
		100 kHz to 300 kHz	4.6 % + 2.3 µV	
	10 mV to 100 mV	1 Hz to 40 Hz	0.013 % + 4.6 µV	
		40 Hz to 1 kHz	0.0095 % + 2.3 µV	
		1 kHz to 20 kHz	0.017 % + 2.3 µV	
		20 kHz to 50 kHz	0.037 % + 2.3 µV	
		50 kHz to 100 kHz	0.093 % + 2.3 µV	
		100 kHz to 300 kHz	0.36 % + 12 µV	
		300 kHz to 1 MHz	1.2 % + 12 µV	
	100 mV to 1 V	1 Hz to 40 Hz	0.0098 % + 46 µV	
		40 Hz to 1 kHz	0.0095 % + 23 µV	
		1 kHz to 20 kHz	0.017 % + 23 µV	
		20 kHz to 50 kHz	0.036 % + 23 µV	
		50 kHz to 100 kHz	0.093 % + 23 µV	
		100 kHz to 300 kHz	0.35 % + 0.12 mV	
		300 kHz to 1 MHz	1.2 % + 0.12 mV	
	1 V to 10 V	1 Hz to 40 Hz	0.0095 % + 0.46 mV	
		40 Hz to 1 kHz	0.0095 % + 0.23 mV	
		1 kHz to 20 kHz	0.017 % + 0.23 mV	
		20 kHz to 50 kHz	0.036 % + 0.23 mV	
		50 kHz to 100 kHz	0.093 % + 0.23 mV	
		100 kHz to 300 kHz	0.35 % + 1.2 mV	
		300 kHz to 1 MHz	1.2 % + 1.2 mV	
	10 V to 100 V	1 Hz to 40 Hz	0.024 % + 4.6 mV	
		40 Hz to 1 kHz	0.024 % + 2.3 mV	
		1 kHz to 20 kHz	0.024 % + 2.3 mV	
		20 kHz to 50 kHz	0.041 % + 2.3 mV	
		50 kHz to 100 kHz	0.14 % + 2.3 mV	
		100 kHz to 300 kHz	0.46 % + 12 mV	

