



THE AMERICAN ASSOCIATION FOR  
LABORATORY ACCREDITATION

## ACCREDITED LABORATORY

A2LA has accredited

**SUN-TEC CORPORATION**

**Novi, MI**

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 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 8 January 2009*).

Presented this 8<sup>th</sup> day of May 2009.

A handwritten signature in cursive script, reading "Peter Abney", positioned above a horizontal line.

President  
For the Accreditation Council  
Certificate Number: 1934.01  
Valid to: March 31, 2011



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

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

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CALIBRATION

Valid To: March 31, 2011

Certificate Number: 1934.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Mechanical

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments	
Calibration of Standardized Rockwell Hardness and Rockwell Superficial Hardness Test Blocks <sup>4</sup> –  Mean Hardness Value	HRA (Carbide):			
	Low	0.14 HRA	ASTM B294	
	Medium	0.12 HRA		
	High	0.11 HRA		
	HRA (Brass):			
	Low	0.58 HRA	ASTM E18	
	Medium	0.57 HRA		
	High	0.55 HRA		
	HRA (Steel):			
	Low	0.23 HRA		
	Medium	0.21 HRA		
	High	0.19 HRA		
	HRB:			
Low	0.66 HRBW			
Medium	0.54 HRBW			
High	0.43 HRBW			







Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Calibration of Standardized Rockwell Hardness and Rockwell Superficial Hardness Test Blocks <sup>4</sup> – (cont)  Mean Hardness Value	HR45T: Low Medium High  HR45W: Low Medium High  HR45X: Low Medium High  HR45Y: Low Medium High	0.49 HR45TW 0.46 HR45TW 0.44 HR45TW  0.52 HR45WW 0.41 HR45WW 0.32 HR45WW  0.53 HR45XW 0.52 HR45XW 0.48 HR45XW  0.53 HR45YW 0.50 HR45YW 0.45 HR45YW	ASTM E18
Calibration of Standardized Brinell Hardness Test Blocks <sup>6</sup> –  Mean Hardness Value –			
2.5/62.5/10 5/125/10 10/125/10 2.5/187.5/10 5/250/10 10/250/10 10/500/10 5/750/10 10/1000/10 10/1500/10 10/2000/10 10/2500/10 10/3000/10	(35 to 200) HBW (20 to 100) HBW (10 to 25) HBW (95 to 600) HBW (40 to 200) HBW (15 to 50) HBW (40 to 130) HBW (90 to 600) HBW (35 to 200) HBW (50 to 300) HBW (65 to 400) HBW (80 to 500) HBW (95 to 600) HBW	2.1 µm 4.3 µm 8 µm 2.1 µm 4.3 µm 8 µm 8 µm 4.3 µm 8 µm 8 µm 8 µm 8 µm 8 µm	ASTM E10

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Calibration of Standardized Vickers Hardness Test Blocks <sup>7</sup> –  Mean Hardness Value ≥ 1 kgf	(100 to 240) HV >240 to 600) HV > 600 HV	1.6 % of range 0.78 % of range 0.6 % of range	ASTM E92
Calibration of Standardized Microindentation Hardness Test Blocks <sup>5</sup> –  Mean Hardness Value – ≤ 1kgf	(100 to 240) HV >240 to 600) HV > 600 HV  (100 to 250) HK >250 to 650) HK > 650 HK	0.71 % of range 0.44 % of range 0.3 % of range  0.68 % of range 0.42 % of range 0.2 % of range	ASTM E384
Calibration of Standardized Leeb Hardness Test Blocks <sup>9</sup>	750 HLD	7.4 HLD	ASTM A956
Direct Verification of Rockwell Hardness Testers <sup>3</sup> –  Verification of the Test Force  Depth Measuring Gage	(3 to 150) kgf	0.05 % of range  0.05 μm	Direct verification per ASTM E18  Verification of the test force by load cell per ASTM E4.  Gage blocks

