THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

3M CORPORATE METROLOGY SERVICES

St. Paul, MN

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets any additional program requirements in the field of calibration. 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 January 2009*).

Presented this 10th day of February 2009.

President
For the Accreditation Council
Certificate Number: 2218.01
Valid to: February 28, 2011

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

3M CORPORATE METROLOGY SERVICES
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CALIBRATION

Valid To: February 28, 2011 Certificate Number: 2218.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Dimensional

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Gage Blocks	(0 to 1) in 2 in 3 in 4 in (0 to 25) mm (25 to 50) mm (50 to 75) mm (75 to 100) mm	3 µin 2.8 µin 4.2 µin 4.9 µin 0.065 µm 0.068 µm 0.081 µm 0.095 µm	Gage block comparator
Plain Pin/Plug Gages	(0 to 1) in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in	9.3 µin 9.4 µin 9.5 µin 10 µin 11 µin	Universal measuring machine (SIP)

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Plain Ring Gages	(0.393 to 1) in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in	11 µin 11 µin 11 µin 12 µin 12 µin	Universal measuring machine (SIP)
Feeler Gages	(0.001 to 0.200) in	23 µin	Universal measuring machine (SIP)
Steel Rulers	(0 to 4) ft (4 to 8) ft	0.001 in 0.002 in	Laser interferometer
Height Gage	(0 to 12) in (12 to 25) in	23 µin 32 µin	Gage blocks
Standard End Measuring Rods	(0 to 4) in (4 to 8) in (8 to 12) in	24 µin 28 µin 29 µin	Universal measuring machine (SIP)
Digital Caliper[3]	Up to 6 in Up to 12 in	540 µin 620 µin	Gage blocks
Dial Indicator[3]	Up to 1 in	130 µin	Brown & Sharpe electronic micrometer head and readout
Pin Gages[3]	Up to 1 in	34 µin	Pratt & Whitney universal supermicrometer
Micrometer[3]	Up to 1 in Up to 4 in	53 µin 86 µin	Gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5] (±)	Comments
DC Voltage – Generate	(10 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	8 µV/V + 0.5 µV 4.5 µV/V + 0.8 µV 3.5 µV/V + 3 µV 3.5 µV/V + 5 µV 5 µV/V + 50 µV 7 µV/V + 500 µV	Fluke 5700A/EP
DC Current – Generate	(10 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	45 µA/A + 7 nA 37 µA/A + 8 nA 37 µA/A + 50 nA 47 µA/A + 0.8 µA 80 µA/A + 15 µA 0.035 % + 480 µA	Fluke 5700A/EP Fluke 5700A/EP and 5725A
Resistance – Generate, Fixed Points	0 Ω (1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9, 10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	50 µΩ/Ω 0.01 % 27 µΩ/Ω 13 µΩ/Ω 11 µΩ/Ω 13 µΩ/Ω 21 µΩ/Ω 22 µΩ/Ω 40 µΩ/Ω 50 µΩ/Ω 0.012 %	Fluke 5700A/EP
Capacitance – Generate	(0.33 to 10.999) nF (11 to 109.99) nF (110 to 329.99) nF (0.33 to 1.0999) µF (1.1 to 3.2999) µF (3.3 to 10.999) µF (11 to 32.999) µF (33 to 109.99) µF (110 to 329.99) µF (0.330 to 1.1) mF	0.6 % + 0.1 nF 0.4 % + 0.1 nF 0.4 % + 0.3 nF 0.4 % + 1 nF 0.48 % + 3 nF 0.48 % + 10 nF 0.52 % + 30 nF 0.6 % + 100 nF 0.77 % + 300 nF 2.6 % + 300 nF	Fluke 5500A

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Electrical Calibration of Thermocouple Indicators[3] –			
Type E	-260 °C to 1000 °C	0.058 °C	Fluke 5720A
Type J	-210 °C to 1200 °C	0.42 °C	
Type K	-270 °C to 1372 °C	0.18 °C	
Type T	-270 °C to 400 °C	0.017 °C	

