



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

**Starr Instrument Service
Division of Starr Calibration, Inc.
Starr-Chek (an affiliate laboratory)
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.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 19 December 2024

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 Instrument Service
Division of Starr Calibration, Inc.
Starr-Chek (an affiliate laboratory)**
1101 West Lawrence Highway
Charlotte, MI 48813
Robin Shuten 517-543-8089

CALIBRATION

Valid to: **December 19, 2024**

Certificate Number: **AC-1360**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	Up to 300 V	19 mV	Process Calibrator
DC Voltage – Source ¹	Up to 15 V	2.7 mV	Process Calibrator
DC Current – Measure ¹	Up to 100 mA	38 μ A	Process Calibrator
DC Current – Source ¹	Up to 22 mA	6.7 μ A	Process Calibrator
Resistance – Measure ¹	(0 to 1 100) Ω (1.1 to 11) k Ω	1.2 Ω 23 Ω	Process Calibrator
Resistance – Source ¹	(0 to 1 100) Ω (1.1 to 11) k Ω	0.81 Ω 9.24 Ω	Process Calibrator
Electrical Simulation of Thermocouple Indicating Devices – Measure ¹	Type E (-100 to 995) $^{\circ}$ C Type J (-100 to 1 200) $^{\circ}$ C Type K (-100 to 1 372) $^{\circ}$ C Type N (-100 to 1 300) $^{\circ}$ C	0.37 $^{\circ}$ C 0.37 $^{\circ}$ C 0.41 $^{\circ}$ C 0.45 $^{\circ}$ C	Thermocouple Calibrator, Process Calibrators; AMS 2750, AIAG CQI-9 or internal calibration procedures.

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Measure ¹	Type R (50 to 1 767) °C	1.1 °C	Thermocouple Calibrator, Process Calibrators; AMS 2750, AIAG CQI-9 or internal calibration procedures
	Type S (50 to 1 767) °C	1.1 °C	
	Type T (-100 to 400) °C	0.44 °C	
Electrical Simulation of Thermocouple Indicating Devices – Source ¹	Type E (-100 to 995) °C	0.37 °C	Thermocouple Calibrator, Process Calibrators; AMS 2750, AIAG CQI-9 or internal calibration procedures
	Type J (-100 to 1 200) °C	0.37 °C	
	Type K (-100 to 1 372) °C	0.41 °C	
	Type N (-100 to 1 300) °C	0.45 °C	
	Type R (50 to 1 767) °C	1.1 °C	
	Type S (50 to 1 767) °C	1.1 °C	
	Type T (-100 to 400) °C	0.44 °C	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Scopes ¹	Up to 7 mm	19 µm	Stage Micrometer
Micrometers ^{1,2}	Up to 24 in	(46 + 4.3L) µin	Gage Blocks
Calipers ^{1,2}	Up to 80 in	(105 + 4.38L) µin	Gage Blocks, Caliper Master
Indicators ¹	Up to 2 in	260 µin	Micrometer Head with Digital Display, Gage Blocks
Depth Micrometers ^{1,2}	Up to 12 in	(69 + 2.73L) µin	Gage Blocks
Height Gages ^{1,2}	Up to 48 in	(50 + 4.24L) µin	Gage Blocks
Measuring Microscopes ¹	Up to 1 in	200 µin	Stage Micrometer; ASTM E1951 or internal calibration procedure.