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
<p>Direct Verification of Rockwell Hardness Testers<sup>3</sup> – (cont)</p> <p>Direct Verification of Indenters:</p> <p>Diamond Indenter –</p> <p>Included Cone Angle Mean Tip Radius Tip Radius Section Axis Normal to Seating Surface</p> <p>Cone Flank Straightness</p> <p>Performance (Δ HR) –</p> <p>Regular Scale Superficial Scale</p> <p>Ball Protrusion</p> <p>Carbide Ball Indenter: Diameter Vickers Hardness</p> <p>Steel Ball Indenter: Diameter Vickers Hardness</p>	<p>120° ± 0.35° (0.200 ± .010) mm (0.200 ± .015) mm ≤ 0.5°</p>	<p>14' 5.6 μm 2.9 μm 13'</p> <p>3 μm</p> <p>0.1 HR 0.1 HR</p> <p>2.5 μm</p> <p>(0.66 μm) 19 HV</p> <p>(0.66 μm) 7.8 HV</p>	<p>Direct verification per ASTM E18</p> <p>Rockwell A, C , D &amp; N</p> <p>Evaluated by non-contact two axis CMM (vision system)</p> <p>Vickers hardness determination per ASTM E92</p>
<p>Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers<sup>3, 4</sup> –</p>	<p>HRA: (Carbide) Low Middle High</p> <p>HRA: (Brass) Low Middle High</p>	<p>0.16 HRA 0.14 HRA 0.13 HRA</p> <p>0.63 HRA 0.63 HRA 0.62 HRA</p>	<p>Indirect verification per ASTM E18 and ASTM B294, see footnote 8</p> <p>Indirect verification per ASTM E18 and ASTM E110</p>

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers <sup>3, 4</sup> – (cont)	HRA: (Steel)		Indirect verification per ASTM E18 and ASTM E110
	Low	0.50 HRA	
	Middle	0.44 HRA	
	High	0.31 HRA	
	HRB:		
	Low	0.75 HRBW	
	Middle	0.61 HRBW	
	High	0.52 HRBW	
	HRC:		
	Low	0.41 HRC	
	Middle	0.39 HRC	
	High	0.36 HRC	
	HRD:		
	Low	0.61 HRD	
	Middle	0.54 HRD	
	High	0.51 HRD	
	HRE:		
	Low	0.56 HREW	
	Middle	0.53 HREW	
	High	0.50 HREW	
	HRF:		
	Low	0.61 HRFW	
	Middle	0.57 HRFW	
	High	0.49 HRFW	
HRG:			
Low	0.49 HRGW		
Middle	0.49 HRGW		
High	0.43 HRGW		
HRH:			
Low	0.55 HRHW		
Middle	0.50 HRHW		
High	0.45 HRHW		
HRK:			
Low	0.53 HRKW		
Middle	0.49 HRKW		
High	0.46 HRKW		

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers <sup>3,4</sup> – (cont)	HRL: Low Middle High  HRM: Low Middle High  HRP: Low Middle High  HRR: Low Middle High  HRS: Low Middle High  HRV: Low Middle High  HR15N: Low Middle High  HR15T: Low Middle High  HR15W: Low Middle High	0.51 HRLW 0.48 HRLW 0.43 HRLW  0.59 HRMW 0.56 HRMW 0.50 HRMW  0.53 HRPW 0.50 HRPW 0.44 HRPW  0.51 HRRW 0.49 HRRW 0.46 HRRW  0.46 HRSW 0.41 HRSW 0.39 HRSW  0.61 HRVW 0.49 HRVW 0.47 HRVW  0.47 HR15N 0.36 HR15N 0.31 HR15N  0.69 HR15TW 0.55 HR15TW 0.51 HR15TW  0.54 HR15WW 0.50 HR15WW 0.42 HR15WW	Indirect verification per ASTM E18 and ASTM E110

