CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Starr Calibrations, Inc.
dba Starr Instrument Service,
dba Starr-Chek
1101 West Lawrence Highway
Charlotte, MI 48813

Fulfills the requirements of

ISO/IEC 17025:2017

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

In the field of

CALIBRATION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

Jason Stine, Vice President

Expiry Date: 19 December 2026
Certificate Number: AC-1360

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. 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).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

AND

ANSI/NCSL Z540-1-1994 (R2002)

Starr Calibrations, Inc.
dba Starr Instrument Service, dba Starr-Chek
1101 West Lawrence Highway
Charlotte, MI 48813
Robin Shuten 517-543-8089

CALIBRATION

ISO/IEC 17025 Accreditation Granted: **17 September 2024**

Certificate Number: **AC-1360** Certificate Expiry Date: **19 December 2026**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure [1]	(0 to 110) mV (0.11 to 1.1) V (1.1 to 11) V (11 to 300) V	48 µV 0.36 mV 9.6 mV 0.19 V	Comparison to Process Calibrator
DC Voltage – Source [1]	(0 to 110) mV (0.11 to 1.1) V (1.1 to 15) V	18 µV 0.18 mV 2.5 mV	Comparison to Process Calibrator
DC Current – Measure [1]	Up to 100 mA	38 µA	Comparison to Process Calibrator
DC Current – Source [1]	Up to 22 mA	6.7 µA	Comparison to Process Calibrator
Resistance – Measure [1]	(0 to 110) Ω (0.11 to 1.1) kΩ (1.1 to 11) kΩ	0.13 Ω 1.2 Ω 28 Ω	Comparison to Process Calibrator
Resistance – Source [1]	(0 to 110) Ω (0.11 to 1.1) kΩ (1.1 to 11) kΩ	58 mΩ 0.81 Ω 9.2 Ω	Comparison to Process Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type E (-100 to 982) °C Type J (-100 to 1 199) °C Type K (-100 to 1 371) °C Type N (-100 to 1 300) °C Type R (50 to 1 760) °C Type S (50 to 1 760) °C Type T (-100 to 399) °C	0.3 °C 0.35 °C 0.27 °C 0.27 °C 0.36 °C 0.35 °C 0.29 °C	Thermocouple Calibrator, Process Calibrators; AMS 2750, AIAG CQI-9 or internal calibration procedures.

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Scopes [1]	Up to 7 mm	31 µm	Comparison to Stage Micrometer
Micrometers [1,2]	Up to 24 in	(52 + 3.8L) µin	Comparison to Gage Blocks
Calipers [1,2]	Up to 80 in	(102 + 4.7L) µin	Comparisons to Gage Blocks, Caliper Master
Indicators [1]	Up to 2 in	260 µin	Comparison to Micrometer Head with Digital Display, Gage Blocks
Depth Micrometers [1,2]	Up to 12 in	(69 + 2.7L) µin	Comparison to Gage Blocks
Height Gages [1,2]	Up to 48 in	(160 + 3.1L) µin	Comparison to Gage Blocks
Measuring Microscopes [1]	Up to 1 in Up to 25 mm	170 µin 2.5 µm	Stage Micrometer; ASTM E1951 or internal calibration procedure.
Linear Measuring Gages [1,2]	Up to 80 in	(102 + 4.7L) µin	Comparison to Gage Blocks

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Protractors [1]	Up to 90°	0.4°	Comparison to Angle Blocks, Surface Plate
Standardized Rockwell Hardness Test Blocks	HRA ≥ 80 (70 to 80) ≤ 70 HRBW ≥ 88 (60 to 88) ≤ 60 HRC ≥ 60 (35 to 60) ≤ 35 HREW ≥ 93 (84 to 93) ≤ 84 HRFW ≥ 94 (80 to 94) ≤ 80 HRGW ≥ 80 (55 to 80) ≤ 55 HRHW ≥ 95 ≤ 95 HR15N ≥ 90 (80 to 90) < 80	 0.3 HRA 0.26 HRA 0.26 HRA 0.32 HRBW 0.31 HRBW 0.31 HRBW 0.31 HRC 0.31 HRC 0.25 HRC 0.4 HREW 0.41 HREW 0.35 HREW 0.4 HRFW 0.45 HRFW 0.36 HRFW 0.44 HRGW 0.37 HRGW 0.32 HRGW 0.3 HRHW 0.31 HRHW 0.36 HR15N 0.33 HR15N 0.38 HR15N	Rockwell Hardness Tester; ASTM E-18 with internal calibration procedure.