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		300 kHz to 1 MHz	1.7 % + 12 mV	
	700 V to 10 kV	60 Hz	0.17 % + 0.16 V	Vitrek 4700A
	10 kV to 20 kV	60 Hz	0.17 % + 0.6 V	4700A w/HVP-35
	20 kV to 35 kV	60 Hz	0.23 % + 3.5 V	
	12.5 kV to 25 kV	60 Hz	0.15 % + 1.4 V	4700A w/HVL-70
	25 kV to 37.5 kV	60 Hz	0.16 % + 2.8 V	
	37.5 kV to 50 kV	60 Hz	0.20 % + 0.2 V	
	25 kV to 75 kV	60 Hz	0.19 % + 3.5 V	4700A w/ HVL-100
	0 mV to 1 mV	100 kHz to 1 MHz	2.0 % + 2.4 µV	R&S URE3
		1 MHz to 3 MHz	3.8 % + 2.4 µV	
		3 MHz to 10 MHz	10 % + 2.4 µV	
		10 MHz to 20 MHz	25 % + 2.4 µV	
	1 mV to 3 mV	100 kHz to 1 MHz	1.0% + 2 µV	
		1 MHz to 3 MHz	3.8 % + 2 µV	
		3 MHz to 10 MHz	11 % + 2 µV	
		10 MHz to 20 MHz	25 % + 2 µV	
	3 mV to 100 mV	100 kHz to 1 MHz	0.98 % + 3 µV	
		1 MHz to 3 MHz	1.9 % + 3 µV	
		3 MHz to 10 MHz	3.2 % + 3 µV	
		10 MHz to 20 MHz	7.6 % + 3 µV	
		20 MHz to 30 MHz	16 % + 3 µV	
AC Voltage Measuring Equipment Field calibrations Available [Note 4]	0 mV to 2.2 mV	10 Hz to 20 Hz	0.16 % + 4.0 µV	5700A/EP
		20 Hz to 40 Hz	0.10 % + 4.0 µV	
		40 Hz to 20 kHz	0.077 % + 4.0 µV	
		20 kHz to 50 kHz	0.13 % + 4.0 µV	
		50 kHz to 100 kHz	0.17 % + 5 µV	
		100 kHz to 300 kHz	0.33 % + 10 µV	
		300 kHz to 500 kHz	0.47 % + 20 µV	
		500 kHz to 1 MHz	0.58 % + 20 µV	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) [Note 3,5]	Remarks
	2.2 mV to 22 mV	10 Hz to 20 Hz	0.042 % + 4.0 µV	
		20 Hz to 40 Hz	0.030 % + 4.0 µV	
		40 Hz to 20 kHz	0.014 % + 4.0 µV	
		20 kHz to 50 kHz	0.030 % + 4.0 µV	
		50 kHz to 100 kHz	0.058 % + 5.0 µV	
		100 kHz to 300 kHz	0.12 % + 10 µV	
		300 kHz to 500 kHz	0.16 % + 20 µV	
		500 kHz to 1 MHz	0.27 % + 20 µV	
	22 mV to 220 mV	10 Hz to 20 Hz	0.028 % + 12 µV	
		20 Hz to 40 Hz	0.011 % + 7.0 µV	
		40 Hz to 20 kHz	0.0085 % + 7.0 µV	
		20 kHz to 50 kHz	0.021 % + 7.0 µV	
		50 kHz to 100 kHz	0.047 % + 17 µV	
		100 kHz to 300 kHz	0.091 % + 20 µV	
		300 kHz to 500 kHz	0.14 % + 25 µV	
		500 kHz to 1 MHz	0.28 % + 45 µV	
	220 mV to 2.2 V	10 Hz to 20 Hz	0.027 % + 40 µV	
		20 Hz to 40 Hz	0.01 % + 15 µV	
		40 Hz to 20 kHz	0.0048 % + 8.0 µV	
		20 kHz to 50 kHz	0.008 % + 10 µV	
		50 kHz to 100 kHz	0.012 % + 30 µV	
		100 kHz to 300 kHz	0.043 % + 80 µV	
		300 kHz to 500 kHz	0.10 % + 0.20 mV	
		500 kHz to 1 MHz	0.18 % + 0.30 mV	
	2.2 V to 22 V	10 Hz to 20 Hz	0.028 % + 0.40 mV	
		20 Hz to 40 Hz	0.01 % + 0.15 mV	
		40 Hz to 20 kHz	0.0049 % + 50 µV	
		20 kHz to 50 kHz	0.0083 % + 0.10 mV	
		50 kHz to 100 kHz	0.011 % + 0.20 mV	
		100 kHz to 300 kHz	0.030 % + 0.60 mV	
		300 kHz to 500 kHz	0.10 % + 2.0 mV	
		500 kHz to 1 MHz	0.17 % + 3.2 mV	

