National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION LABORATORIES **NVLAP LAB CODE 200108-0**

NVLAP Code: 20/A01 ANSI/NCSL Z540-1-1994; Part 1 Compliant

DIMENSIONAL

NVLAP Code: 20/D01
Angle Blocks

Range	***Best Uncertainty (±)*** [note 1]	***Remarks***
to 45º	1.3 arc seconds	Comparison Method
Autocollimators		
≤ 30 arc seconds	0.10 arc seconds	Small Angle Generator and Mirror
>30 to 1200 arc sec	(0.2 arc seconds +0.2 % of angle)	
Index Table/Polygons		
0º to 360º (in 10º or 30º increments)	0.5 arc seconds	3 Stack Method

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NVLAP Code: 20/D03
Gage Blocks

Range	***Best Uncertainty (±)*** [notes 1, 4]	***Remarks***
< 0.04 in	2.7 µin	Comparison
0.04 in to 4 in	(2.6 + 0.3 L) µin [note 2]	Comparison
> 4 in to 20 in	(6.7 + 0.3 L) µin [note 2]	Comparison
< 1 mm	0.07 µm	Comparison
1 mm to 100 mm	(0.07 + 0.3 L) µm [note 3]	Comparison
> 100 mm to 500 mm	(0.13 + 0.3 L) µm [note 3]	Comparison

NVLAP Code: 20/D04
Laser Frequency/Wavelength

Laser Type	***Best Uncertainty (±)*** [note 1]	***Remarks***
HeNe (632.991370 nm)	0.027 ppm	Comparison

NVLAP Code: 20/D05
Length
Line Scales (Chrome on Glass)

Range	***Best Uncertainty (±)*** [note 1]	***Remarks***
0 in to 16 in	(15 + 0.5 L) µin	Vision System with Laser Interferometer
Step Gages		
0 in to 40 in	(20 + 1.0 L) µin [note 2]	Shelton CMM
1-D Ball Plates		
to 48 in	(20 + 1.0 L) µin [note 2]	CMM Single – Axis Method
Squares		
to 24 in by 36 in	20 µin	CMM, Self Closing Method
Straight Edges		

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to 48 in	5 µin	CMM, Reversal Method

NVLAP Code: 20/D07
Thread Measuring Wires

Range	***Best Uncertainty (±)*** *note 1*	***Remarks***
All 29° and 60° Wires	8.0 µin	Direct Measurement

NVLAP Code: 20/D08
Optical Reference Planes
Optical Flats, Mirrors

Range	***Best Uncertainty (±)*** *note 1*	***Remarks***
0 in to 12 in	1.2 µin	3 Flat Method
0 to 10 in	2.7 µin	Comparison to Master / Interferometer

NVLAP Code: 20/D09
Roundness

Range	***Best Uncertainty (±)*** *note 1*	***Remarks***
to 18 in Diameter	2 µin	Roundness Machine

NVLAP Code: 20/D11
Spherical Diameter

Range	***Best Uncertainty (±)*** *note 1*	***Remarks***
1/16 in to 1 (1 to 25 mm)	8.3 µin	Comparison to Master

NVLAP Code: 20/D12
Surface Plates

Range	***Best Uncertainty (±)*** *note 1*	***Remarks***
to 8 ft Diagonal	(30 µin + 2 µin/ft^2)	Moody and Least Squares Method with Autocollimator

NVLAP Code: 20/D14
Plain Plug Gages

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Range	*Best Uncertainty (±)* [note 1]	*Remarks*
0 in to 1 in	6.2 µin	Comparison to Master

Plain Ring Gages

0 in to 1 in	10 µin	Comparison

NVLAP Code: 20/D15
2-D Ball Plates

Range	*Best Uncertainty (±)* [note 1]	*Remarks*
36 in x 36 in	(20 + 1.0 L) µin [note 2]	CMM Single – Axial Method

NVLAP Code: 20/D16
Coordinate Measuring Machines

Range	*Best Uncertainty (±)* [notes 1, 2]	*Remarks*
To 56 in	Axial (60 + 3 L) µin	Step Gage / Ball Plate
Volumetric Diagonal	Planar (65 + 3 L) µin	
	Spatial (70 +3 L) µin	

