National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES

NVLAP LAB CODE 200348-0
Scope Revised: 2012-02-02

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Fluke Calibration, American Fork-Primary Temperature Lab 799 E. Utah Valley Drive American Fork, UT 84003-9775 Mr. Thomas J. Wiandt Phone: 801-763-1700 Fax: 801-763-1010 E-mail: tom.wiandt@flukecal.com URL: http://us.flukecal.com/support/accreditations	**Parameter(s) of Accreditation** Electromagnetics - DC/Low Frequency Thermodynamic This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY			
NVLAP Code: 20/E05 **DC RESISTANCE AND CURRENT**			
DC Resistance	1 Ω to 10 Ω	0.30 μΩ/Ω	
	>10 Ω to 100 Ω	0.40 μΩ/Ω	
	>100 Ω to 1 kΩ	0.55 μΩ/Ω	
	>1 kΩ to 10 kΩ	0.65 μΩ/Ω	
	>10 kΩ to 100 kΩ	1.5 μΩ/Ω	
	>100 kΩ to 500 kΩ	2.0 μΩ/Ω	
	>500 kΩ to 1 MΩ	3.0 μΩ/Ω	
Digital Thermometry Indicators			Readout devices that actually measure resistance
Ratio Function	0.25 to 4.0	0.20	Ratio is dimensionless
Resistance Function	1 Ω	5.0 μΩ/ Ω	
	10 Ω	1.0 μΩ/ Ω	
	25 Ω	1.0 μΩ/ Ω	
	100 Ω	0.80 μΩ/ Ω	
	10 kΩ	1.2 μΩ/ Ω	
	40 kΩ	2.0 μΩ/ Ω	
	100 kΩ	5.0 μΩ/ Ω	
	300 kΩ	5.0 μΩ/ Ω	
	500 kΩ	5.0 μΩ/ Ω	

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

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
	0 Ω to 1 Ω	10 μΩ	
	>1 Ω to 25 Ω	10 μΩ/Ω	
	>25 Ω to 400 Ω	4.0 μΩ/ Ω	
	>400 Ω to 10 kΩ	8.0 μΩ/ Ω	
	10 kΩ to 100 kΩ	8.0 μΩ/ Ω	
	100 kΩ to 1 MΩ	25 μΩ/ Ω	
DC Current – Source/Measure	4.0 mA to 20.0 mA	40 μA/A + 0.4 μA	
NVLAP Code: 20/E06 **DC VOLTAGE** Digital Thermometry Indicators			Readout devices that actually measure voltage.
Voltage Function	0 mV to 50 mV	0.45 μV	
	>50 mV to 100 mV	0.75 μV	
Digital Thermometers Reference Junction Compensation Circuits	0.0 °C to 25.0 °C	10 mK	Internal Reference Junction Compensation
THERMODYNAMIC			
NVLAP Code: 20/T02 **HUMIDITY** Humidity – Calibration of Digital Thermo-Hygrometers and Chilled Mirror Hygrometers			
RH Function	10 % RH to 50 % RH	0.30 % RH	Valid from 15 °C to 35 °C
	>50 % RH to 70 % RH	0.35 % RH	
	>70 % RH to 90 % RH	0.40 % RH	
Temperature Function, in Air	0 °C to 70 °C	0.025 °C	
Temperature Function, in Stirred Liquid	0 °C to 70 °C	0.010 °C	

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NVLAP Code: 20/T06 **RADIATION THERMOMETRY**		Uncertainty between points to be linearly interpolated from adjacent points.	
Direct Calibration of Infrared Radiation Thermometers		0.13 °C	
Using Blackbody Cavities	-15 °C		
	0 °C	0.12 °C	
	35 °C	0.12 °C	
	50 °C	0.12 °C	
	100 °C	0.12 °C	
	120 °C	0.12 °C	
	200 °C	0.12 °C	
	250 °C	0.15 °C	
	350 °C	0.23 °C	
	500 °C	0.37 °C	
Direct Calibration of Infrared Calibrators Using Infrared Radiation Thermometers	-15 °C	0.20 °C	Calibration is performed over the spectral band of 8 µm to 14 µm.
	0 °C	0.16 °C	
	50 °C	0.16 °C	
	100 °C	0.20 °C	
	120 °C	0.21 °C	
	200 °C	0.27 °C	
	250 °C	0.32 °C	
	350 °C	0.45 °C	
	500 °C	0.79 °C	
NVLAP Code: 20/T07 **RESISTANCE THERMOMETRY**			
Fixed Point Schedule 1 Direct Comparison	-197 °C	0.60 mK	LN_2 TPAr Substitution