2014-10-01 through 2015-09-30

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) [Note 3,5]	Remarks
	22 V to 220 V	10 Hz to 20 Hz	0.028 % + 4.0 mV	
		20 Hz to 40 Hz	0.01 % + 1.5 mV	
		40 Hz to 20 kHz	0.0056 % + 0.60 mV	
		20 kHz to 50 kHz	0.0093 % + 1.0 mV	
		50 kHz to 100 kHz	0.016 % + 2.5 mV	
		100 kHz to 300 kHz	0.090 % + 16 mV	
		300 kHz to 500 kHz	0.44 % + 40 mV	
		500 kHz to 1 MHz	0.8 % + 80 mV	
	220 V to 750 V	30 kHz to 50 kHz	0.061 % + 11 mV	5700A/EP w/ 5725A
		50 kHz to 100 kHz	0.23 % + 45 mV	
	220 V to 1100 V	40 Hz to 1 kHz	0.011 % + 4.0 mV	
		1 kHz to 20 kHz	0.017 % + 6.0 mV	
		20 kHz to 30 kHz	0.061 % + 11 mV	
LF CAPACITANCE (20/E10)				
Capacitance – Measure Field calibrations Available [Note 4]	1nF to 10 mF	1 kHz	0.06 %	Quadtech 7600
		10 Hz to 1 MHz	2.3 %	
Capacitance Measuring Equipment Field calibrations Available [Note 4]	0.1 nF to 0.7 nF	0.1 kHz to 1 kHz	0.10 % + 0.53 pF	Arco SS32
	0.7 nF to 600 nF	0.1 kHz to 1 kHz	0.15 % + 0.20 pf	
	600 nF to 1400 nF	0.1 kHz to 1 kHz	0.045 % + 0.50 nF	
	0.5 nF to 1400 nF	0.1 kHz to 1 kHz	0.12 % + 0.018 pF	Fluke 5520A
	0.19 nF to 1.1 nF	10 Hz to 10 kHz	0.39 % + 6.1 pF	
	1.1 nF to 3.3 nF	10 Hz to 3 kHz	0.39 % + 6.1 pF	
	3.3 nF to 11 nF	10 Hz to 1 kHz	0.21 % + 6.1 pF	
	11 nF to 110 nF	10 Hz to 1 kHz	0.21 % + 61 pF	
	110 nF to 330 nF	10 Hz to 1 kHz	0.21 % + 0.18 nF	
	0.33 µF to 1.1 µF	10 Hz to 600 Hz	0.20 % + 0.61 nF	
	1.1 µF to 3.3 µF	10 Hz to 300 Hz	0.20 % + 1.9 nF	
	3.3 µF to 11 µF	10 Hz to 150 Hz	0.20 % + 6.1 nF	
	11 µF to 33 µF	10 Hz to 120 Hz	0.32 % + 18 nF	
	33 µF to 110 µF	10 Hz to 80 Hz	0.35 % + 61 nF	

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) Note 3,5	Remarks
	110 µF to 330 µF 0.33 mF to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to 11 mF 11 mF to 33 mF 33 mF to 110 mF	DC to 50 Hz DC to 20 Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz	0.35 % + 0.18 µF 0.35 % + 0.61 µF 0.35 % + 1.8 µF 0.35 % + 6.1 µF 0.58 % + 18 µF 0.85 % + 61 µF	
LF INDUCTANCE (20/E11)				
Inductance – Measure Field calibrations Available Note 4	1 µH to 100 H	1 kHz	0.07%	Quadtech 7600
Inductance Measuring Equipment Field calibrations Available Note 4	100 mH	1 kHz	0.14 %	Standard Inductor
LF POWER/ENERGY (20/E12)				
Power – Measuring Equipment (for current range listed below) DC Power				
0.33 mA to 330 mA	11 µW to 1.1 mW 1.1 mW to 0.11 W 0.11W to 110 W 110 W to 330 W	DC DC DC DC	0.024 % 0.027 % 0.024 % 0.018 %	Fluke 5520A
0.33 A to 3 A	11 W to 110 mW 0.11 W to 990 W 1 W to 3 kW	DC DC DC	0.044 % 0.053 % 0.0096 %	
3 A to 20.5 A	99 mW to 0.99 W 0.99 W to 6.8 kW 6.8 W to 20.5 kW	DC DC DC	0.088 % 0.07 % 0.04 %	
AC Power Note 8 (PF = 1)				
3.3 mA to 9 mA	0.11 mW to 3 mW 3 mW to 9 W	10 Hz to 65 Hz 10 Hz to 65 Hz	0.13 % 0.077 %	
9 mA to 33 mA	0.3 mW to 10 mW	10 Hz to 65 Hz	0.089 %	