ELECTROMAGNETICS – DC/LOW FREQUENCY

NVLAP Code: 20/E05
DC Resistance

Range	*Best Uncertainty (±) in ppm* [note 1]	*Remarks*
0.001 Ω	3.6	Comparison Method
0.01 Ω	3.6	Comparison Method
0.1 Ω	3.6	Comparison Method
1 Ω	1.1	Comparison Method
10 kΩ	1.9	Comparison Method
1 Ω to 100 Ω	3.6	Comparison Method
100 Ω to 1 MΩ	3.6	Comparison Method
10^7 Ω	13.4	Comparison Method
10^8 Ω	16.7	Comparison Method

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NVLAP Code: 20/E06
DC Voltage

Range	*Best Uncertainty (±) in ppm* [note 1]	*Remarks*
1.018 V	0.41	Comparison Method
10.00 V	0.45	Comparison Method
1.000 V	3.1	Comparison Method
10.00 V	3.1	Comparison Method
100.0 V	3.1	Comparison Method
1000.0 V	3.1	Comparison Method
10.0 kV	235	Comparison Method
100.0 kV	220	Comparison Method

NVLAP Code: 20/E09
LF AC Voltage

Best Uncertainty (±) in ppm +µV [note 1]
Frequency in Hz

Range	*10 to 20*	*20 to 40*	*40 to 20 k*	*20 k to 50 k*	*50 k to 100 k*	*100 k to 300 k*	*300 k to 500 k*	*500 k to 1M*
2.2 mV	1700 + 1.3	740 + 1.3	420 + 1.3	810 + 2.0	1200 + 2.5	2300 + 4.0	2400 + 8.0	3500 + 8.0
7 mV	850 + 1.3	370 + 1.3	210 + 1.3	400 + 2.0	600 + 2.5	1200 + 4.0	1300 + 8.0	2300 + 8.0
22 mV	290 + 1.3	190 + 1.3	110 + 1.3	210 + 2.0	310 + 2.5	810 + 4.0	890 + 8.0	1700 + 8.0
70 mV	240 + 1.5	120 + 1.5	100 + 1.5	130 + 2.0	260 + 2.5	510 + 4.0	670 + 8.0	1100 + 8.0
220 mV	210 + 1.5	100 + 1.5	100 + 1.5	100 + 2.0	160 + 2.5	250 + 4.0	380 + 8.0	1000 + 8.0
700 mV	210 + 1.5	100 + 1.5	100 + 1.5	100 + 2.0	150 + 2.5	200 + 4.0	350 + 8.0	960 + 8.0
2.2 V	200	100	100	100	150	200	300	1200
7 V	200	100	100	100	150	200	400	1200
22 V	200	100	100	100	150	200	400	1200
70 V	200	100	100	100	150	200	410	1200
220 V	200	100	100	100	150	400	500	
700 V	200	100	100	200	500			
1000 V	200	100	100	200	800			

NVLAP Code: 20/E10
LF Capacitance

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Range	*Best Uncertainty (±)* [note 1]	*Remarks*
0.01 pF to 10 pF	100 ppm	AH2700 @ 1kHz Direct Measurement
10 pF to 1000 pF	10 ppm	AH2700 @ 1kHz Direct Measurement

NVLAP Code: 20/E11
LF Inductance

	Best Uncertainty (±) % of Reading [note 1]			
Range	*100 Hz*	*1 kHz*	*10 kHz*	*Remarks*
100 µH	0.19	0.18	0.19	Comparison Method
200 µH		0.09	0.11	Comparison Method
500 µH		0.09	0.08	Comparison Method
1 mH	0.05	0.04	0.09	Comparison Method
5 mH		0.034	0.082	Comparison Method
10 mH	0.035	0.035	0.08	Comparison Method
20 mH		0.04	0.1	Comparison Method
50 mH		0.034	0.079	Comparison Method
100 mH	0.033	0.035	0.098	Comparison Method
200 mH	0.035	0.045		Comparison Method
500 mH	0.046	0.044		Comparison Method
1 H	0.03	0.08		Comparison Method
2 H		0.074		Comparison Method
5 H		0.158		Comparison Method
10 H	0.033	0.34		Comparison Method

