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

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CALIBRATION

Valid To: August 31, 2019 Certificate Number: 0887.01

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] (±)	Comments
Olsen Cal 60 Extensometer Calibrator[4]	(0.005 to 1) in	6 µin	Gage blocks
Dial Indicator[3]	(0.0001 to 1) in (0.0010 to 5) in	0.0002 in or 0.04 % of rdg (whichever is greater) 0.00026 in or 0.04 % of rdg (whichever is greater)	CAL 60 & gage blocks
Calipers	Up to 6 in	0.0005 in	Gage blocks
Micrometers	Up to 4 in	0.00005 in	Gage blocks
Torsion Lever Length	(1 to 100) in	0.07 % of lever length	Steel scales & calipers
Extrusion Plastometer Level (Tinius Olsen)	-----	0.00059 in/in	Fixture & gage blocks

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II. Dimensional Testing/Calibration[1]

Parameter/Equipment	Range	CMC[2] (±)	Comments
One Dimensional[3, 6] – Measure	Up to 1 in Up to 1 in Up to 6 in Up to 60 in Up to 10 in	40 µin (0.06 % of rdg) 0.00021 in 0.0015 in 0.0066 in 44 µin	CAL 60 Micrometer Caliper Scales Gage blocks
One Dimensional[4, 6] – Measure	Up to 6 in	0.0006 in	Gage blocks & comparator

III. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Universal Testing Machines, Compression Testing Machines, Tension Testing Machines[3]	(0.001 to 1 000 000) lbf (0.001 to 500 000) lbf	0.22 % of applied force 0.22 % of applied force	ASTM E4, load cells, proving rings & dead weight ISO 7500-1, load cells, proving rings & dead weight, Class 0.5, 1, 2, 3
Static Uniaxial Testing Machines[3] – Tension Creep Testing Machines	(0.001 to 1 000 000) lbf (0.001 to 500 000) lbf	0.22 % of applied force 0.22 % of applied force	ASTM E4, load cells, proving rings & dead weight ISO 7500-2, load cells, proving rings & dead weight, Class 0.5, 1, 2, 3
Torsion Testing Machine[3]	(0.2 to 660 000) in·lbf (180 to 10 500) in·lbf	0.30 % of applied force 0.22% of applied force	ASTM E2624, load cells, proving rings, dead weight & lever Torsion cell
Dynamic Force Machines[3]	(60 to 225 000) lbf	1.3 % of applied force	Dynamometer & NASM 1312B

Parameter/Equipment	Range	CMC[2] (±)	Comments
Extensometers, Deflectometers & Rate Indicators[3]			ASTM E83 w/ Class B1, B2, C, D, & E; ISO 9513 w/ Class 0.5, 1, 2, 3
	Up to 0.04 in of motion	44 µin	Using CAL 60
	(0.04 to 24) in of motion	$\sqrt{[(41)^2 + (410 \cdot Rdg)^2]}$ µin	Using CAL 60 or long travel rig
	(0 to 1) mm of motion	1.2 µm	Using short travel rig or CAL 60
Gauge Length Verification	(≥1 to 25) mm of motion	$\sqrt{[(1)^2 + (0.54 \cdot Rdg)^2]}$ µm	Using short travel rig or CAL 60
Direct Verification of Brinell Hardness Testers – Verification of the Test Force	(1 to 3000) kgf	0.22 % of applied load	Per direct verification of ASTM E10
Verification of the Indenter[4]	(1 to 10) mm	0.0025 mm	Verification of the test force is by load cell, proving ring, weights per the method of ASTM E4
Verification of the Device for Measuring Indention Diameters	Up to 6 mm	0.0048 mm	
Verification of Test Cycle	(0 to 30) s	0.11 s	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification with a Force Verification of Brinell Hardness Machines[3] –			Indirect verification method per ASTM E10
HBW 10/500/15	(15.9 to 70) HBW (70 to 130) HBW	0.5 HBW 0.50 HBW	
HBW 10/1000/15	(31.8 to 120) HBW (120 to 225) HBW	0.40 HBW 2.3 HBW	
HBW 10/1500/15	(47.7 to 188) HBW (188 to 327) HBW	0.90 HBW 3.7 HBW	
HBW 10/3000/15	(95.5 to 373) HBW (373 to 650) HBW	0.81 HBW 4.7 HBW	
HBW 2.5/31.25/15	(15.9 to 70) HBW (70 to 110) HBW	1.6 HBW 2.5 HBW	
HBW 2.5/62.5/15	(31.8 to 120) HBW (120 to 225) HBW	2.0 HBW 4.1 HBW	
HBW 2.5/187.5/15	(95.5 to 373) HBW (373 to 650) HBW	2.1 HBW 14.6 HBW	
HBW 2.5/250/15	(95.5 to 373) HBW (373 to 650) HBW	3.0 HBW 11 HBW	
HBW 5/750/15	(95.5 to 300) HBW (300 to 650) HBW	1.6 HBW 2.9 HBW	
HBW 5/250/15	(31.8 to 120) HBW (120 to 225) HBW	1.1 HBW 3.2 HBW	
HBW 1/30/15	(96 to 200) HBW (>450 to <650) HBW	3.1 HBW 15 HBW	
HBW 1/10/15	(>32 to <100) HBW (>150 to <210) HBW	1.0 HBW 3.8 HBW	
Verification of The Device for Measuring Indention Diameters	Up to 6 mm	0.0048 mm	Verification of the test force is by load cell, proving ring, weights per ASTM E4