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers <sup>3,4</sup> – (cont)	HR15X: Low Middle High	0.62 HR15XW 0.47 HR15XW 0.39 HR15XW	Indirect verification per ASTM E18 and ASTM E110
	HR15Y: Low Middle High	0.59 HR15YW 0.58 HR15YW 0.49 HR15YW	
	HR30N: Low Middle High	0.51 HR30N 0.44 HR30N 0.39 HR30N	
	HR30T: Low Middle High	0.57 HR30TW 0.51 HR30TW 0.47 HR30TW	
	HR30W: Low Middle High	0.71 HR30WW 0.61 HR30WW 0.63 HR30WW	
	HR30X: Low Middle High	0.58 HR30XW 0.55 HR30XW 0.51 HR30XW	
	HR30Y: Low Middle High	0.56 HR30YW 0.49 HR30YW 0.49 HR30YW	
	HR45N: Low Middle High	0.58 HR45N 0.56 HR45N 0.53 HR45N	
	HR45T: Low Middle High	0.65 HR45TW 0.54 HR45TW 0.50 HR45TW	

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers <sup>3,4</sup> – (cont)	HR45W: Low Middle High  HR45X: Low Middle High  HR45Y: Low Middle High	0.58 HR45WW 0.52 HR45WW 0.47 HR45WW  0.60 HR45XW 0.59 HR45XW 0.56 HR45XW  0.63 HR45YW 0.57 HR45YW 0.54 HR45YW	Indirect verification per ASTM E18 and ASTM E110
Direct Verification of Brinell Hardness Testers <sup>3</sup> –			Direct verification per ASTM E10 and ASTM E110
Verification of the Test Force	≤ 3000 kgf	0.05 % of range	Verification of the test force is by load cell ASTM E4.
Verification of the Mean Diameter of the Indenter	(2.5, 5, 10) mm	0.65 μm	Determined by mechanical comparison.
Verification of the Device for Measuring Indentation Diameters		0.9 μm	Stage micrometer
Indirect Verification of Brinell Hardness Testers <sup>3,6</sup> –			
2.5/62.5/10 5/125/10 10/125/10 2.5/187.5/10	(35 to 200) HBW (20 to 100) HBW (10 to 25) HBW (95 to 600) HBW	2.5 μm 5 μm 10 μm 2.5 μm	Indirect verification per ASTM E10 and ASTM E110

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Indirect Verification of Brinell Hardness Testers <sup>3,6</sup> – (cont)  5/250/10 10/250/10 10/500/10 5/750/10 10/1000/10 10/1500/10 10/2000/10 10/2500/10 10/3000/10	(40 to 200) HBW (15 to 50) HBW (40 to 130) HBW (90 to 600) HBW (35 to 200) HBW (50 to 300) HBW (65 to 400) HBW (80 to 500) HBW (95 to 600) HBW	5 µm 10 µm 10 µm 5 µm 10 µm 10 µm 10 µm 10 µm 10 µm	Indirect verification per ASTM E10 and ASTM E110
Direct Verification of Vickers Hardness Testers <sup>3</sup> –  Verification of the Test Force  Verification of the Device for Measuring Indentation Diagonals	≥ 1 kgf	0.05 % of range  2 µm	Direct verification per ASTM E92.  Verification of the test force is by load cell per ASTM E4.  Stage micrometer
Indirect Verification of Vickers Hardness Testers <sup>3,7</sup>	(100 to 240) HV (>240 to 600) HV >600 HV	1.6 % of range 0.8 % of range 0.62 % of range	Indirect verification per ASTM E92.