NVLAP Code: 20/E18
Resistance Dividers

Range	*Best Uncertainty (±) in ppm* [note 1]	*Remarks*
0 V to 1200 V	2	Ratio Measurement
0 kV to 10 kV	44	Ratio Measurement

TIME AND FREQUENCY

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NVLAP Code: 20/F01
Frequency Dissemination

	Range	***Best Uncertainty (±)*** [note 1]	***Remarks***
Frequency	0.1 MHz	1×10^{-12}	
Frequency	1.0 MHz	1×10^{-12}	
Frequency	10.0 MHz	1×10^{-12}	
Frequency Counters			
Internal Oscillator	(1 to 10) MHz	1.01×10^{-12}	
Frequency	1.0 Hz to 50 GHz	(0.001 to 0.012) ppm + 1 LSD	
Time	10 ns to 10 s	(0.001 to 0.012) ppm + 1 LSD	
Generator Frequency			
Internal Oscillator	10 MHz	1.01×10^{-12}	
Frequency	1 Hz to 50 GHz	(0.001 to 0.012) ppm	

NVLAP Code: 20/F02
Stopwatches and Timers

	Range	***Best Uncertainty (±)*** [note 1]	***Remarks***
Time	1 day	0.053 s/day + 1 LSD	

MECHANICAL

NVLAP Code: 20/M03
Air Speed

Range in fpm	***Best Uncertainty (±) % of Reading*** [note 1]	***Remarks***
50 to 9500	6	

NVLAP Code: 20/M06
Force

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Range	*Best Uncertainty (±) %* [note 1,5]	*Remarks*
5 lbf thru 500 lbf	0.005	Deadweight
> 500 lbf thru 100 000 lbf	0.025	Proving Ring, Uncertainty of Range

NVLAP Code: 20/M08
Mass

Range	*Best Uncertainty (±) in mg* [note 1,6]	*Remarks*
5 kg	2.3	Echelon II
3 kg	1.6	Echelon II
2 kg	1.1	Echelon II
1 kg	0.19	Echelon II
500 g	0.14	Echelon II
300 g	0.086	Echelon II
200 g	0.062	Echelon II
100 g	0.047	Echelon II
50 g	0.024	Echelon II
30 g	0.014	Echelon II
20 g	0.0095	Echelon II
10 g	0.0051	Echelon II
5 g	0.0026	Echelon II
3 g	0.0016	Echelon II
2 g	0.0011	Echelon II
1 g	0.00071	Echelon II
500 mg	0.00044	Echelon II
300 mg	0.00033	Echelon II
200 mg	0.00030	Echelon II
100 mg	0.00032	Echelon II
50 mg	0.00018	Echelon II
30 mg	0.00012	Echelon II
20 mg	0.00010	Echelon II
10 mg	0.00010	Echelon II
5 mg	0.00020	Echelon II
3 mg	0.00018	Echelon II
2 mg	0.00018	Echelon II

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1 mg	0.00022	Echelon II

NVLAP Code: 20/M11
Vibration/Acceleration

Range	***Best Uncertainty (±) in % note 1***
0.5 g @ 5 Hz	2.5
1 g @ 10 Hz thru 50 Hz	1.8
2 g, 5 g @ 10 Hz	2.5
5 g @ 100 Hz	1.8
10 g @ 30 Hz thru < 100 Hz	2.5
10 g @ 100 Hz thru 2000 Hz	1.8
10 g @ > 2000 Hz thru 10 000 Hz	2.5
Temperature Coefficient 10 g, 100 Hz thru 4000 Hz -65°C thru 125°C	3.0
Shock	
100 thru 10 000 g at the test duration	3.0
@ 0.1 thru 50 ms. Over the range at the customer's requested duration	3.7

NVLAP Code: 20/M14
Tachometers

Range	***Best Uncertainty (±) note 1***	***Remarks***
RPM		
1.5 rpm to 10 000 rpm	0.052 to 10.2 rpm	

