SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: December 31, 2018 Certificate Number: 0866.01

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	CMC[2, 4] (±)	Comments
Dial/Digital Indicators – Displacement[3]	Up to 1 in (1 to 4) in (4 to 12) in	62 µin 74 µin 140 µin	Gage blocks, digital micrometer head
Extensometers/COD Gage/Deflectometers[3]	Up to 1 in (1 to 2) in (2 to 10) in (10 to 25) in	39 µin 80 µin 110 µin 280 µin	ASTM E83 calibrator, gage blocks ISO 9513
Gauge Length	Up to 8 in	0.0016 in	Caliper
Microscopes[3] – Displacement	Up to 1 in Up to 25.4 mm	60 µin 12 µin	ASTM E1951 stage micrometers
Alignment System Calibration	(100 to 3000) µe	0.13 % + 1.0 µe	Vishay 1550

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 6] (±)	Comments
DC Voltage[3] – Measure	(-1000 to -100) V (-100 to -10) V (-10 to -1) V -1 V to -100 mV (-100 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	12 µV/V + 350 µV 12 µV/V + 52 µV 12 µV/V + 2.4 µV 12 µV/V + 0.42 µV 12 µV/V + 0.35 µV 12 µV/V + 0.42 µV 12 µV/V + 2.4 µV 12 µV/V + 52 µV 12 µV/V + 350 µV	HP3458A
DC Current[3] – Measure	(-3 to -1) A (-1 to -100) mA (-100 to -10) mA (-10 to -1) mA -1 mA to -100 µA (-100 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 3) A	0.14 % + 0.69 mA 130 µA/A + 18 µA 46 µA/A + 0.86 µA 29 µA/A + 81 nA 29 µA/A + 8.0 nA 20 µA/A + 1.3 nA 29 µA/A + 8.0 nA 29 µA/A + 81 nA 46 µA/A + 0.86 µA 130 µA/A + 18 µA 0.14 % + 0.39 mA	HP 34401 HP 3458A HP 34401
Resistance[3] – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	23 µΩ/Ω + 130 µΩ 23 µΩ/Ω + 1.2 mΩ 17 µΩ/Ω + 1.4 mΩ 17 µΩ/Ω + 16 mΩ 17 µΩ/Ω + 170 mΩ 23 µΩ/Ω + 4.6 Ω 87 µΩ/Ω + 120 Ω 0.12 % + 1.2 kΩ 1.2 % + 14 kΩ	HP 3458A

III. Mechanical

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Scales and Balances[3]	(0 to 1) g (1 to 10) g (10 to 100) g (100 to 500) g (500 to 1000) g (1 to 5) kg (5 to 10) kg (10 to 20) kg (0 to 1) lb (1 to 10) lb (10 to 100) lb (100 to 600) lb	0.04 mg 0.06 mg 0.29 mg 1.4 mg 2.9 mg 30 mg 58 mg 2.9 g 0.00018 lb 0.0012 lb 0.012 lb 0.07 lb	Precision weights Precision weights
Mass – Measure[5]	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 205 g 300 g 500 g 1 kg 2 kg 3 kg 5 kg 5.1 kg 10 kg 11.8 kg 20 kg 25 kg 30 kg 32.1 kg	0.0055 mg 0.0056 mg 0.0072 mg 0.0072 mg 0.0062 mg 0.0055 mg 0.0073 mg 0.0073 mg 0.0052 mg 0.0097 mg 0.012 mg 0.012 mg 0.0097 mg 0.0085 mg 0.020 mg 0.021 mg 0.033 mg 0.043 mg 0.085 mg 0.099 mg 0.18 mg 0.31 mg 0.32 mg 0.73 mg 0.84 mg 1.9 mg 6.4 mg 6.0 mg 8.0 mg 8.2 mg 44 mg 44 mg 53 mg 79 mg 120 mg 130 mg	Comparison to precision weights