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
<p>Direct Verification of Microindentation Hardness Testers<sup>3</sup> –</p> <p>Verification of the Test Force</p> <p>Verification of the Device for Measuring Indentation Diagonals</p>	<p>≤ 1 Kgf</p>	<p>0.05 % of range</p> <p>0.6 μm</p>	<p>Direct verification per ASTM E384.</p> <p>Verification of the test force is by load cell per ASTM E4.</p> <p>Stage micrometer</p>
<p>Indirect Verification of Microindentation Hardness Testers<sup>3,5</sup> –</p> <p>Mean Hardness Value</p> <p>≤ 1 Kgf</p> <p>≤ 1 Kgf</p>	<p>(100 to 240) HV (&gt; 240 to 600) HV &gt; 600 HV</p> <p>(100 to 250) HK (&gt; 250 to 650) HK &gt; 650 HK</p>	<p>0.72 % of range 0.45 % of range 0.31 % of range</p> <p>0.69 % of range 0.43 % of range 0.21 % of range</p>	<p>Indirect verification per ASTM E384</p>
<p>Indirect verification of Leeb Testers<sup>3,9</sup></p>	<p>750 HLD</p>	<p>7.5 HLD</p>	<p>Indirect verification per ASTM A956</p>
<p>Indirect Verification of Ultrasonic Contact Impedance testers<sup>3,4</sup></p>	<p>UCI (HRC) Low Middle High</p>	<p>0.41 UCI (HRC) 0.34 UCI (HRC) 0.036 UCI (HRC)</p>	<p>ASTM A1038</p>
<p>Calibration of Stage Micrometers</p>	<p>(0 to 10) mm</p>	<p>2 μm</p>	<p>Non-contact 2 axis CMM (vision system)</p>

Parameter/Equipment	Range	Best Uncertainty <sup>2</sup> (±)	Comments
Direct Verification of the Ball Punch Deformation Machines <sup>3</sup> –	(1 to 25) lbf (25 to 100) lbf (100 to 500) lbf (500 to 2000) lbf (2000 to 10 000) lbf (10 000 to 50 000) lbf	0.05 % of range 0.05 % of range 0.05 % of range 0.05 % of range 0.05 % of range 0.13 % of range	Direct verification per ASTM E643 & ASTM E4
Height Indicator	(0 to 1) in	0.00058 in	Compared to gage blocks
Force <sup>3</sup> –			
Tension and Compression	(1 to 25) lbf (25 to 100) lbf (100 to 500) lbf (500 to 2000) lbf (2000 to 10 000) lbf (10 000 to 50 000) lbf (50 000 to 120 000) lbf (120 000 to 600 000) lbf	0.05 % of range 0.05 % of range 0.05 % of range 0.05 % of range 0.05 % of range 0.13 % of range 0.13 % of range 0.13 % of range	ASTM E4

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.

<sup>2</sup> “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, to the environment and to influences from the circumstances of the specific calibration.

<sup>3</sup> 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.

<sup>4</sup> The standardized test blocks used for verification are calibrated at the Sun-Tec Standardizing Laboratory in accordance with ASTM E18 using NIST Rockwell HRC standard reference material (SRM) 2810, 2811, and 2812, unless otherwise noted. All other Rockwell scales are traceable to Sun-Tec hardness

levels through laboratory standardizing machines. The standardizing machines are directly verified according to ASTM E18 using devices that are traceable to NIST.

- <sup>5</sup> The standardized test blocks used for verification are calibrated at the Sun-Tec Standardizing Laboratory in accordance with ASTM E384 using NIST Vickers or Knoop standard reference material (SRM) 1906, 1893, 1894a, 1895, and 1896. All other micro-indentation scales are traceable to Sun-Tec hardness levels through laboratory standardizing machines. The standardizing machines are directly verified according to ASTM E384 using devices that are traceable to NIST.
- <sup>6</sup> The standardized test blocks used for verification are calibrated at the Sun-Tec Standardizing Laboratory in accordance with ASTM E10 and are traceable through laboratory standardizing machines. The standardizing machines are directly verified according to ASTM E10 using devices that are traceable to NIST.
- <sup>7</sup> The standardized test blocks used for verification are calibrated at the Sun-Tec Standardizing Laboratory in accordance with ASTM E92 using devices that are traceable to NIST. The standardizing machines are directly verified according to ASTM E92 using devices that are traceable to NIST.
- <sup>8</sup> The standardized test blocks used for verification are calibrated at the Sun-Tec Standardizing Laboratory in accordance with ASTM E18 and ASTM B294 using a master set from the CCPA.
- <sup>9</sup> The standardized test blocks used for verification are calibrated at the Sun-Tec standardizing laboratory in accordance with ASTM A956.