RF MICROWAVE

NVLAP Code: 20/R01
Coaxial Air Line Standards
Air Lines (Air-Dielectric)

Connector Type	***Quantity***	***Range***	***Frequency (Hz)***	***Best Uncertainty (±) note 1***

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GR-900	Impedance	50 Ω	50 M to 8.5 G	(0.028 to 0.050) Ω
APC-7	Impedance	50 Ω	50 M to 18.0 G	(0.045 to 0.082) Ω
N	Impedance	50 Ω	50 M to 18.0 G	(0.047 to 0.210) Ω
APC-3.5	Impedance	50 Ω	50 M to 26.5 G	(0.069 to 0.176) Ω
2.4 mm	Impedance	50 Ω	150 M to 50.0 G	(0.093 to 0.222) Ω
GR-900	Electrical Length	(3 to 30) cm	50 M to 8.5 G	(0.0017 to 0.012) cm
APC-7	Electrical Length	(3 to 30) cm	50 M to 18.0 G	(0.0018 to 0.042) cm
N	Electrical Length	(3 to 30) cm	50 M to 18.0 G	(0.0018 to 0.042) cm
APC-3.5	Electrical Length	(5 to 15) cm	50 M to 26.5 G	(0.0018 to 0.042) cm
2.4 mm	Electrical Length	(3 to 5) cm	150 M to 50 G	(0.0018 to 0.012) cm
GR-900, 7 mm, N, 3.5 mm, & 2.4 mm	Diameter	(0.10 to 1.5) cm		(0.00033 to 0.00045) cm
GR-900, 7 mm, N, 3.5 mm, & 2.4 mm	Physical Length	(3 to 30) cm (5 to 15) cm (3 to 5) cm		(0.0010 to 0.0026) cm

NVLAP Code: 20/R02
Coaxial/Waveguide Terminations
Reflection Coefficient (Scattering Parameter S_{ii}) on a Vector Automatic Network Analyzer

Connector Type	*Quantity*	*Range*	*Frequency in Hz*	*Best Uncertainty (±)* [note 1]
GR-900	$\|S_{ii}\|$	0 to 1	300 k to 8.5 G	0.004 to 0.009
APC-7	$\|S_{ii}\|$	0 to 1	300 k to 18.0 G	0.003 to 0.018
N	$\|S_{ii}\|$	0 to 1	300 k to 18.0 G	0.007 to 0.030
APC-3.5	$\|S_{ii}\|$	0 to 1	50 M to 26.5 G	0.008 to 0.045
2.4 mm	$\|S_{ii}\|$	0 to 1	500 M to 50 G	0.015 to 0.065
GR-900	$Arg(S_{ii})$	-180° to 180°, $0< \|S_{ii}\| < 1$	300 k to 8.5 G	(0.52 to 180)°
APC-7	$Arg(S_{ii})$	-180° to 180°, $0< \|S_{ii}\| < 1$	300 k to 18.0 G	(0.5 to 180)°
N	$Arg(S_{ii})$	-180° to 180°, $0< \|S_{ii}\| < 1$	300 k to 18.0 G	(1.0 to 180)°
APC-3.5	$Arg(S_{ii})$	-180° to 180°, $0< \|S_{ii}\| < 1$	50 M to 26.5 G	(1.25 to 180)°
2.4 mm	$Arg(S_{ii})$	-180° to 180°, $0< \|S_{ii}\| < 1$	500 M to 50 G	(2.0 to 180)°

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NVLAP Code: 20/R12
RF/Microwave Bolometer Units
Thermistor Mounts

Connector Type	*Quantity*	*Range in dBm*	*Frequency Range*	*Best Uncertainty (±)* note 1
N	Calibration Factor	(- 10 to + 10)	1 MHz to 18.0 GHz	(1.25 to 3.0) %

NVLAP Code: 20/R13
RF/Microwave Attenuators
Attenuation (Scattering Parameter S_{ij}) on a Vector Automatic Network Analyzer