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	10 mW to 33 W	10 Hz to 65 Hz	0.077 %	
33 mA to 90 mA	1 mW to 30 mW	10 Hz to 65 Hz	0.071 %	
	30 mW to 90 W	10 Hz to 65 Hz	0.057 %	
90 mA to 330 mA	3.0 mW to 100 mW	10 Hz to 65 Hz	0.089 %	
	100 mW to 300 W	10 Hz to 65 Hz	0.078 %	
0.33 A to 0.9 A	11 mW to 0.3 W	10 Hz to 65 Hz	0.071 %	
	0.3 W to 900 W	10 Hz to 65 Hz	0.081 %	
0.9 A to 2.2 A	30 mW to 0.72 W	10 Hz to 65 Hz	0.089 %	
	0.72 W to 2 kW	10 Hz to 65 Hz	0.079 %	
2.2 A to 4.5 A	80 mW to 1.4 W	10 Hz to 65 Hz	0.088 %	
	1.4 W to 4.5 kW	10 Hz to 65 Hz	0.18 %	
4.5 A to 20.5 A	150 mW to 6.7 W	10 Hz to 65 Hz	0.17 %	
	6.7 W to 20 kW	10 Hz to 65 Hz	0.17 %	
PHASE METERS (20/E15)				
Measuring Equipment Field calibrations Available [Note 4]	0° to 90°	10 Hz to 65 Hz	0.11°	Fluke 5520A
		65 Hz to 500 Hz	0.20°	
		500 Hz to 1 kHz	0.39°	
		1 kHz to 5 kHz	1.9°	
		5 kHz to 10 kHz	3.9°	
		10 kHz to 30 kHz	7.8°	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
TIME AND FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Source and Measure In-Lab	10 MHz	3.8×10^{-12}	Fluke 910R

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
Field Service Note 4	10 MHz	2.1×10^{-7}	HP 53131A Counter
OSCILLATOR CHARACTERIZATION (20/F03)			
Total Harmonic Distortion Field calibrations Available Note 4 (0 dB to -80 dB)	20 Hz to 2 GHz	1.5 dB	Agilent 8903 w/8590A
(5 Hz to 600 kHz) Voltage Range < 30 V 100 % to 0.3 %	(Harmonic Range) 10 Hz to 1 MHz 1 MHz to 3 MHz	 3.5 % 6.9 %	Agilent 334A
0.1%	10 Hz to 20 Hz 20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz	14 % 6.9 % 3.5 % 6.9 % 14 %	
Voltage Range > 30 V 100 % to 0.3 %	10 Hz to 300 kHz 300 kHz to 500 kHz 0.5 MHz to 3 MHz	3.5 % 6.9 % 14 %	
0.1 %	20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz	14 % 3.5 % 6.9 % 14 %	
PULSE WAVEFORM (20/F04)			
Rise Time (Generate) Field calibrations Available Note 4	≤ 25 ps	6.8 ps	Fluke 9500B
Rise Time (Measure)	≥ 700 ps	0.18 % + 6.8 ps	Agilent DSO6102
MECHANICAL			
Air Speed (20/M03)			
Air Velocity	0.0 m/s to 70 m/s	1% + 0.01m/sec	Westenberg Westi-box

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
FORCE (20/M06)			
Force Measuring Equipment	1 lbf to 300 lbf	0.01 %	Deadweight
TORQUE (20/M15)			
Torque Measure	9 lbf-in to 800 lbf-ft	1.0 %	Torque Calibrator
Pneumatic Torque	0 lbf-in to 20 lbf-in 4 lbf-in to 160 lbf-in	0.54 lbf-in 2.2%	Cleco P/2B Cleco P15
CALIBRATION OF WEIGHING INSTRUMENTS (20/M16)			
Balances & Scales – Metric Field calibrations Available Note 4	10 k 2 kg 1 kg 500 g 300 g 200 g 100 g 50 g 20 g 10 g 5 g 2 g 1 g 500 mg 200 mg 100 mg 50 mg 20 mg 10 mg 5 mg 2 mg 1 mg	8.2 mg 5.9 mg 2.7 mg 1.5 mg 1.1 mg 0.63 mg 0.17 mg 0.18 mg 75 µg 47 µg 51 µg 90 µg 47 µg 69 µg 69 µg 69 µg 69 µg 69 µg 69 µg 69 µg 69 µg 69 µg	ASTM Class 1
Avoirdupois	2.2 lb to 450 lb	0.017 %	NIST Class F