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5] (±)	Comments
AC Voltage – Generate			
(1 to 2.2) mV	(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	0.2 % 0.19 % 0.19 % 0.2 % 0.2 % 0.55 % 2.6 % 1.2 %	Fluke 5700A/EP
(2.2 to 22) mV	(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	17 µV 8.9 µV 8.7 µV 11 µV 27 µV 38 µV 54 µV 100 µV	
(22 to 220) mV	(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	91 µV 17 µV 17 µV 26 µV 54 µV 170 µV 410 µV 660 µV	

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5] (±)	Comments
AC Voltage – Generate (cont)			
220 mV to 2.2 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	0.016 % 0.0065 % 0.0065 % 0.012 % 0.055 % 0.055 % 0.18 % 0.29 %	Fluke 5700A/EP
(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	0.0016 % 0.0078 % 0.0078 % 0.013 % 0.026 % 0.61 % 0.61 % 1.2 %	
(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	0.036 % 0.036 % 0.017 % 0.049 % 0.18 %	
(220 to 1100) V	15 Hz to 1 kHz	0.0089 %	
(220 to 750) V	30 kHz to 50 kHz 50 kHz to 100kHz	0.046 % 0.17 %	
(220 to 1100) V	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 100 kHz	0.0089 % 0.0091 % 0.045 %	Fluke 5700A/EP and 5725A
AC Current – Generate			
(10 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 20 nA 0.019 % + 12 nA 0.014 % + 10 nA 0.034 % + 15 nA 0.12 % + 80 nA	Fluke 5700A/EP

Parameter/Range	Frequency	Best Uncertainty[2, 4] (±)	Comments
AC Current – Generate (cont)			
220 µA 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	0.029 % + 50 nA 0.019 % + 40 nA 0.014 % + 40 nA 0.023 % + 130 nA 0.12 % + 800 nA	Fluke 5700A/EP
(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	0.029 % + 500 nA 0.019 % + 400 nA 0.014 % + 400 nA 0.023 % + 700 nA 0.12 % + 6 µA	
(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	0.029 % + 5 µA 0.019 % + 4 µA 0.013 % + 3 µA 0.023 % + 4 µA 0.12 % + 12 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.031 % + 40 µA 0.048 % + 100 µA 0.75 % + 200 µA	
(2.2 to 11) A	(45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	0.044 % + 170 µA 0.09 % + 380 µA 0.35 % + 750 µA	

III. Fluid Quantities

Parameter/Equipment	Range	Best Uncertainty[2, 5] (±)	Comments
Gas Flow	(0 to 50) SCCM (0 to 500) SCCM (0 to 5) SLPM (0 to 30) SLPM (0 to 100) SLPM (0 to 200) SPLM	0.34 % 0.22 % 0.24 % 0.48 % 0.62 % 0.42 %	DHI Moblocs

IV. Mechanical

Parameter/Equipment	Range	Best Uncertainty[2]	Comments
Force	(0 to 200) lbf	0.014 % of value	Deadweight
	(0 to 2000) lbf	0.0094 % of value	Morehouse deadweight calibrator
	(2000 to 10 000) lbf	2.8 lbf	Proving rings
Mass	1 mg	0.53 µg	1 kg standard with NIST designs
	2 mg	0.51 µg	
	3 mg	0.52 µg	
	5 mg	0.59 µg	ASTM 617
	10 mg	0.53 µg	Class 1, 2, 3, 4, 5
	20 mg	0.5 µg	
	30 mg	0.52 µg	OIML F1, F2
	50 mg	0.6 µg	
	100 mg	0.58 µg	
	200 mg	0.69 µg	
	300 mg	0.89 µg	
	500 mg	1.3 µg	
	1 g	2.5 µg	
	2 g	2.3 µg	
	3 g	2.6 µg	
	5 g	3.1 µg	
	10 g	4.2 µg	
	20 g	5.2 µg	
	30 g	6.8 µg	
	50 g	10 µg	
	100 g	21 µg	
	200 g	21 µg	
	300 g	25 µg	
	500 g	33 µg	
	1 kg	0.059 mg	
	2 kg	0.38 mg	
	3 kg	0.53 mg	
	5 kg	0.86 mg	
	10 kg	1.7 mg	
	20 kg	13 mg	
	25 kg	14 mg	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Mass (cont)	1 mg	0.003 mg	NBS Class F
	2 mg	0.003 mg	
	3 mg	0.003 mg	ASTM Class 6
	5 mg	0.004 mg	
	10 mg	0.005 mg	
	20 mg	0.007 mg	
	30 mg	0.004 mg	
	50 mg	0.005 mg	
	100 mg	0.009 mg	
	200 mg	0.018 mg	
	300 mg	0.027 mg	
	500 mg	0.045 mg	
	1 g	0.048 mg	
	2 g	0.049 mg	
	3 g	0.05 mg	
	5 g	0.052 mg	
	10 g	0.06 mg	
	20 g	0.087 mg	
	30 g	0.12 mg	
	50 g	0.18 mg	
	100 g	0.36 mg	
	200 g	0.73 mg	
	300 g	2.6 mg	
	500 g	1.8 mg	
	1 kg	3.6 mg	
	2 kg	7.3 mg	
	3 kg	11 mg	
	5 kg	18 mg	
	10 kg	36 mg	
	20 kg	93 mg	
	0.5 lb	1.7 mg (3.8×10^{-6} lb)	Double substitution
	1 lb	1.7 mg (3.8×10^{-6} lb)	
	2 lb	1.9 mg (4.2×10^{-6} lb)	Cast Iron
	5 lb	2.7 mg (6×10^{-6} lb)	
	10 lb	4.5 mg (9.9×10^{-6} lb)	NIST Class F, C
	20 lb	61 mg (1.4×10^{-5} lb)	
	25 lb	61 mg (1.4×10^{-5} lb)	ASTM Class 6
	50 lb	64 mg (1.5×10^{-5} lb)	

