



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

SUN-TEC CORPORATION
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CALIBRATION

Valid To: April 30, 2023

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

5202 Presidents Court, Suite 220, Frederick, MD 21703-6515 | Phone: 301 644 5245 | Fax: 240 454 7447 | www.A2LA.org

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 Medium High	0.14 HRA 0.12 HRA 0.11 HRA	ASTM B294
	HRA Low Medium High	0.23 HRA 0.21 HRA 0.19 HRA	ASTM E18
	HRBW Low Medium High	0.66 HRBW 0.54 HRBW 0.43 HRBW	
	HRC: Low Medium High	0.35 HRC 0.33 HRC 0.31 HRC	
	HRD: Low Medium High	0.51 HRD 0.42 HRD 0.40 HRD	
	HREW: Low Medium High	0.46 HREW 0.41 HREW 0.41 HREW	
	HRFW: Low Medium High	0.49 HRFW 0.43 HRFW 0.39 HRFW	
	HRGW: Low Medium High	0.46 HRGW 0.41 HRGW 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 High HRKW: Low Medium High 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	0.44 HRHW 0.37 HRHW 0.48 HRKW 0.45 HRKW 0.42 HRKW 0.44 HRLW 0.38 HRLW 0.47 HRMW 0.42 HRMW 0.50 HRPW 0.36 HRPW 0.46 HRRW 0.43 HRRW 0.41 HRSW 0.30 HRSW 0.55 HRVW 0.38 HRVW 0.36 HR15N 0.28 HR15N 0.22 HR15N 0.58 HR15TW 0.42 HR15TW 0.33 HR15TW	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	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 Medium High HR45WW: Low High HR45XW: Low High HR45YW: Low High	0.49 HR45TW 0.46 HR45TW 0.44 HR45TW 0.52 HR45WW 0.32 HR45WW 0.53 HR45XW 0.48 HR45XW 0.53 HR45YW 0.45 HR45YW	ASTM E18



<p>Calibration of Standardized Brinell Hardness Test Blocks⁶ –</p> <p>Mean Hardness Value –</p> <p>1/5/10</p> <p>1/10/10</p> <p>1/30/10</p> <p>2.5/62.5/10</p> <p>5/125/10</p>	<p>Low Medium High</p> <p>Low Medium High</p> <p>Low Medium High</p> <p>Low Medium High</p> <p>Low Medium High</p>	<p>0.19 HBW 0.42 HBW 0.8 HBW</p> <p>0.34 HBW 0.69 HBW 1.5 HBW</p> <p>0.79 HBW 1.3 HBW 5.3 HBW</p> <p>0.24 HBW 0.44 HBW 1.5 HBW</p> <p>0.14 HBW 0.32 HBW 0.85 HBW</p>	<p>ASTM E10</p>
Parameter/Equipment	Range	CMC ² (±)	Comments
<p>Calibration of Standardized Brinell Hardness Test Blocks⁶ – (cont)</p> <p>Mean Hardness Value –</p> <p>2.5/187.5/10</p> <p>5/250/10</p> <p>10/500/10</p> <p>5/750/10</p>	<p>Low Medium High</p> <p>Low Medium High</p> <p>Low Medium High</p> <p>Low Medium High</p>	<p>0.58 HBW 1.7 HBW 3.8 HBW</p> <p>0.19 HBW 0.41 HBW 1.2 HBW</p> <p>0.12 HBW 0.38 HBW 1.1 HBW</p> <p>0.75 HBW 1.6 HBW 3.8 HBW</p>	<p>ASTM E10</p>

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 2 kgf	(50 to 250) HK (>250 to 650) HK >650 HK	1.5 % of range 1.6 % of range 1.5 % of range	ASTM E92
Mean Hardness Value ≥ 1 kgf	(50 to 240) HV (> 240 to 600) HV > 600 HV	1.1 % of range 0.78 % of range 0.60 % of range	
Mean Hardness Value < 1 kgf	(50 to 240) HV (> 240 to 600) HV > 600 HV	0.71 % of range 0.44 % of range 0.30 % of range	
	(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	

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

Parameter/Equipment	Range	CMC ² (±)	Comments
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Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers ^{3, 4, 7}	HRA (Carbide):			
	Low	0.15 HRA	Indirect verification per ASTM E18 and ASTM B294	
	Medium	0.13 HRA		
	High	0.12 HRA		
	HRA			
	Low	0.24 HRA	Indirect verification per ASTM E18 and ASTM E110	
	Medium	0.22 HRA		
	High	0.20 HRA		
	HRBW			
	Low	0.67 HRBW		
	Medium	0.55 HRBW		
	High	0.44 HRBW		
	HRC:			
	Low	0.36 HRC		
	Medium	0.34 HRC		
	High	0.32 HRC		
	HRD:			
	Low	0.52 HRD	Indirect verification per ASTM E18 and ASTM B294	
	Medium	0.43 HRD		
	High	0.41 HRD		
	HREW:			
Low	0.47 HREW	Indirect verification per ASTM E18 and ASTM E110		
Medium	0.42 HREW			
High	0.42 HREW			
HRFW:				
Low	0.50 HRFW			
Medium	0.44 HRFW			
High	0.40 HRFW			
HRGW:				
Low	0.47 HRGW			
Medium	0.43 HRGW			
High	0.40 HRGW			
HRHW:				
Low	0.45 HRHW			
High	0.39 HRHW			
HRKW:				
Low	0.49 HRKW			
Medium	0.46 HRKW			
High	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	0.45 HRLW 0.39 HRLW	Indirect verification per ASTM E18 and ASTM E110
	HRMW: Low High	0.48 HRMW 0.44 HRMW	
	HRPW: Low High	0.51 HRPW 0.37 HRPW	
	HRRW: Low High	0.47 HRRW 0.44 HRRW	
	HRSW: Low High	0.42 HRSW 0.31 HRSW	
	HRVW: Low High	0.56 HRVW 0.40 HRVW	
	HR15N: Low Medium High	0.37 HR15N 0.30 HR15N 0.23 HR15N	
	HR15TW: Low Medium High	0.59 HR15TW 0.43 HR15TW 0.34 HR15TW	
	HR15WW: Low High	0.43 HR15WW 0.39 HR15WW	



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



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 Verification of the Device for Measuring Indentation Diameters Verification of Test Cycle	≤ 3000 kgf 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 Up to 30 s	0.050 % of range 0.009 mm 0.017 mm 0.025 mm 0.034 mm 0.042 mm 0.051 mm 0.059 mm 0.067 mm 0.14 s	Direct verification per ASTM E10 and ASTM E110 Verification of the test force is by load cell ASTM E4, stage micrometer 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 Testers³ –			
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	0.72 % of range 0.45 % of range 0.31 % of range	Indirect verification per ASTM E92
	(100 to 250) HK (> 250 to 650) HK > 650 HK	0.69 % of range 0.43 % of range 0.21 % of range	
> 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 (±)	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 –	(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	0.050 % of range 0.050 % of range 0.050 % of range 0.050 % of range 0.050 % of range 0.13 % of range	Direct verification per Sun-Tec procedure WI-S004 (Reference ASTM E643 and ASTM E4)
Height Indicator	(0 to 1) in	0.00012 in	Micrometer head
Force ³ – 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*.



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/NC SL 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 8th day of June 2021.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1934.01
Valid to April 30, 2023
Revised March 21, 2023

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