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Comparators, Toolmakers Microscope ¹ X, Y Scales Magnification	Up to 12 in (10 to 200) X	0.002 4 in 0.001 9 in	Glass Master; ASTM E1951 or internal calibration procedure.
Stage Micrometers ¹	Up to 25 mm	2.8 μm	Microscope, Micrometer Head
Linear Measuring Gages ^{1,2}	Up to 80 in	(105 + 4.38L) μin	Gage Blocks
Protractors ¹	Up to 90°	(0.46 + 0.032L)°	Angle Blocks, Surface Plate

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Standardized Rockwell Hardness Test Blocks	HRA ≥ 80 (70 to 80) ≤ 70	0.3 HRA 0.26 HRA 0.26 HRA	Rockwell Hardness Tester; ASTM E-18 with internal calibration procedure
	HRBW ≥ 88 (60 to 88) ≤ 60	0.32 HRBW 0.31 HRBW 0.31 HRBW	
	HRC ≥ 60 (35 to 60) ≤ 35	0.31 HRC 0.31 HRC 0.25 HRC	
	HREW ≥ 93 (84 to 93) ≤ 84	0.4 HREW 0.41 HREW 0.35 HREW	
	HRFW ≥ 94 (80 to 94) ≤ 80	0.4 HRFW 0.45 HRFW 0.36 HRFW	
	HRGW ≥ 80 (55 to 80) ≤ 55	0.44 HRGW 0.37 HRGW 0.32 HRGW	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Standardized Rockwell Hardness Test Blocks	HRHW		Rockwell Hardness Tester; ASTM E-18 with internal calibration procedure.
	≥ 95	0.3 HRHW	
	≤ 95	0.31 HRHW	
	HR15N		
	≥ 90	0.36 HR15N	
	(80 to 90)	0.33 HR15N	
	< 80	0.38 HR15N	
	HR30N		
	≥ 77	0.4 HR30N	
	(55 to 77)	0.38 HR30N	
	≤ 55	0.37 HR30N	
	HR45N		
	≥ 66	0.36 HR45N	
	(37 to 66)	0.37 HR45N	
	≤ 37	0.37 HR45N	
	HR15TW		
	≥ 87	0.5 HR15TW	
	(81 to 87)	0.46 HR15TW	
≤ 81	0.4 HR15TW		
HR30TW			
≥ 70	0.44 HR30TW		
(57 to 70)	0.48 HR30TW		
≤ 57	0.46 HR30TW		
HR45TW			
≥ 53	0.46 HR45TW		
(33 to 53)	0.37 HR45TW		
≤ 33	0.33 HR45TW		
HR15WW			
≥ 86	0.43 HR15WW		
< 86	0.35 HR15WW		
HR15XW			
≥ 90	0.32 HR15XW		
< 90	0.38 HR15XW		
HR15YW			
≥ 95	0.34 HR15YW		
< 95	0.42 HR15YW		
Standardized Brinell Hardness Test Blocks	(2 to 5) mm	0.021 mm	Optical Scanning System, Brinell Test Bar; ASTM E-18 with internal calibration procedure.

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		
HRMW			
≥ 105	0.67 HRMW		
< 105	0.77 HRMW		
HRPW			
≥ 90	0.67 HRPW		
< 90	0.7 HRPW		



ANSI National Accreditation Board

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers ¹	HRRW		Indirect verification per ASTM E18, ASTM E110 and internal calibration procedure; Rockwell Hardness Test Blocks.
	≥ 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		
HR15WW			
≥ 86	0.33 HR15WW		
< 86	0.45 HR15WW		
HR15XW			
≥ 90	0.36 HR15XW		
< 90	0.25 HR15XW		
HR15YW			
≥ 95	0.42 HR15YW		
< 95	0.29 HR15YW		