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Force[3] – Measure			Load cells, Class F weights
Tension Compression	(0.001 to 200 000) lbf (0.001 to 600 000) lbf (0.001 to 1 000 000) lbf	0.06 % 0.06 % 0.25 %	ASTM E4
Tension Compression	(0.001 to 200 000) lbf (0.001 to 600 000) lbf	0.14 % 0.18 %	ISO 7500-1
Force – Measuring Equipment			
Dead Weight with Gravity and Air Buoyancy (Corrections in Tension and Compression)	(0.004 to 125) lbf	0.0018 %	Force calibration includes ASTM E4 (Class A), ASTM E74 (Class A and AA), and ISO 376 (Class 00,0.5, 1 and 2)
Force Multiplier Calibration Frame with Master Load Cell (In Tension and Compression)	(> 125 to 200) lbf (> 200 to 500) lbf (> 500 to 1200) lbf (> 1200 to 2000) lbf (> 2000 to 5000) lbf (> 5000 to 25 000) lbf (> 25 000 to 30 000) lbf (> 30 000 to 100 000) lbf	0.010 % + 0.0055 lbf 0.012 % + 0.0018 lbf 0.011 % + 0.015 lbf 0.012 % + 0.0037 lbf 0.012 % + 0.015 lbf 0.012 % + 0.080 lbf 0.0079 % + 2.8 lbf 0.011 % + 1.9 lbf	
Pressure – Source and Measure			
Hydraulic[3, 5]			
Effective Area Determination of High Accuracy Piston-Cylinder Unit (PCU)	(100 to 4000) PSI (500 to 20 000) PSI (1000 to 40 000) PSI	0.0047 % 0.0034 % 0.0057 %	Cross float method against Ruska deadweight tester
Calibration of Pressure Devices	(100 to 400) PSI (400 to 4000) PSI (500 to 20 000) PSI (1000 to 40 000) PSI	0.0030 % + 0.0090 PSI 0.0044 % + 0.0035 PSI 0.0034 % + 0.0025 PSI 0.0055 % + 0.0020 PSI	Comparison to Ruska deadweight tester

Parameter/Equipment	Range	CMC[2] (±)	Comments
Verification of Test Frames[3] –			
Specimen Alignment (50 to 10 000) lbf	(0 to 25) % bending	1.3 % bending	ASTM E1012
Crosshead Displacement	(0 to 25) in	0.003 in	ASTM E2309, digital encoder gauge blocks
	(0 to 10) in	160 µin	
Crosshead Speed	(0 to 20) in/min	0.33 %	ASTM E 2658, digital encoder, stop watch
Strain Rate	(0.001 to 0.01) in/in/min	0.12 %	Strain device, stop watch
Torque Testing Machines	(0.01 to 200) ft/lbs	0.1 %	ASTM E 2624 Loading arm, mass standards
Indirect Verification of Rockwell Hardness Testers[3]	HRA: (20 to 65) HRA (70 to 78) HRA (80 to 84) HRA HRBW: (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW HRC: (20 to 30) HRC (35 to 55) HRC (60 to 65) HRC HREW: (70 to 79) HREW (84 to 90) HREW (93 to 100) HREW HRFW: (60 to 75) HRFW (80 to 90) HRFW (94 to 100) HRFW HRGW: (30 to 50) HRGW (55 to 75) HRGW (80 to 94) HRGW	 0.50 HRA 0.39 HRA 0.34 HRA 0.72 HRBW 0.72 HRBW 0.61 HRBW 0.45 HRC 0.44 HRC 0.43 HRC 0.63 HREW 0.65 HREW 0.57 HREW 0.55 HRFW 0.55 HRFW 0.61 HRFW 0.59 HRGW 0.48 HRGW 0.49 HRGW	Indirect verification per ASTM E18

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3] (cont)	HRHW: (80 to 94) HRHW (96 to 100) HRHW HRKW: (40 to 60) HRKW (65 to 80) HRKW (85 to 100) HRKW HRMW: Low High HRLW: Low High HRRW: — HR15TW: (74 to 80) HR15TW (81 to 86) HR15TW (87 to 93) HR15TW HR30TW: (43 to 56) HR30TW (57 to 69) HR30TW (70 to 83) HR30TW HR45TW: (13 to 32) HR45TW (33 to 52) HR45TW (53 to 73) HR45TW HR15N: (70 to 77) HR15N (78 to 88) HR15N (90 to 92) HR15N HR30N: (42 to 50) HR30N (55 to 73) HR30N (77 to 82) HR30N HR45N: (20 to 31) HR45N (37 to 61) HR45N (66 to 72) HR45N HR15WW: Low High	 0.61 HRHW 0.48 HRHW 0.54 HRKW 0.51 HRKW 0.46 HRKW 0.62 HRMW 0.59 HRMW 0.58 HRLW 0.48 HRLW 0.61 HRRW 0.63 HR15TW 0.65 HR15TW 0.48 HR15TW 0.58 HR30TW 0.55 HR30TW 0.47 HR30TW 0.58 HR45TW 0.61 HR45TW 0.62 HR45TW 0.49 HR15N 0.62 HR15N 0.45 HR15N 0.70 HR30N 0.62 HR30N 0.54 HR30N 0.49 HR45N 0.57 HR45N 0.52 HR45N 0.58 HR15WW 0.53 HR15WW	Indirect verification per ASTM E18