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Standardized Rockwell Hardness Test Blocks	HR30N ≥ 77 (55 to 77) ≤ 55 HR45N ≥ 66 (37 to 66) ≤ 37 HR15TW ≥ 87 (81 to 87) ≤ 81 HR30TW ≥ 70 (57 to 70) ≤ 57 HR45TW ≥ 53 (33 to 53) ≤ 33 HR15WW ≥ 86 < 86 HR15XW ≥ 90 < 90 HR15YW ≥ 95 < 95	 0.4 HR30N 0.38 HR30N 0.37 HR30N 0.36 HR45N 0.37 HR45N 0.37 HR45N 0.5 HR15TW 0.46 HR15TW 0.4 HR15TW 0.44 HR30TW 0.48 HR30TW 0.46 HR30TW 0.46 HR45TW 0.37 HR45TW 0.33 HR45TW 0.43 HR15WW 0.35 HR15WW 0.32 HR15XW 0.38 HR15XW 0.34 HR15YW 0.42 HR15YW	Rockwell Hardness Tester; ASTM E-18 with internal calibration procedure.
Standardized Brinell Hardness Test Blocks	(2 to 5) mm	0.026 mm	Optical Scanning System, Brinell Test Bar; ASTM E-18 with internal calibration procedure.

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers [1]	HRA		Indirect verification per ASTM E18, ASTM E110 and internal calibration procedure; Rockwell Hardness Test Blocks.
	≥ 80	0.26 HRA	
	(60 to 80)	0.26 HRA	
	≤ 60	0.32 HRA	
	HRBW		
	≥ 80	0.33 HRBW	
	(60 to 80)	0.33 HRBW	
	≤ 60	0.32 HRBW	
	HRC		
	≥ 60	0.26 HRC	
	(40 to 60)	0.33 HRC	
	≤ 40	0.33 HRC	
	HRD		
	≥ 61	0.56 HRD	
	≤ 61	0.62 HRD	
	HREW		
	≥ 93	0.33 HREW	
	(84 to 93)	0.48 HREW	
	≤ 84	0.23 HREW	
	HRFW		
	≥ 94	0.26 HRFW	
	(80 to 94)	0.33 HRFW	
	≤ 80	0.25 HRFW	
	HRGW		
	≥ 80	0.36 HRGW	
	(55 to 80)	0.42 HRGW	
	≤ 55	0.51 HRGW	
	HRHW		
	≥ 95	0.33 HRHW	
	≤ 95	0.32 HRHW	
	HRKW		
	≥ 75	0.65 HRKW	
	< 75	0.71 HRKW	
	HRLW		
	≥ 110	0.47 HRLW	
	< 110	0.52 HRLW	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers [1]	HRMW		Indirect verification per ASTM E18, ASTM E110 and internal calibration procedure; Rockwell Hardness Test Blocks.
	≥ 105	0.67 HRMW	
	< 105	0.77 HRMW	
	HRPW		
	≥ 90	0.67 HRPW	
	< 90	0.7 HRPW	
	HRRW		
	≥ 120	0.59 HRRW	
	< 120	0.62 HRRW	
	HRSW		
	≥ 115	0.56 HRSW	
	< 115	0.61 HRSW	
	HR15N		
	≥ 90	0.36 HR15N	
	(80 to 90)	0.26 HR15N	
	< 80	0.32 HR15N	
	HR30N		
	≥ 77	0.33 HR30N	
	(55 to 77)	0.36 HR30N	
	≤ 55	0.39 HR30N	
	HR45N		
	≥ 66	0.33 HR45N	
	(37 to 66)	0.33 HR45N	
	≤ 37	0.32 HR45N	
	HR15TW		
	≥ 87	0.38 HR15TW	
	(81 to 87)	0.48 HR15TW	
	≤ 81	0.51 HR15TW	
	HR30TW		
	≥ 70	0.48 HR30TW	
	(57 to 70)	0.51 HR30TW	
	≤ 57	0.45 HR30TW	
	HR45TW		
	≥ 53	0.26 HR45TW	
	(33 to 53)	0.33 HR45TW	
	≤ 33	0.47 HR45TW	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers [1]	HR15WW ≥ 86 < 86 HR15XW ≥ 90 < 90 HR15YW ≥ 95 < 95	 0.33 HR15WW 0.45 HR15WW 0.36 HR15XW 0.25 HR15XW 0.42 HR15YW 0.29 HR15YW	Indirect verification per ASTM E18, ASTM E110 and internal calibration procedure; Rockwell Hardness Test Blocks.
Macro Vickers Hardness Testers [1]	(1) kg ≤ 545 ≥ 545 (2) kg ≤ 545 ≥ 545 (3) kg ≤ 545 ≥ 545 (5) kg ≤ 545 ≥ 545 (10) kg ≤ 545 ≥ 545 (20) kg ≤ 545 ≥ 545 (30) kg ≤ 545 ≥ 545 (50) kg ≤ 545 ≥ 545	 19 HV 7 HV 13 HV 6.4 HV 9.7 HV 6.6 HV 9.2 HV 5.7 HV 7.5 HV 3 HV 6.4 HV 3.2 HV 5.5 HV 2.6 HV 4.9 HV 3.2 HV	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure; Macro-Vickers Hardness Test Blocks.