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Macro Vickers Hardness Testers ¹	(1) kg ≤ 545	19 HV	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure; Macro-Vickers Hardness Test Blocks
	≥ 545	7 HV	
	(2) kg ≤ 545	13 HV	
	≥ 545	6.4 HV	
	(3) kg ≤ 545	9.7 HV	
	≥ 545	6.6 HV	
	(5) kg ≤ 545	9.2 HV	
	≥ 545	5.7 HV	
	(10) Kg ≤ 545	7.5 HV	
	≥ 545	3 HV	
	(20) Kg ≤ 545	6.4 HV	
	≥ 545	3.2 HV	
	(30) Kg ≤ 545	5.5 HV	
	≥ 545	2.6 HV	
Vickers Hardness Testers ¹	(10 to 50) gf ≤ 540 HV	36 HV	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure; Vickers Micro-indentation Hardness Test Blocks
	≥ 540 HV	13 HV	
	(100) gf ≤ 540 HV	25 HV	
	≥ 540 HV	11 HV	
	(200) gf ≤ 540 HV	18 HV	
	≥ 540 HV	7.7 HV	
	(300) gf ≤ 540 HV	16 HV	
	≥ 540 HV	8.5 HV	
	(500) gf ≤ 540 HV	12 HV	
	≥ 540 HV	6.9 HV	
	(1000) gf ≤ 540 HV	11 HV	
	≥ 540 HV	6.3 HV	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
Knoop Hardness Testers ¹	(10 to 50) gf ≤ 540 HK ≥ 540 HK	28 HK 15 HK	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure; Knoop Micro-indentation Hardness Test Blocks		
	(100) gf ≤ 540 HK ≥ 540 HK	24 HK 16 HK			
	(200) gf ≤ 540 HK ≥ 540 HK	19HK 12 HK			
	(300) gf ≤ 540 HK ≥ 540 HK	16 HK 11 HK			
	(500) gf ≤ 540 HK ≥ 540 HK	15 HK 9.9 HK			
	(1000) gf ≤ 540 HK ≥ 540 HK	19 HK 12 HK			
	Brinell Hardness Testers ¹	(2 to 5) MM		0.029 MM	Indirect verification per ASTM E10 and internal calibration procedure; Hardness Test Bars
	Portable Hardness Tester – Leeb ¹	≤ 850 L _D		3.22 L _D	Indirect verification per ASTM E110 and internal calibration procedure; Calibration Standard Test Blocks
Optical Scanning Systems ¹	(0 to 6) mm	16 μm	Brinell Test Bar, B.O.S.S. Certified Calibration Standard		
Rockwell Hardness Testers ¹					
Test Force	(3 to 45) kgf (60 to 150) kgf	5.7 gf 43 gf	Direct verification per ASTM E18 and internal calibration procedure; Master Load Cell, Ceramic gage Blocks		
Depth Measurement	Up to 18 mm	0.3 μm			
Hysteresis	(100 to 130) HR	0.15 HR			

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Hardness Tester ¹ Force	(500 to 3 000) kgf	0.56 kg	Direct verification per ASTM E10 and internal calibration procedure; Master Load Cell, Ceramic Gage Blocks
Measuring System	(0 to 6) mm	16 μm	
Balances and Scales ^{1,3} (SI)	Up to 100 g (101 to 15 000) g	2.2 g 1.74 g	NIST Class F Weights, NIST HB 44, and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales ^{1,3} (Avoirdupois)	(10 to 230) lb	0.19 lb	NIST Class F Weights, NIST HB 44, and internal calibration procedure utilized for the calibration of the weighing system.
Force – Compression ¹	(0.1 to 1 000) lb (1 000 to 10 000) lb	0.012 % of reading 0.013 % of reading	Master Weight Sets, Master Load Cells

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Measure ¹	(10 to 90) %RH	2.4 %RH	Temperature/Humidity Monitor
Dew Point (Ambient Air, Compressed Air, Dry Nitrogen)	(-61 to 10) °F (10 to 60) °F	2.9 °F 1.8 °F	Dew Point Analyzer
Temperature – Measure ¹ (System Accuracy)	(0 to 1 093) °C (1 093 to 1 200) °C	0.99 °C 2 °C	Thermocouple Calibrator and Reference Thermocouple Probe; In accordance with AMS 2750, AIAG CQI-9 or internal calibration procedure.

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Ovens – 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	Stopwatch or NIST Phone System

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 at the time of calibration.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1360.



R. Douglas Leonard Jr., VP, PILR SBU