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness & Rockwell Superficial Hardness Machines[3]	HRA: Low Medium High HRBW: Low Medium High HRC: Low Medium High HRD: Low Medium High HREW: Low Medium High HRFW: Low Medium High HRHW: Low High HRMW Entire Range HRRW Entire Range HR15N: Low Medium High HR30N: Low Medium High HR45N: Low Medium High	 0.27 HRA 0.16 HRA 0.15 HRA 0.26 HRBW 0.25 HRBW 0.37 HRBW 0.37 HRC 0.32 HRC 0.31 HRC 0.14 HRD 0.19 HRD 0.10 HRD 0.16 HREW 0.18 HREW 0.49 HREW 0.44 HRFW 0.44 HRFW 0.44 HRFW 0.38 HRHW 0.35 HRHW 0.41 HRMW 0.20 HRRW 0.35 HR15N 0.21 HR15N 0.20 HR15N 0.28 HR30N 0.28 HR30N 0.17 HR30N 0.44 HR45N 0.12 HR45N 0.12 HR45N	Indirect verification per ASTM E18

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness & Rockwell Superficial Hardness Machines[3] (cont)	HR15TW: Low Medium High HR30TW: Low Medium High HR45TW: Low Medium High	 0.25 HR15TW 0.24 HR15TW 0.29 HR15TW 0.51 HR30TW 0.19 HR30TW 0.20 HR30TW 0.60 HR45TW 0.39 HR45TW 0.38 HR45TW	Indirect verification per ASTM E18
Direct Verification of Rockwell Hardness Testers (Limited) –			
Verification of the Test Force	(3 to 150) kgf	0.22 % of applied load	Verification of the test force is by load cell, proving ring, weights per the method of ASTM E4 & E18
Verification of Machine Hysteresis	--	0.14 microns	
Verification of the Depth – Measuring Device	--	0.36 microns	Per direct verification method of ASTM E18
Verification of Test Cycle	(0 to 30) s	0.11 s	Note: This calibration is a limited calibration

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Microindentation Hardness Machines[3] –			
Vickers	(100 to 240) HV (> 240 to 600) HV > 600 HV	0.60 HV 1.5 HV 4.1 HV	Indirect verification per ASTM E384 & ASTM E92
Knoop	(100 to 250) HK (250 to 650) HK > 650 HK	4.1 HK 6.4 HK 15 HK	
Vickers/Knoop Stage Motion	Up to 20 mm	0.0048 mm	Stage micrometer
Direct Verification of Vickers & Knoop Hardness Testers (Limited) –			
Verification of Test Force	(0.100 to 120) kgf	0.22 % of applied force	Verification of the test force is by load cell, proving ring, weights per the method of ASTM E4 & E384 & ASTM E92
Verification of the Device for Measuring Indentation Diagonals	Up to 200 µm	0.00036 mm	Direct verification method per ASTM E384 & ASTM E92
Verification of Test Cycle	(0 to 30) s	0.11 s	Note: This calibration is a limited calibration