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) Note 3,5	Remarks
ELECTROMAGNETICS – RF/MICROWAVE				
RF/MICROWAVE POWER (20/R17)				
Relative RF Power	0 dB to -10 dB -10 dB to -20 dB -20 dB to -30 dB -30 dB to -40 dB -40 dB to -50 dB	100 kHz to 4.2 GHz	1.1 % 1.4 % 1.4 % 1.5 % 4.3 %	Agilent 438A/8482A

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
THERMODYNAMIC			
HUMIDITY (20/T02)			
Measuring Equipment (-10 °C to 70 °C)	10 % to 95 %	0.5 %	Thunder Scientific 2500
Measure Field calibrations Available Note 4	20 % to 90 %	1.3 %	Vaisala HMI41/HMP46
LABORATORY THERMOMETERS (20/T03)			
Measure Field calibrations Available Note 4	-195 °C to 0 °C 0 °C to 420 °C 420 °C to 660 °C 600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1450 °C	0.012 °C 0.025 °C 0.034 °C 0.55 °C 0.76 °C 2.9 °C	Hart 5628 w/Black Stack Hart 5649 w/3458A
Measuring Equipment Field calibrations Available Note 4	-80 °C to 100 ºC 100 °C to 200 ºC 200 °C to 400 °C 400 °C to 600 °C	0.033 ºC 0.052 ºC 0.074 °C 0.12 °C	Hart 5628 w/Hart Bath & Black Stack

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3,5	Remarks
	600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1200 °C	1.2 °C 1.5 °C 3.6 °C	Hart 5649 w/Furnace & 3458A
PRESSURE (20/T05)			
Absolute Measure & Measuring Equipment	0 psia to 30 psia 30 psia to 1000 psia	0.0024 psia 0.0066 % + 0.00048 psia	DHI PPC4 Controller
	500 psia to 16 000 psia	0.019 %	P3125-3 DWT w/barometer
Gage Pressure Measure & Measuring Equipment – Pneumatic	0 in H_2O to 0.5 in H_2O	0.0005 in H_2O	Ashcroft ASQ-1
	-14.7 psig to 30 psig 30 psig to 1000 psig	0.0021 psig 0.0066 % + 0.001 psig	DHI PPC4 Controller
	-36 in H_2O to -22 in H_2O -22 in H_2O to 22 in H_2O 22 in H_2O to 60 in H_2O 60 in H_2O to 72 in H_2O 72 in H_2O to 804 in H_2O	0.0090 % + 150 µin H_2O 0.002 in H_2O 0.0090 % + 150 µin H_2O 0.0065 in H_2O 0.0090 % + 150 µin H_2O	DHI PPC4-ui
Gage Pressure Measuring Equipment – Pneumatic Field calibrations Available Note 4	-14.7 psig to -0.5 psig 3 psig to 500 psig	0.010 % + 0.00011 psig 0.0071 % + 0.0039 psig	Fluke P3025-PSI
Pressure Measuring Equipment – Hydraulic Field calibrations Available Note 4	500 psig to 16 000 psig	0.010 %	P3125-3 DWT
RADIATION THERMOMETRY (20/T06)			
Infrared Temperature – Measuring equipment	-15 °C to 0 °C 0 °C to 50 °C 50 °C to 100 °C	0.8 °C 0.65 °C 0.70 °C	Hart Black Body