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3] (cont)	HR30WW: Low High HR15YW: Low High HR15TS: (74 to 80) HR15TS (81 to 86) HR15TS (87 to 93) HR15TS HR30TS: (43 to 56) HR30TS (57 to 69) HR30TS (70 to 83) HR30TS HRBS: (40 to 59) HRBS (60 to 79) HRBS (80 to 100) HRBS	 0.80 HR30WW 0.65 HR30WW 0.53 HR15YW 0.55 HR15YW 0.70 HR15TS 0.70 HR15TS 0.46 HR15TS 0.57 HR30TS 0.55 HR30TS 0.47 HR30TS 0.75 HRBS 0.71 HRBS 0.64 HRBS	ASTM E18-05E1
Indirect Verification of Brinell Hardness Testers[3] at Test Condition(s) –			
HBW 10/3000/15	(95 to 650) HBW	7.3 HBW	Indirect verification method per ISO 6506-2
HBW 10/3000/30	(96 to 650) HBW	4.1 HBW	Indirect verification method per ASTM E10
HBW 10/1500/15	(48 to 327) HBW	1.7 HBW	
HBW 10/1000/10	(32 to 218) HBW	1.8 HBW	
HBW 5/750/30	(96 to 650) HBW	11 HBW	
HBW 10/500/5	(16 to 109) HBW	4.3 HBW	
HBW 2.5/187.5/30	(96 to 650) HBW	9.9 HBW	
HBW 2.5/62.5/10	(32 to 218) HBW	6.4 HBW	
Direct Verification of the Test Force	(62.5, 187.5, 500, 750, 1000, 1500, 3000) kgf	0.12 %	ASTM E4 Load cells
Verification of the Brinell Scope	(0 to 10) mm Type A Type B	 0.012 mm 0.12 mm	Stage micrometer

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Microindentation Hardness Testers (Knoop and Vickers) –			
For Loads Less than 1000 g	(100 to 250) HK (250 to 650) HK > 650 HK	1.0 % HK 1.1 % HK 1.1 % HK	Indirect verification method per ASTM E384
	(100 to 240) HV (240 to 600) HV > 600 HV	1.1 % HV 0.9 % HV 0.8 % HV	
For Loads Greater than 1000 g	(100 to 240) HV (240 to 600) HV > 600 HV	1.2 % HV 1.2 % HV 1.2 % HV	
X-Y Stage	(0 to 1) inch (0 to 25) mm	59 µin 12 µm	Stage micrometer
Indirect Verification of Charpy Impact Testers[3]	2092 Series 2096 Series 2098 Series	0.80 ft/lbf 1.9 ft/lbf 5.6 ft/lbf	ASTM E 23
	30 J 80 J 120 J	1.2 J 2.8 J 5.0 J	ISO 148-2

[1] This laboratory offers commercial calibration service and field calibration service.

[2] Calibration and Measurement Capability Uncertainty (CMC) 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 or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC 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 actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found 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 actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] In the statement of CMC, percentages are percent of reading unless otherwise indicated.

[5] Uncertainties may differ depending on the accuracy requirements of the device under test or the artifact being measured.

[6] The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

Accredited Laboratory

A2LA has accredited

CAL-RITE CORPORATION

Naperville, IL

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 the requirements of ANSI/NCSL Z540-1-1994 and *R205 – Specific Requirements: Calibration Laboratory Accreditation Program*. 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 8 January 2009*).

Presented this 7th day of October 2016.

Senior Director of Quality and Communications
For the Accreditation Council
Certificate Number 866.01
Valid to December 31, 2018
Revised on October 8, 2018

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