Parameter/Equipment	Range	CMC[2] (±)	Comments
Impact Testing Machines – Plastics[3]			
Level	0.001 in/in	0.0001 in/in	ASTM D256, D6110; ISO 179-1, 180, 13802
Center of Percussion Timing	≈ 60 s	0.16 s	
Pendulum Length	(12.8 to 16) in	0.007 in	
Vertical Fall	(2 to 25) in	0.007 in	
Shaft Play	Up to 0.020 in	0.0005 in	
Free Hang	Up to 1 in	0.0066 in	
Weight	(0 to 12 000) g	0.16 % of applied weight	
Vice to Clamp Height Difference	Up to 0.020 in	0.00022 in	
Izod Striker Centered	Up to 0.2 in	0.004 in	
Radius Gauge	--	0.0016 in	
TMI Replicate	--	0.0008 in	
Line Of Imp Above Spec Holder	(0.864 to 0.868) in	0.0003 in	
Charpy Striker Centered ASTM	0.016 in	0.001 in	
Charpy Anvil Spacing ASTM	(3.74 to 3.76) in	0.00058 in	
Charpy Striker Centered ISO	0.38 in	0.0016 in	
Charpy Anvil Spacing ISO	(2.356 to 2.376) in	0.0011 in	
Impact Testing Machines – Metals[3]			
Distance Between Anvils	≈ 1.575 in	0.00018 in	ASTM E23
Striker Centered on Anvils	≈ 0.016 in	0.0015 in	
Striking Bit Parallel to Anvils	Up to 0.005 in/in	0.0008 in	
Machine Level	Up to 0.003 in/in	0.00012 in/in	
Free Swing Zero Check	(0 to 10) ft·lbf	0.14 ft·lbf	
11 Free Swing Friction Check	(0 to 30) ft·lbf	0.4 ft·lbf	
Striker and Anvil Replicate	Up to 2.0 in	0.0008 in	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Specimen Alignment of Universal Testing Machines[3]	3000 microstrain	22 microstrain	SAE AS 7101, ASTM E1012 & GE S 400
Extrusion Plastometers[3] –			
Bore Measurement	(0.3755 to 0.3765) in	0.00017 in	ASTM D1238 & ISO 1133-1
Piston Rod Diameter	Up to 1 in	0.0001 in	
Piston Foot Diameter	Up to 1 in	0.00021 in	
Piston Foot & Orifice Length	Up to 1 in	0.0013 in	
Weight of Piston & Weights	(0 to 12 000) g	0.11 % of applied weight	
Height of Switch/Vertical Adjustment	Up to 3 in	0.0029 in	
Switch Calibration	Up to 2 in	0.00068 in	
Temperature	Up to 400 °C	0.09 °C	
Levelness of Machine	Up to 0.010 in/in	0.0023 in/in	
Timer Calibration	(0 to 3600) s	0.11 s	
Go Gauge	0.0823 in	0.000027 in	
No-Go Gauge	0.0827 in	0.000027 in	
Deflection Temperature Testing Machines[3] –			
Support Spacing	Up to 6 in	0.0041 in	ASTM D648 & ISO 75
Standard Support Radius	Up to 1 in	0.0015 in	
HDUL Load Radius	Up to 1 in	0.0015 in	
LVDT Readings	Up to 1 in	0.00028 in	
Dial Indicator Readings	Up to 0.050 in	0.00006 in	
Weight: Rod & Weights	(0 to 12 000) g	0.27 % of applied weight	
Temperature	Up to 400 °C	0.09 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Vicat Testing Machines[3] –			
Vicat Needle	Up to 1 in	0.0002 in	ASTM D1525 & ISO 306
LVDT Readings	Up to 1 in	0.00016 in	
Dial Indicator Readings	Up to 0.050 in	0.00003 in	
Weight	(0 to 12 000) g	0.27 % of applied weight	
Temperature	Up to 400 °C	0.09 °C	
Bending Moment Machines[4] –			
Angle Reading (Degrees of Bending)	100°	0.20°	ASTM D747
Timing	60 s	0.11 s	
Force Reading (% of Full Scale Moment Range)	(0 to 100) % of scale reading	0.41 % of scale reading	
Span	(0.25 to 6.0) in	0.0073 in	
Weight	> 200 g (30 to 199) g < 30 g	0.28 % of applied weight 0.27 % of applied weight 0.27 % of applied weight	
Standard Shim – Test Force Reading	(0 to 100) % of scale reading	0.8 % of scale reading	
Plastic Impact Specimen Notcher[3] & Plastic Impact Notched Specimen[4] –			
Main Spindle Shaft Motion	Up to 0.1 in	0.0005 in	ASTM D256; ASTM D6110; ISO 179; ISO 180
Notch Verification Device	Up to 0.9 in	0.00044 in	
Notch Angle	(44 to 46)°	0.22°	
Notch Radius	Up to 0.1 in	0.00027 in	
Thickness Under the Notch	Up to 0.9 in	0.00082 in	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Rate Verification[3] –			
Load Rate	(0.001 to 1 000 000) lb/min	1.0 % of applied load	Class B1
Strain Rate	Speeds up to: 0.025 in/in/min	0.0002 in/in/min	Extensometer
	Speeds greater than: 0.025 in/in/min	$2 \cdot \sqrt{[0.0001^2 + (0.00165 \cdot \text{Rate})]^2}$ in/in/min	
Crosshead Speed			ASTM E2658
	Up to 4 in/min	0.46 % of calibrated speed	Using dial indicator
	(4 to 40) in/min	0.56 % of calibrated speed	Using machine display
Mass[3]	Up to 50 lb (25 kg) (1 to 5) kg (180 to 999) g (5 to 135) g (0.5 to 2) g	0.03 % of applied weight 0.01 % of applied weight 0.035 % of applied weight 0.03 % of applied weight 0.12 % of applied weight	NIST technical note 577
Displacement Measurement Systems & Devices Verification	(0.01 to 40) in	0.0012 in or 0.28 % of rdg, (whichever is greater)	ASTM E2309 Using dial indicator
		0.02 mm or 0.2 % of rdg, (whichever is greater)	Using long travel strain device

