



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 standards

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.

A handwritten signature in black ink, appearing to read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 19 December 2022
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, 2022**

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	14 mV	Fluke 744 Process Calibrator
DC Voltage – Source ¹	Up to 15 V	0.1 mV	Fluke 725/Fluke 744 Process Calibrators
DC Current – Measure ¹	Up to 110 mA	35 µA	Fluke 744 Process Calibrator
DC Current – Source ¹	(2 to 22) mA	6.6 µA	Fluke 744 Process Calibrator
Resistance – Measure ¹	Up to 11 kΩ	0.62 Ω	Fluke 744 Process Calibrator
Resistance – Source ¹	Up to 3.2 kΩ	0.1 Ω	Fluke 725 Process Calibrator
Electrical Simulation of Thermocouple Indicating Devices – Measure ¹	Type E (-200 to 1 000) °C Type J (-200 to -100) °C (-100 to 1 200) °C Type K (-180 to 1 300) °C Type N (-200 to 1 300) °C	0.4 °C 0.51 °C 0.31 °C 0.58 °C 0.64 °C	Fluke 725/Fluke 744 Process Calibrators and AMS 2750, AIAG CQI-9 or internal calibration procedures utilized in the calibration of these devices.

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 (-20 to 1 767) °C	0.72 °C	Fluke 725/Fluke 744 Process Calibrators and AMS 2750, AIAG CQI-9 or internal calibration procedures utilized in the calibration of these devices.
	Type S (0 to 1 767) °C	0.71 °C	
	Type T (-250 to 400) °C	0.7 °C	
Electrical Simulation of Thermocouple Indicating Devices – Source ¹	Type E (-200 to 1 000) °C	0.33 °C	Fluke 725/Fluke 744 Process Calibrators and AMS 2750, AIAG CQI-9 or internal calibration procedures utilized in the calibration of these devices.
	Type J (-200 to 1 300) °C	0.51 °C	
	Type K (-200 to 1 300) °C	0.67 °C	
	Type N (-200 to 1 300) °C	0.42 °C	
	Type R (-20 to 1 767) °C	0.47 °C	
	Type S (0 to 200) °C	1.1 °C	
	Type S (200 to 1 767) °C	0.43 °C	
Type T (-250 to 400) °C	0.51 °C		

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Scopes ¹	Up to 7 mm	16 µm	Stage Micrometer
Micrometers ^{1,2}	Up to 24 in	$(72 + 8.85L) \mu\text{in}$	Gage Blocks, Micrometer Standards
Calipers ^{1,2}	Up to 120 in	$(94 + 5.78L) \mu\text{in}$	Gage Blocks, Caliper Master, Check Master
Indicators ^{1,2}	Up to 4 in	$(130.7 + 1.96L) \mu\text{in}$	Micrometer Head with Digital Display, Gage Blocks
Depth Micrometers ^{1,2}	(0.001 to 12) in	$(73.5 + 4.35L) \mu\text{in}$	Gage Blocks
Height Gages ^{1,2}	Up to 48 in	$(29.7 + 20.3L) \mu\text{in}$	Gage Blocks, Check Master

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Bore Gages ^{1,2}	Up to 12 in	$(132.6 + 2.7L) \mu\text{in}$	Micrometer Head with Digital Display
Measuring Microscopes ¹	Up to 1 in Up to 14 in	170 μin 160 μin	Stage Micrometer and ASTM E1951 or internal calibration procedure utilized in the calibration of these devices.
Optical Comparators, Toolmakers Microscope ¹ X, Y Scales Squareness Magnification	Up to 12 in Up to 12 in (10 to 200) X	390 μin 240 μin 290 μin	Glass Master and ASTM E1951 or internal calibration procedure utilized in the calibration of these devices.
Stage Micrometers ¹	Up to 25 mm	1.47 μm	Microscope, Micrometer Head
Linear Measuring Gages ^{1,2}	Up to 84 in	$(34 + 9.6L) \mu\text{in}$	Gage Blocks, Long Gage Blocks
Protractors ¹	Up to 360 °	0.58 °	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		Rockwell Hardness Tester and ASTM E-18 with internal calibration procedure utilized in the calibration of these hardness blocks.	
		≥ 80		0.19 HRA
		(60 to 80)		0.21 HRA
		≤ 60		0.23 HRA
	HRBW			
		≥ 80		0.24 HRBW
		(60 to 80)		0.25 HRBW
		≤ 60		0.28 HRBW
	HRC			
		≥ 60		0.16 HRC
		(40 to 60)		0.19 HRC
		≤ 40		0.22 HRC
HRD				
	≥ 80	0.27 HRD		
	(62 to 80)	0.22 HRD		
	≤ 62	0.19 HRD		