Parameter/Equipment	Range	Best Uncertainty[2, 5] (±)	Comments
Torque	(0 to 50) in·lb (51 to 100) in·lb (101 to 200) in·lb (201 to 300) in·lb (300 to 600) in·lb 100 ft·lb 200 ft·lb 300 ft·lb 400 ft·lb 500 ft·lb	2.6 % 1.4 % 0.85 % 0.7 % 0.59 % 0.88 % 0.66 % 0.62 % 0.06 % 0.059 %	Torque calibrator
Torque Transducers	(0 to 100) in·lb (0 to 1000) in·lb (0 to 500) ft·lb	0.11 % 0.11 % 0.11 %	Deadweights and moment arms (4 in, 10 in and 24 in)
Durometers – Types A & D	(0 to 100) units	0.6 units	Shore durocalibrator
Pressure[3] –			
Pneumatic	(-15 to -4.5) psig negative gage	0.01 %	7250 SYS
	(-4.5 to 0) psig negative gage	0.00045 psi	
	(0 to 1000) psig	0.01 %	
	(0 to 1000) psig	0.0028 %	Deadweight gage
	(0 to 500) psig	0.0028 % + 0.02 psi	Ruska 7010
	(0 to 300) psig	0.0056 % + 0.09 psi	SI PC6 PRO
Low pressure	(-10 to 10) inH_2O (-30 to 30) inH_2O	0.0017 inH_2O 0.004 inH_2O	Ruska 7250LP
	(0 to 5) inH_2O (0 to 10) inH_2O	0.032 % + 0.0024 inH_2O 0.032 % + 0.0035 inH_2O	Druck DP615 Druck DP610
Hydraulic	(0 to 10 000) psig	0.029 %	Deadweight tester

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Balances[3]	1 mg 2 mg 3 mg 5 mg 10 mg 20 mg 30 mg 50 mg 100 mg 200 mg 300 mg 500 mg 1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 3 kg 5 kg 10 kg 20 kg 60 kg	0.53 µg 0.51 µg 0.52 µg 0.59 µg 0.53 µg 0.5 µg 0.52 µg 0.6 µg 0.58 µg 0.69 µg 0.89 µg 1.3 µg 2.5 µg 2.3 µg 2.6 µg 3.1 µg 4.2 µg 5.2 µg 6.8 µg 10 µg 21 µg 21 µg 25 µg 33 µg 0.059 mg 0.38 mg 0.53 mg 0.86 mg 1.7 mg 20 mg 27 mg	Class 1 weights
Scales[3]	1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g	0.9 mg 1.2 mg 1.3 mg 1.5 mg 2 mg 4 mg 6 mg 10 mg 20 mg 40 mg 60 mg 70 mg	NBS Handbook 105-1 Class F Weights

