SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

SUN-TEC CORPORATION
46590 Ryan Court
Novi, MI 48377
George Smolboski Phone: 248 669 3100

CALIBRATION

Valid To: April 30, 2025 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[1, 9]:

I. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Extensometers/ Deflectometers[3] –	Up to 2 in (1 to 20) in	130 µin 200 µin	ASTM E83, calibrator, gage blocks
Gauge Length	Up to 8 in	0.0014 in	Caliper
Calibration of Stage Micrometers	Up to 10 mm	3.5 µm	Non-contact 2 axis CMM (vision system)

II. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calibration of Standardized Rockwell Hardness and Rockwell Superficial Hardness Test Blocks[3, 4, 7] –			
Mean Hardness Value	HRA (Carbide):		
	Low	0.14 HRA	ASTM B294
	Medium	0.12 HRA	
	High	0.11 HRA	
	HRA		
	Low	0.23 HRA	ASTM E18
	Medium	0.21 HRA	
	High	0.19 HRA	
	HRBW		
	Low	0.66 HRBW	
	Medium	0.54 HRBW	
	High	0.43 HRBW	
	HRC:		
	Low	0.35 HRC	
	Medium	0.33 HRC	
	High	0.31 HRC	
	HRD:		
	Low	0.51 HRD	
	Medium	0.42 HRD	
	High	0.40 HRD	
	HREW:		
	Low	0.46 HREW	
	Medium	0.41 HREW	
	High	0.41 HREW	
	HRFW:		
	Low	0.49 HRFW	
	Medium	0.43 HRFW	
	High	0.39 HRFW	
	HRGW:		
	Low	0.46 HRGW	
	Medium	0.41 HRGW	
	High	0.38 HRGW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calibration of Standardized Rockwell Hardness and Rockwell Superficial Hardness Test Blocks[3, 4, 7] – (cont)			
Mean Hardness Value	HRHW:		
	Low	0.44 HRHW	ASTM E18
	High	0.37 HRHW	
	HRKW:		
	Low	0.48 HRKW	
	Medium	0.45 HRKW	
	High	0.42 HRKW	
	HRLW:		
	Low	0.44 HRLW	
	High	0.38 HRLW	
	HRMW:		
	Low	0.47 HRMW	
	High	0.42 HRMW	
	HRPW:		
	Low	0.50 HRPW	
	High	0.36 HRPW	
	HRRW:		
	Low	0.46 HRRW	
	High	0.43 HRRW	
	HRSW:		
	Low	0.41 HRSW	
	High	0.30 HRSW	
	HRVW:		
	Low	0.55 HRVW	
	High	0.38 HRVW	
	HR15N:		
	Low	0.36 HR15N	
	Medium	0.28 HR15N	
	High	0.22 HR15N	
	HR15TW:		
	Low	0.58 HR15TW	
	Medium	0.42 HR15TW	
	High	0.33 HR15TW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calibration of Standardized Rockwell Hardness and Rockwell Superficial Hardness Test Blocks[3, 4, 7] – (cont)			
Mean Hardness Value	HR15WW: Low High HR15XW: Low High HR15YW: Low High HR30N: Low Medium High HR30TW: Low Medium High HR30WW: Low High HR30XW: Low High HR30YW: Low High HR45N: Low Medium High	 0.42 HR15WW 0.38 HR15WW 0.47 HR15XW 0.33 HR15XW 0.46 HR15YW 0.38 HR15YW 0.41 HR30N 0.36 HR30N 0.31 HR30N 0.50 HR30TW 0.42 HR30TW 0.34 HR30TW 0.63 HR30WW 0.55 HR30WW 0.49 HR30XW 0.44 HR30XW 0.50 HR30YW 0.40 HR30YW 0.48 HR45N 0.42 HR45N 0.42 HR45N	ASTM E18