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Standardized Rockwell Hardness Test Blocks	HREW		
	≥ 80	0.20 HREW	
	(65 to 80)	0.25 HREW	
	≤ 65	0.19 HREW	
	HRFW		
	≥ 80	0.22 HRFW	
	(70 to 80)	0.2 HRFW	
	≤ 70	0.23 HRFW	
	HRGW		
	≥ 80	0.19 HRGW	
	(40 to 80)	0.19 HRGW	
	≤ 40	0.22 HRGW	
	HRHW		
	≥ 95	0.20 HRHW	
	≤ 95	0.25 HRHW	
	HRKW		
	≥ 75 HRKW	0.26 HRKW	
	≤ 75 HRKW	0.25 HRKW	
	HR15N		
	≥ 90	0.20 HR15N	
(80 to 90)	0.23 HR15N		
< 80	0.17 HR15N		
HR30N			
≥ 79	0.20 HR30N		
(60 to 79)	0.22 HR30N		
≤ 60	0.22 HR30N		
HR45N			
≥ 65	0.2 HR45N		
(50 to 65)	0.25 HR45N		
≤ 50	0.21 HR45N		
HR15TW			
≥ 100	0.19 HR15TW		
(80 to 100)	0.23 HR15TW		
≤ 80	0.26 HR15TW		
HR30TW			
≥ 70	0.24 HR30TW		
(50 to 70)	0.23 HR30TW		
≤ 55	0.18 HR30TW		
HR45TW			
≥ 50	0.25 HR45TW		
(25 to 50)	0.29 HR45TW		
≤ 25	0.25 HR45TW		
			Rockwell Hardness Tester and ASTM E-18 with internal calibration procedure utilized in the calibration of these hardness blocks.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Standardized Rockwell Hardness Test Blocks	HR15WW ≥ 86 HR15	0.19 HR15WW	Rockwell Hardness Tester and ASTM E-18 with internal calibration procedure utilized in the calibration of these hardness blocks.
	< 86 HR15	0.26 HR15WW	
	HR15XW ≥ 90	0.27 HR15XW	
	< 90	0.29 HR15XW	
	HR15YW ≥ 95	0.38 HR15YW	
	< 95	0.25 HR15YW	
	HRMW ≥ 105	0.23 HRMW	
	≤ 105	0.25 HRMW	
	HRRW ≥ 120	0.29 HRRW	
	< 120	0.23 HRRW	
HRSW ≥ 120	0.3 HRSW	Optical Scanning System, Brinell Test Bar, and ASTM E-18 with internal calibration procedure utilized in the calibration of these hardness blocks.	
< 120	0.19 HRSW		
Standardized Brinell Hardness Test Blocks	(2.5 to 4.8) MM	0.018 MM	Optical Scanning System, Brinell Test Bar, and ASTM E-18 with internal calibration procedure utilized in the calibration of these hardness blocks.
Rockwell Hardness and Superficial Testers ¹	HRA ≥ 80	0.24 HRA	Indirect verification per ASTM E18 and internal calibration procedure Starr-Chek Rockwell Hardness Test Blocks
	(60 to 80)	0.27 HRA	
	≤ 60	0.28 HRA	
	HRBW ≥ 80	0.28 HRBW	
	(60 to 80)	0.31 HRBW	
	≤ 60	0.35 HRBW	
	HRC ≥ 60	0.20 HRC	
	(40 to 60)	0.24 HRC	
	≤ 40	0.26 HRC	
	HRD ≥ 80	0.32 HRD	
(62 to 80)	0.27 HRD		
≤ 62	0.25 HRD		

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers ¹	HREW ≥ 100 (75 to 100) ≤ 75	0.26 HREW 0.31 HREW 0.25 HREW	Indirect verification per ASTM E18 and internal calibration procedure Starr-Chek Rockwell Hardness Test Blocks
	HRFW ≥ 80 (70 to 80) ≤ 70	0.26 HRFW 0.26 HRFW 0.28 HRFW	
	HRGW ≥ 80 (40 to 80) ≤ 40	0.24 HRGW 0.25 HRGW 0.26 HRGW	
	HRHW ≥ 95 ≤ 95	0.26 HRHW 0.32 HRHW	
	HRKW ≥ 75 < 75	0.33 HRKW 0.32 HRKW	
	HRMW ≥ 105 < 105	0.23 HRMW 0.32 HRMW	
	HRRW ≥ 120 < 120	0.33 HRRW 0.31 HRRW	
	HRSW ≥ 120 < 120	0.34 HRSW 0.25 HRSW	
	HR15N ≥ 90 (80 to 90) < 80	0.26 HR15N 0.28 HR15N 0.23 HR15N	
	HR30N ≥ 79 (60 to 79) ≤ 60	0.26 HR30N 0.27 HR30N 0.27 HR30N	
	HR45N ≥ 65 (50 to 65) ≤ 50	.26 HR45N 0.3 HR45N 0.27 HR45N	