Connector Type	*Quantity*	*Range in dB*	*Frequency in Hz*	*Best Uncertainty (±) in dB* note 1
7 mm	$\|S_{ij}\|$	(0 to 70)	300 k to 18.0 G	0.02 to 0.35
7 mm	$\|S_{ij}\|$	(>70 to 100)	250 M to 18.0 G	0.25 to 1.5
APC-3.5	$\|S_{ij}\|$	(0 to 80)	50 M to 26.5 G	0.02 to 1.5

NVLAP Code: 20/R17
RF/Microwave Power Meters
CW Microwave Power Meter

Connector Type	*Quantity*	*Range in dBm*	*Frequency in Hz*	*Best Uncertainty (±) in dB* note 1
N	Power	(-60 to -20)	100 k to 18 G	(0.13 to 0.30)
N	Power	(-20 to +20)	100 k to 18 G	(0.10 to 0.25)

THERMODYNAMICS

NVLAP Code: 20/T02
Humidity

Range	*Best Uncertainty (±)* note 1	*Remarks*
-80 to 10 Frost Point	2 ºC Frost Point	
5 to 98 % RH	0.8 % RH	

NVLAP Code: 20/T03
Laboratory Thermometers

Range in ºC	*Best Uncertainty (±) in ºC* note 1	*Remarks*

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-60 to 260	0.03	Comparison to SPRTs
> 260 to 420	0.06	Comparison to SPRTs

NVLAP Code: 20/T04
Leak Artifacts

Range	***Best Uncertainty (±) % of Reading*** [note 1]	***Remarks***
10×10^{-7} cc/sec STP	5	Comparison Method Helium
10×10^{-8} cc/sec STP	5	Comparison Method Helium
10×10^{-9} cc/sec STP	5	Comparison Method Helium
10×10^{-10} cc/sec STP	6	Comparison Method Helium
10×10^{-6} cc/sec STP	4	Comparison Method Argon
10×10^{-7} cc/sec STP	4	Comparison Method Argon
10×10^{-2} cc/sec STP to 10×10^{-8} cc/sec STP	6.7	Rate of Rise Method

NVLAP Code: 20/T05
Pressure

Range	***Best Uncertainty (±) % of Reading*** [note 1]	***Remarks***
0 psia to 500 psia	0.015	
>500 psia to 12 000 psia	0.06	
0 psia to 500 psig	0.015	
>500 psig to 12 000 psig	0.06	
>12 000 psig to 40 000 psig	0.05	
>40 000 psig to 100 000 psig	0.07	
0.002 psid to 500 psid	0.08	

NVLAP Code: 20/T07
Resistance Thermometry - SPRT

Range in°C	***Best Uncertainty (±) in °C*** [note 1]	***Remarks***
-40 to 232	0.005	Fixed Point Cell
-190 to 100	0.020	SPRT Comparison Method

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NVLAP Code: 20/T08
Thermocouples

Range in °C	*Best Uncertainty (±) in* [note 1]	*Remarks*
-75 to 485	0.4	Type J
0 to 500	0.75	Type K
>500 to 1100	1.0	Type K
>1100 to 1250	1.4	Type K
-75 to 260	0.25	Type T

NVLAP Code: 20/T09
Thermocouple Calibrator/ Reader (Simulated or Measured)

Range in °C	*Best Uncertainty (±) in °C* [note 1]	*Remarks*
100 to 1820	0.34 to 0.39	Type B
-270 to 1000	0.36 to 0.63	Type E
-200 to 1200	0.34 to 0.36	Type J
-200 to 1350	0.34 to 0.38	Type K
-50 to 1750	0.34 to 0.39	Type R
-50 to 1750	0.34 to 0.40	Type S
-200 to 400	0.34	Type T

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1. Represents an expanded uncertainty using a coverage factor, k = 2, at an approximate level of confidence of 95 %.
2. L is in inches.
3. L is in meters.
4. Best uncertainty is for steel blocks.
5. ASTM E74 compliant calibrations. Best uncertainty includes the uncertainty of a high quality artifact under test. Specific artifact uncertainty is determined by the statistics of the test and the artifact under test.
6. Using redundant weighing designs and assuming density standard uncertainty of ±0.005 g /cc for subject weights

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