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Vickers Hardness Testers [1]	(10 to 50) gf ≤ 540 HV ≥ 540 HV (100) gf ≤ 540 HV ≥ 540 HV (200) gf ≤ 540 HV ≥ 540 HV (300) gf ≤ 540 HV ≥ 540 HV (500) gf ≤ 540 HV ≥ 540 HV (1 000) gf ≤ 540 HV ≥ 540 HV	 36 HV 13 HV 25 HV 11 HV 18 HV 7.7 HV 16 HV 8.5 HV 12 HV 6.9 HV 11 HV 6.3 HV	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure; Vickers Micro-indentation Hardness Test Blocks.
Knoop Hardness Testers [1]	(10 to 50) gf ≤ 540 HK ≥ 540 HK (100) gf ≤ 540 HK ≥ 540 HK (200) gf ≤ 540 HK ≥ 540 HK (300) gf ≤ 540 HK ≥ 540 HK (500) gf ≤ 540 HK ≥ 540 HK (1 000) gf ≤ 540 HK ≥ 540 HK	 28 HK 15 HK 24 HK 16 HK 19HK 12 HK 16 HK 11 HK 15 HK 9.9 HK 19 HK 12 HK	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure; Knoop Micro-indentation Hardness Test Blocks.
Brinell Hardness Testers [1]	(> 0 to 6) mm	0.034 mm	Indirect verification per ASTM E10 and internal calibration procedure; Hardness Test Bars.

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Portable Hardness Tester – Leeb [1]	≤ 850 HLD	3.2 HLD	Indirect verification per ASTM A956 and internal calibration procedure; Calibration Standard Test Blocks.
Optical Scanning Systems [1]	(> 0 to 6) mm	16 µm	Comparison to Brinell Test Bar, B.O.S.S. Certified Calibration Standard
Rockwell Hardness Testers [1] Test Force Depth Measurement Hysteresis	 (3 to 15) kgf (30 to 45) kgf (60 to 150) kgf (> 0 to 25) mm (100 to 130) HR	 10 gf 51 gf 0.11 kgf 0.3 µm 0.15 HR	Direct verification per ASTM E18 and internal calibration procedure; Master Load Cell, Ceramic gage Blocks, Heidenhain Indicator
Brinell Hardness Tester [1] Force Measuring System	 (500 to 3 000) kgf (> 0 to 6) mm	 2 kg 11 µm	Direct verification per ASTM E10 and internal calibration procedure; Master Load Cell, Ceramic Gage Blocks
Balances and Scales [1,3] (SI)	Up to 6 kg	0.000 4 % of reading + 1.8 mg	ASTM E617 Class 1 Weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,3] (SI)	Up to 100 g 101 g to 15 kg	0.9 mg 0.000 1 % of reading + 12.6 mg	NIST Class F Weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,3] (Avoirdupois)	(1 to 480) lb	0.000 2 % of reading + 0.000 2 lb	NIST Class F Weights and internal calibration procedure utilized for the calibration of the weighing system.

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force – Compression [1]	(5 to 50) lbf (50 to 100) lbf (100 to 10 000) lbf	0.031 % of reading 0.11 % of reading 0.067 % of reading	Master Weight Sets, Master Load Cells

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Measuring Equipment [1]	(45 to 95) °F (10 to 90) %RH	1.2 °F 2.4 %RH	Comparison to Temperature/Humidity Monitor
Dew Point [1] (Ambient Air, Compressed Air, Dry Nitrogen)	(-61 to 10) °F (10 to 60) °F	2.8 °F 1.5 °F	Comparison to Dew Point Analyzer
Thermal Installations – System Accuracy Test [1]	(0 to 1 093) °C (1 093 to 1 200) °C	1.1 °C 2 °C	Thermocouple Calibrator and Reference Thermocouple Probe; In accordance with AMS 2750, AIAG CQI-9 or internal calibration procedure.
Thermal Installations – Temperature Uniformity Surveys [1]	(100 to 1 999) °F (2 000 to 2 200) °F	2.2 °F 3.8 °F	Data Logger with Calibrated "Type K" Thermocouple Wire; In accordance with AMS 2750, AIAG CQI-9 or internal calibration procedure.

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Timers [1]	Up to 86 400 s	0.53 s	Comparison to Stopwatch or NIST Phone System

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 (k=2), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. L = length in inches.
3. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The CMC presented here does not include resolution of the unit under test. The resolution will be included in the reported measurement uncertainty (MU) at the time of calibration (0.58R, where R equals the resolution of the unit under test.
4. Unless otherwise specified in the far-right column, the calibration procedure or method has been written internally.
5. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1360.

Jason Stine, Vice President

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org