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	100 °C to 120 °C 120 °C to 200 °C 200 °C to 350 °C 350 °C to 500 °C 500 °C to 1000 °C	0.76 °C 0.94 °C 1.6 °C 2.1 °C 2.2 °C + 0.27 %	
TEMPERATURE INDICATORS (20/T08)			
Electrical Calibration of Thermocouple Devices Field calibrations Available Note 4			
Type B	250 °C to 350 °C 350 °C to 445 °C 445 °C to 580 °C 580 °C to 750 °C 750 °C to 1000 °C 1000 °C to 1820 °C	1.0 °C 0.77 °C 0.61 °C 0.47 °C 0.39 °C 0.31 °C	Ectron 1140A
Type C	0 °C to 250 °C 250 °C to 1000 °C 1000 °C to 1500 °C 15000 °C to 1800 °C 1800 °C to 2000 °C 2000 °C to 2250 °C 2250 °C to 2315 °C	0.21 °C 0.17 °C 0.19 °C 0.22 °C 0.24 °C 0.30 °C 0.33 °C	
Type E	-270 °C to -245 °C -245 °C to -195 °C -195 °C to -155 °C -155 °C to -90 °C -90 °C to 0 °C 0 °C to 15 °C 15 °C to 890 °C 890 °C to 1000 °C	2.1 °C 0.20 °C 0.11 °C 0.09 °C 0.08 °C 0.08 °C 0.07 °C 0.08 °C	
Type J	-210 °C to -180 °C -180 °C to -120 °C	0.13 °C 0.11 °C	

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	-120 °C to -50 °C	0.09 °C	
	-50 °C to 990 °C	0.08 °C	
	990 °C to 1200 °C	0.08 °C	
Type K	-270 °C to -255 °C	2.3 °C	
	-255 °C to -195 °C	0.73 °C	
	-195 °C to -115 °C	0.14 °C	
	-115 °C to -55 °C	0.10 °C	
	-55 °C to 1000 °C	0.08 °C	
	1000 °C to 1372 °C	0.09 °C	
Type N	-270 °C to -260 °C	5.1 °C	
	-260 °C to -200 °C	1.1 °C	
	-200 °C to -140 °C	0.25 °C	
	-140 °C to -70 °C	0.16 °C	
	-70 °C to 25 °C	0.13 °C	
	25 °C to 160 °C	0.11 °C	
	160 °C to 1300 °C	0.10 °C	
Type R	-50 °C to -30 °C	0.68 °C	
	-30 °C to -45 °C	0.58 °C	
	-45 °C to 160 °C	0.42 °C	
	160 °C to 380 °C	0.31 °C	
	380 °C to 775 °C	0.28 °C	
	775 °C to 1768 °C	0.23 °C	
Type S	-50 °C to -30 °C	0.65 °C	
	-30 °C to 45 °C	0.59 °C	
	45 °C to 105 °C	0.42 °C	
	105 °C to 310 °C	0.35 °C	
	310 °C to 615 °C	0.31 °C	
	615 °C to 1768 °C	0.27 °C	
Type T	-270 °C to -255 °C	1.8 °C	
	-255 °C to -240 °C	0.52 °C	
	-240 °C to -210 °C	0.32 °C	

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)[Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	-210 °C to -150 °C	0.19 °C	
	-150 °C to -40 °C	0.13 °C	
	-40 °C to 100 °C	0.09 °C	
	100 °C to 400 °C	0.08 °C	
Type B	600 °C to 800 °C	0.34 °C	Fluke 5520
Type B	800 °C to 1000 °C	0.26 °C	
Type B	1000 °C to 1550 °C	0.23 °C	
Type B	1550 °C to 1820 °C	0.26 °C	
END			

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

Notes
Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable. **Note 2:** Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit. **Note 3:** The uncertainty associated with a measurement in a CMC is an expanded uncertainty with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg). **Note 3a:** The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use. **Note 3b:** As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC. **Note 3c:** As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions.* However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements. **Note 4:** Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.) **Note 5:** Values listed with percent (%) are percent of reading or generated value unless otherwise noted. **Note 6:** NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories. **Note 7:** See NIST Handbook 150 for further explanation of these notes.

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200914-0**

Scope Revised: 2015-05-26

Notes
Note 8: The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one, but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown. **Note 9:** Where L is the numerical value of the measurand in the same unit given in the range.

2014-10-01 through 2015-09-30

Effective dates

For the National Institute of Standards and Technology