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calibration of Standardized Rockwell Hardness and Rockwell Superficial Hardness Test Blocks[3, 4, 7] – (cont)			
Mean Hardness Value	HR45TW:		
	Low	0.49 HR45TW	ASTM E18
	Medium	0.46 HR45TW	
	High	0.44 HR45TW	
	HR45WW:		
	Low	0.52 HR45WW	
	High	0.32 HR45WW	
	HR45XW:		
	Low	0.53 HR45XW	
	High	0.48 HR45XW	
	HR45YW:		
	Low	0.53 HR45YW	
	High	0.45 HR45YW	
Calibration of Standardized Brinell Hardness Test Blocks[6] –			
Mean Hardness Value:			
1/5/10	Low	0.19 HBW	ASTM E10
	Medium	0.42 HBW	
	High	0.8 HBW	
1/10/10	Low	0.34 HBW	
	Medium	0.69 HBW	
	High	1.5 HBW	
1/30/10	Low	0.79 HBW	
	Medium	1.3 HBW	
	High	5.3 HBW	
2.5/62.5/10	Low	0.24 HBW	
	Medium	0.44 HBW	
	High	1.5 HBW	
5/125/10	Low	0.14 HBW	
	Medium	0.32 HBW	
	High	0.85 HBW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calibration of Standardized Brinell Hardness Test Blocks[6] – (cont)			
Mean Hardness Value:			
2.5/187.5/10	Low Medium High	0.58 HBW 1.7 HBW 3.8 HBW	ASTM E10
5/250/10	Low Medium High	0.19 HBW 0.41 HBW 1.2 HBW	
10/500/10	Low Medium High	0.12 HBW 0.38 HBW 1.1 HBW	
5/750/10	Low Medium High	0.75 HBW 1.6 HBW 3.8 HBW	
10/1000/10	Low Medium High	0.21 HBW 0.40 HBW 0.85 HBW	
10/1500/10	Low Medium High	0.34 HBW 0.56 HBW 1.4 HBW	
10/2000/10	Low Medium High	0.95 HBW 0.87 HBW 3.1 HBW	
10/2500/10	Low Medium High	0.46 HBW 0.89 HBW 3.0 HBW	
10/3000/10	Low Medium High	0.80 HBW 1.6 HBW 3.7 HBW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calibration of Standardized Knoop and Vickers Hardness Test Blocks[5] –			
Mean Hardness Value:			ASTM E92
2 kgf	(50 to 250) HK (>250 to 650) HK >650 HK	1.5 % of range 1.6 % of range 1.5 % of range	
≥ 2 kgf	(50 to 240) HV (> 240 to 600) HV > 600 HV	1.1 % of range 0.78 % of range 0.60 % of range	
≤ 1 kgf	(50 to 240) HV (> 240 to 600) HV > 600 HV	0.71 % of range 0.44 % of range 0.30 % of range	
≤ 1 kgf	(50 to 250) HK (> 250 to 650) HK > 650 HK	0.68 % of range 0.42 % of range 0.20 % of range	
Calibration of Standardized Leeb Hardness Test Blocks	HLD: Low Medium High	 6.6 HLD 7.8 HLD 9.2 HLD	ASTM A956
Direct Verification of Rockwell Hardness Testers[3] –			
Verification of the Test Force	(3 to 150) kgf	0.050 % of range	Direct verification per ASTM E18, verification of the test force by load cell per ASTM E4, gage blocks
Depth Measuring Gage	(0 to 0.2) mm	0.11 µm	
Hysteresis	100 and 130 HR	0.12 HR	
Timing	Up to 30 s	0.14 s	Digital stopwatch