Parameter/Equipment	Range	CMC[2] (±)	Comments
Balance & Weighing Scale[3]			
1 mg to 22 kg	0.001 g to 22 kg	$2 \cdot \sqrt{[(0.000026 \cdot \text{Rdg})^2 + (T/2.5)^2]}$	NIST Handbook 44, Class F weights Note: *T* is the tolerance of the Class F weight
1 mg to 1.2 kg	(0.001 to 1200) g	$2 \cdot \sqrt{[(0.000026 \cdot \text{Rdg})^2 + (T/2.5)^2]}$	NIST Handbook 44, Class 1 weights Note: *T* is the tolerance of the Class 1 weight

IV. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Temperature – Measure[3]	(0 to 400) °C	0.09 °C	RTD w/ indicator system
Oven Temperature – Measure[3]	(25 to 110) °C (110 to 350) °C (350 to 550) °C (77 to 199) °F (199 to 662) °F (662 to 1022) °F	1.5 °C 2.1 °C 2.9 °C 2.7 °F 3.9 °F 5.4 °F	Digital thermometer w/ thermocouple wire

V. Time & Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
Stopwatch[5]	(0 to 1000) s	0.07 s	NIST

[1] This laboratory offers commercial dimensional testing/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] Customer calibrations for this parameter are performed at the Horsham, PA location only.

[5] Calibrations for this parameter are internally performed for Tinius Olsen owned equipment.

[6] This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

Accredited Laboratory

A2LA has accredited

TINIUS OLSEN

Horsham, PA

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 4th day of April 2017.

President and CEO
For the Accreditation Council
Certificate Number 887.01
Valid to August 31, 2019
Revised September 26, 2018

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