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

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3]	Remarks
Fixed Point	-38.8344 °C	0.35 mK	TPHg
	0.010 °C	0.15 mK	TPW
	29.7646 °C	0.35 mK	MPGa
	156.599 °C	0.65 mK	FPIn
	231.928 °C	0.85 mK	FPSn
	419.527 °C	1.1 mK	FPZn
	660.323 °C	1.7 mK	FPAl
	961.78 °C	4.7 mK	FPAg
Fixed Point Schedule 2			
Routine Measurement	-197 °C	0.75 mK	LN_2
Capability	-38.8344 °C	0.75 mK	TPHg
	0.010 °C	0.50 mK	TPW
	29.7646 °C	0.75 mK	MPGa
	156.599 °C	1.5 mK	FPIn
	231.928 °C	1.5 mK	FPSn
	419.527 °C	1.8 mK	FPZn
	660.323 °C	2.5 mK	FPAl
	961.78 °C	6.0 mK	FPAg
Fixed Point Schedule 3			
Single Power Calibration –	-197 °C	2.0 mK	LN_2
any SPRTs	-38.8344 °C	2.0 mK	TPHg
	0.010 °C	2.0 mK	TPW
	29.7646 °C	2.0 mK	MPGa
	156.599 °C	3.0 mK	FPIn
	231.928 °C	3.0 mK	FPSn
	419.527 °C	4.0 mK	FPZn
	660.323 °C	7.0 mK	FPAl
	961.78 °C	10 mK	FPAg

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
Fixed Point Schedule 4 – Single Power Calibration in Mini Fixed Points Comparison-			
High Quality PRTs	-197 °C	6.0 mK	LN_2
	-100 °C	6.0 mK	
	-38.8344 °C	6.0 mK	TPHg
	0.010 °C	4.0 mK	TPW
	156.599 °C	6.0 mK	FPIn
	231.928 °C	7.0 mK	FPSn
	419.527 °C	9.0 mK	FPZn
	660.323 °C	14 mK	FPAl
	961.78 °C	30 mK	FPAg
Comparison Schedule 1 – Single Power Calibration by Comparison			
High Quality PRTs	-200 °C	10 mK	
	-100 °C to -50 °C	10 mK	
	-50 °C to 0 °C	8.0 mK	
	0.010°C	6.0 mK	
	0 °C to 200 °C	9.0 mK	
	200 °C to 300 °C	12 mK	
	300 °C to 400 °C	14 mK	
	400 °C to 500 °C	16 mK	
Comparison Schedule 2 – Single Power Calibration by Comparison			
Any Quality PRTs	-200 °C	25 mK	
	-100 °C to -50 °C	25 mK	
	-50 °C to 0 °C	25 mK	
	0 °C to 100 °C	25 mK	
	100 °C to 300 °C	30 mK	
	300 °C to 420 °C	35 mK	

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
	420 °C to 500 °C	45 mK	
	660.323 °C	50 mK	
Comparison Schedule 3 – Dry Block Calibration of PRTs			
	-200 °C	25 mK	Comparison in LN_2
	-38 °C to 0 °C	25 mK	Comparison in Dry Block
	0 °C to 420 °C	45 mK	
	420 °C to 660 °C	50 mK	
Thermistors			
Precision Thermistors	-20 °C to 100 °C	1.5 mK	
	100 °C to 150 °C	3.0 mK	
Thermistors	-50 °C to -20 °C	5.0 mK	
	-20 °C to 120 °C	4.0 mK	
	120 °C to 150 °C	6.0 mK	
Certification of Thermometric Fixed Point Cells			
Direct Comparison to Reference Cells	TPHg	0.20 mK	
	TPW	0.07 mK	
	MPGa	0.07 mK	
	FPIn	0.40 mK	
	FPSn	0.50 mK	
	FPZn	0.60 mK	
	FPAl	1.0 mK	
	FPAg	1.9 mK	
Direct Comparison to Working Cells	TPHg	0.25 mK	
	TPW	0.10 mK	
	MPGa	0.10 mK	
	FPIn	0.60 mK	
	FPSn	0.75 mK	

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
	FPZn	0.75 mK	
	FPAl	1.2 mK	
	FPAg	2.5 mK	
Dry Block Calibrators	-45.0 °C to 155.0 °C	0.020 °C	Direct Comparison to PRT
	155 °C to 225 °C	0.030 °C	
	225 °C to 425 °C	0.040 °C	
	425 °C to 660 °C	0.050 °C	
NVLAP Code: 20/T08 TEMPERATURE INDICATORS			
High Quality Thermocouples		Calibration of used thermocouples may result in larger uncertainties due to increased inhomogeneity.	
Type S and Type R	156.599 °C	0.10 °C	FPIn
	231.928 °C	0.10 °C	FPSn
	419.527 °C	0.13 °C	FPZn
	660.323 °C	0.18 °C	FPAl
	961.78 °C	0.25 °C	FPAg
Au/PT	0.010 °C	10 mK	TPW
	156.599 °C	20 mK	FPIn
	231.928 °C	20 mK	FPSn
	419.527 °C	20 mK	FPZn
	660.323 °C	25 mK	FPAl
	961.78 °C	35 mK	FPAg
	1000.00 °C	40 mK	Extrapolated
Digital Thermometer with PRT System		Probe uncertainty is not included in stated uncertainty.	Comparison or Mini Fixed Points
	-200 °C	10 mK	
	-100 °C to -50 °C	10 mK	
	-50 °C to 0 °C	8.0 mK	

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3]	Remarks
	0.010°C	5.0 mK	
	0 °C to 200 °C	8.0 mK	
	200 °C to 300 °C	9.0 mK	
	300 °C to 400 °C	10 mK	
	400 °C to 500 °C	11 mK	
	660.323 °C	15 mK	FPAl
END			

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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 using a coverage factor, $k = 2$, with a level of confidence of approximately 95 %. 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: Calibration 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.

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