Parameter/Equipment	Range	CMC[2] (±)	Comments
Direct Verification of Indenters –			Per ASTM E18, Rockwell A, C, D, and N, Class B; Carbide A, Class A (ASTM B294)
Rockwell Diamond Indenter –			
Included Cone Angle	120°	0.12°	Evaluated by non-contact two axis CMM (vision system)
Mean Tip Radius	0.200 mm	0.004 mm	
Tip Radius Section	0.200 mm	0.004 mm	
Axis Normal to Seating Surface	≤ 0.5°	0.077°	
Cone Flank Straightness		0.001 mm	
Rockwell Ball Indenter –			
Ball Protrusion	> 0.3 mm	0.0025 mm	
Carbide Ball –			
Vickers Hardness	≥ 1500 HV	19 HV	Vickers hardness determination per ASTM E92
Steel Ball –			
Vickers Hardness	≥ 746 HV	7.8 HV	
Knoop and Vickers			
Diamond Indenter –			Evaluated by non-contact two axis CMM (vision system), direct verification per ASTM E92 Class A, B
Knoop Edge Angle A	172°, 30′	0.048°	
Corresponding Angle B	130°, 0′	0.043°	
Vickers Edge Angle	148° 6′ 36″	0.044°	
Inclination to Axis	(0 to 0.5)°	0.032°	Per ASTM E92
Junction Offset	(0 to 1.0) µm	0.1 µm	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers[3, 4, 7]	HRA (Carbide): Low Medium High	 0.15 HRA 0.13 HRA 0.12 HRA	 Indirect verification per ASTM E18 and ASTM B294
	HRA Low Medium High	 0.24 HRA 0.22 HRA 0.20 HRA	 Indirect verification per ASTM E18 and ASTM E110
	HRBW Low Medium High	 0.67 HRBW 0.55 HRBW 0.44 HRBW	
	HRC: Low Medium High	 0.36 HRC 0.34 HRC 0.32 HRC	
	HRD: Low Medium High	 0.52 HRD 0.43 HRD 0.41 HRD	 Indirect verification per ASTM E18 and ASTM B294
	HREW: Low Medium High	 0.47 HREW 0.42 HREW 0.42 HREW	 Indirect verification per ASTM E18 and ASTM E110
	HRFW: Low Medium High	 0.50 HRFW 0.44 HRFW 0.40 HRFW	
	HRGW: Low Medium High	 0.47 HRGW 0.43 HRGW 0.40 HRGW	
	HRHW: Low High	 0.45 HRHW 0.39 HRHW	
	HRKW: Low Medium High	 0.49 HRKW 0.46 HRKW 0.44 HRKW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers[3, 4, 7] (cont)	HRLW: Low High HRMW: Low High HRPW: Low High HRRW: Low High HRSW: Low High HRVW: Low High HR15N: Low Medium High HR15TW: Low Medium High HR15WW: Low High	 0.45 HRLW 0.39 HRLW 0.48 HRMW 0.44 HRMW 0.51 HRPW 0.37 HRPW 0.47 HRRW 0.44 HRRW 0.42 HRSW 0.31 HRSW 0.56 HRVW 0.40 HRVW 0.37 HR15N 0.30 HR15N 0.23 HR15N 0.59 HR15TW 0.43 HR15TW 0.34 HR15TW 0.43 HR15WW 0.39 HR15WW	Indirect verification per ASTM E18 and ASTM E110

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers[3, 4, 7] (cont)	HR15XW: Low High HR15YW: Low High HR30N: Low Medium High HR30TW: Low Medium High HR30WW: Low High HR30XW: Low High HR30YW: Low High HR45N: Low Medium High HR45TW: Low Medium High	 0.48 HR15XW 0.34 HR15XW 0.47 HR15YW 0.39 HR15YW 0.42 HR30N 0.37 HR30N 0.32 HR30N 0.51 HR30TW 0.43 HR30TW 0.35 HR30TW 0.64 HR30WW 0.56 HR30WW 0.50 HR30XW 0.45 HR30XW 0.51 HR30YW 0.41 HR30YW 0.49 HR45N 0.44 HR45N 0.43 HR45N 0.51 HR45TW 0.48 HR45TW 0.45 HR45TW	Indirect verification per ASTM E18 and ASTM E110

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers[3, 4, 7] (cont)	HR45WW: Low High HR45XW: Low High HR45YW: Low High	 0.53 HR45WW 0.33 HR45WW 0.53 HR45XW 0.49 HR45XW 0.54 HR45YW 0.46 HR45YW	Indirect verification per ASTM E18 and ASTM E110
Direct Verification of Brinell Hardness Testers[3] –			
Verification of the Test Force	≤ 3000 kgf	0.050 % of range	Direct verification per ASTM E10 and ASTM E110
Verification of the Device for Measuring Indentation Diameters	Up to 1 mm Up to 2 mm Up to 3 mm Up to 4 mm Up to 5 mm Up to 6 mm Up to 7 mm Up to 8 mm	0.009 mm 0.017 mm 0.025 mm 0.034 mm 0.042 mm 0.051 mm 0.059 mm 0.067 mm	Verification of the test force is by load cell ASTM E4, stage micrometer
Verification of Test Cycle	Up to 30 s	0.14 s	Digital stopwatch