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Scales[3] (cont)	1 kg 2 kg 3 kg 5 kg 10 kg 20 kg 50 kg 0.5 lb 1 lb 2 lb 5 lb 10 lb 20 lb 25 lb 50 lb 1000 lb	100 mg 200 mg 300 mg 500 mg 1000 mg 2000 mg 5000 mg 0.000099 lb 0.00015 lb 0.00020 lb 0.00050 lb 0.00099 lb 0.0020 lb 0.0024 lb 0.0051 lb 0.102 lb	NBS Handbook 105-1 Class F Weights

V. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Infrared Thermometers	50 ºC to 100 °C 200 ºC to 1050 °C	1 °C 3.6 °C	Blackbody simulator
Temperature Measuring Equipment[3] –			
Liquid-in-glass thermometers	-70 °C to -40 °C -40 °C to 75 °C 75 °C to 180 °C 180 °C to 500 °C	0.046 °C 0.022 °C 0.025 °C 0.022 °C	Comparison to SPRT in bath
RTDs & Thermisters	-70 °C to -40 °C -40 °C to 75 °C 75 °C to 180 °C 180 °C to 500 °C	0.042 °C 0.012 °C 0.018 °C 0.013 °C	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Temperature[3] – Measure	-5 °C to 125 °C	0.25 °C	Hart Scientific 7102
	-200 °C to 0 °C 0 ºC to 200 ºC 200 ºC to 400 ºC 400 ºC to 661 ºC	0.043 ºC 0.018 ºC 0.024 ºC 0.031 ºC	Hart Scientific 1502A/1529 w/ 5628
Thermocouple[3] – Measure			
Type J	-210 ºC to -100 ºC -100 ºC to 800 ºC 800 ºC to 1200 ºC	0.66 °C 0.34 °C 0.55 °C	Fluke 743B/744
	-210 ºC to 1200 ºC	1.2 ºC	w/ Type J thermocouple
Type K	-200 ºC to -100 ºC -100 ºC to 400 ºC 400 ºC to 1200 ºC 1200 ºC to 1372 ºC	0.77 °C 0.4 °C 0.64 °C 0.81 °C	
	-200 ºC to 1372 ºC -200 ºC to 400 ºC	1.4 ºC 1 ºC	w/ Type T thermocouple
Type T	-250 ºC to -200 ºC -200 ºC to 0 ºC 0 ºC to 400 ºC	1.8 °C 0.87 °C 0.34 °C	
Thermocouple Measuring Equipment[3] –			
Type J	-210 °C to -100 °C -100 °C to 800 °C 800 °C to 1200 °C	0.4 °C 0.26 °C 0.3 °C	Fluke 743B/744
Type K	-200 °C to -100 °C -100 °C to 400 °C 400 °C to 1200 °C 1200 °C to 1372 °C	0.52 °C 0.4 °C 0.5 °C 0.5 °C	
Type T	-250 °C to -200 °C -200 °C to 0 °C 0 °C to 400 °C	1.1 °C 0.75 °C 0.34 °C	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Relative Humidity Measuring Equipment[3]	(10 to 20) % RH (20 to 30) % RH (30 to 40) % RH (40 to 50) % RH (50 to 80) % RH (80 to 90) % RH (90 to 95) % RH	0.77 % RH 0.67 % RH 0.68 % RH 0.6 % RH 0.6 % RH 0.62 % RH 0.66 % RH	Thunder Scientific model 2500
Relative Humidity[3] – Measure	(10 to 20) % RH (20 to 30) % RH (30 to 40) % RH (40 to 50) % RH (50 to 80) % RH (80 to 90) % RH (90 to 95) % RH	1.6 % RH 1.6 % RH 1.6 % RH 1.5 % RH 1.7 % RH 1.7 % RH 2.6 % RH	Vaisala MI70/HMP77B

VI. Time and Frequency

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
Frequency Measuring Equipment – Fixed Point	10 MHz Reference	0.4 nHz/Hz	Fluke PM6681R and TrueTime XL-DC GPS

[1] This laboratory does not offer commercial calibration service, but does offer field calibration service to internal customers.

[2] "Best Uncertainty" is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration and this laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

[4] The measurands stated are generated with the Fluke 5700A and 5500A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Best measurement uncertainties are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

[5] In the statement of best uncertainty, percentages represent the percent of reading (rdg) unless otherwise noted.