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Brinell Hardness Testers[3, 6] –			
1/5/10	Low High	0.46 HBW 0.87 HBW	Indirect verification per ASTM E10 and ASTM E110
1/10/10	Low High	0.38 HBW 1.7 HBW	
1/30/10	Low High	1.5 HBW 5.8 HBW	
2.5/62.5/10	Low High	0.25 HBW 1.6 HBW	
5/125/10	Low High	0.54 HBW 0.88 HBW	
2.5/187.5/10	Low High	0.60 HBW 3.9 HBW	
5/250/10	Low High	0.42 HBW 1.3 HBW	
10/500/10	Low High	0.14 HBW 1.3 HBW	
5/750/10	Low High	0.86 HBW 3.9 HBW	
10/1000/10	Low High	0.47 HBW 1.0 HBW	
10/1500/10	Low High	0.41 HBW 1.7 HBW	
10/2000/10	Low High	1.1 HBW 3.7 HBW	
10/2500/10	Low High	1.1 HBW 3.7 HBW	
10/3000/10	Low High	0.96 HBW 4.3 HBW	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Direct Verification of Knoop and Vickers Hardness Testers[3] –			
Verification of the Test Force	≤ 1 kgf > 1 kgf	0.050 % of range	Direct verification per ASTM E92
Verification of the Device for Measuring Indentation Diagonals	Up to 30 µm Up to 60 µm Up to 90 µm Up to 120 µm Up to 150 µm Up to 200 µm Up to 300 µm Up to 400 µm Up to 500 µm Up to 600 µm Up to 700 µm Up to 800 µm Up to 900 µm Up to 1000 µm	0.18 µm 0.33 µm 0.48 µm 0.67 µm 0.83 µm 1.1 µm 1.7 µm 2.2 µm 2.7 µm 3.3 µm 3.7 µm 4.3 µm 4.9 µm 5.4 µm	Verification of the test force is by load cell per ASTM E4, stage micrometer
Verification of Test Cycle	Up to 30 s	0.14 s	Digital stopwatch
Indirect Verification of Knoop and Vickers Hardness Testers[3, 5] –			
≤ 1 kgf	(100 to 240) HV (> 240 to 600) HV > 600 HV (100 to 250) HK (> 250 to 650) HK > 650 HK	0.72 % of range 0.45 % of range 0.31 % of range 0.69 % of range 0.43 % of range 0.21 % of range	Indirect verification per ASTM E92
> 1 kgf	(100 to 240) HV (>240 to 600) HV >600 HV	1.6 % of range 0.80 % of range 0.62 % of range	

Parameter/Equipment	Range	CMC[2, 10] (±)	Comments
Indirect verification of Leeb Testers[3, 8]	HLD: Low Medium High	 7.0 HLD 8.0 HLD 9.5 HLD	Indirect verification per ASTM A956
Indirect Verification of Ultrasonic Contact Impedance Testers[3, 4]	UCI (HRC) Low Medium High	 0.41 UCI (HRC) 0.34 UCI (HRC) 0.36 UCI (HRC)	Indirect verification per ASTM A1038
Direct Verification of the Ball Punch Deformation Machines[3] – Height Indicator	(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 to 1) in	0.050 % of range 0.050 % of range 0.050 % of range 0.050 % of range 0.050 % of range 0.13 % of range 0.00012 in	Direct verification per Sun-Tec procedure WI-S004 (Reference ASTM E643 and ASTM E4) Micrometer head
Force[3] – Measure Tension and Compression	 (0.001 to 25) lbf (25 to 100) lbf (100 to 500) lbf (500 to 2000) lbf (2000 to 10 000) lbf (10 000 to 60 000) lbf (60 000 to 300 000) lbf	 0.050 % of range 0.050 % of range 0.050 % of range 0.050 % of range 0.050 % of range 0.13 % of range 0.13 % of range	 ASTM E4
Crosshead Displacement[3]	(0.001 to 2.0) in (2 to 20) in	0.000 64 in 0.0011 in	ASTM E2309, digital indicator
Crosshead Speed[3]	(0.01 to 20) in/min	0.18 % of reading	ASTM E2658, digital indicator, stopwatch

[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. 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] 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, 2812, 2816, 2817, 2818, 2819, 2820, and 2821 unless otherwise noted. All other Rockwell scales are traceable to the MPA (PTB) or 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.

[5] The standardized test blocks used for verification are calibrated at the Sun-Tec Standardizing Laboratory in accordance with ASTM E92 using NIST Vickers or Knoop standard reference material (SRM) 1906, 1893, 1894a, 1895, and 1896. All other micro-indentation scales are traceable to the MPA or Sun-Tec hardness levels through laboratory standardizing machines. The standardizing machines are directly verified according to ASTM E92 using devices that are traceable to NIST.

[6] 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.

[7] The secondary 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 primary set from the CCPA.

[8] The standardized test blocks used for verification are calibrated at the Sun-Tec standardizing laboratory in accordance with ASTM A956, and traceable to the MPA (PTB).

[9] This scope meets A2LA's *P112 Flexible Scope Policy*.

[10] The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

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 17025:2017 *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 April 2017*).

Presented this 24th day of May 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1934.01
Valid to April 30, 2025
Revised March 21, 2025

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