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
Rockwell Hardness and Superficial Testers ¹	HR15TW ≥ 85 (65 to 85) ≤ 65	0.25 HR15TW 0.28 HR15TW 0.3 HR15TW	Indirect verification per ASTM E18 and internal calibration procedure Starr-Chek Rockwell Hardness Test Blocks		
	HR30TW ≥ 70 (50 to 70) ≤ 55	0.28 HR30TW 0.28 HR30TW 0.23 HR30TW			
	HR45TW ≥ 50 (25 to 50) ≤ 25	0.33 HR45TW 0.36 HR45TW 0.3 HR45TW			
	HR15WW ≥ 86 < 86	0.25 HR15WW 0.33 HR15WW			
	HR15XW ≥ 90 < 90	0.34 HR15XW 0.35 HR15XW			
	HR15YW ≥ 95 < 95	0.43 HR15YW 0.3 HR15YW			
	Micro-indentation and Macro Vickers Hardness Testers ¹	(10 to 50) gf ≤ 500 ≥ 500		2.5 HK 2.5 HK	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure Knoop Micro-indentation Hardness Test Blocks
		(50 to 100) gf ≤ 500 ≥ 500		2.5 HK 2.5 HK	
Knoop Hardness Testers ¹		(100 to 1 000) gf ≤ 500 ≥ 500	3.2 HK 3.2 HK		
		Vickers Hardness Testers ¹	(10 to 50) gf ≤ 500 HV ≥ 500 HV	2.7 HV 2.7 HV	
(50 to 100) gf ≤ 500 HV ≥ 500 HV	4.1 HV 4.1 HV				
(100 to 1000) gf ≤ 500 HV ≥ 500 HV	4.8 HV 4.8 HV				

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Macro Vickers Hardness Testers ¹	(1 to 50) kg ≤ 500 HV ≥ 500 HV	3.4 HV 3.4 HV	Indirect verification per ASTM E92, ASTM E384, and internal calibration procedure Vickers Micro-indentation Hardness Test Blocks
Brinell Hardness Testers ¹	(2.5 to 4.8) MM	0.018 MM	Indirect verification per ASTM E10 and internal calibration procedure Starr-Chek Brinell Hardness Test Bars
Portable Hardness Tester – Rockwell ¹	≥ 60 HRC ≤ 60 HRC	0.83 HRC 0.83 HRC	Indirect verification per ASTM E110 and internal calibration procedure Starr-Chek Test Blocks
Portable Hardness Tester – Leeb ¹	≤ 750 LD	3.32 LD	Indirect verification per ASTM E10, ASTM E110, and internal calibration procedure Calibration Standard Test Blocks
Portable Hardness Tester – Brinell ¹	(2.5 to 4.8) MM	0.07 MM	Indirect verification per ASTM E10, ASTM E110, and internal calibration procedure Starr-Chek Brinell Hardness Test Bars
Optical Scanning Systems ¹	(0 to 6) mm	19 µm	Starr-Chek Brinell Test Bar, B.O.S.S. Certified Calibration Standard
Rockwell Hardness Testers ¹ Test Force (Diamond Indenter, Ball Indenter Grade 25)	(3 to 10) kgf (15 to 150) kgf	0.14 kg 0.14 kg	Direct verification per ASTM E18 and internal calibration procedure Master Load Cell
Rockwell Hardness Testers ¹ Indenter Depth (Diamond Indenter, Ball Indenter Grade 25)	14 mm	1.8 µm	Comparison to Ceramic Gage Blocks



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Hardness Tester ¹ Force (Indenter Grade 25)	(500 to 3 000) kgf	1.8 kg	Direct verification per ASTM E10 and internal calibration procedure Master Load Cell
Brinell Hardness Tester ¹ Indenter Depth (Indenter Grade 25)	(2.8 to 4.7) mm	19 µm	Comparison to Brinell Optical Scanning System
Balances and Scales ^{1,3}	Up to 10 kg Up to 500 lb	1.3 g 0.74 lb	NIST Class F Weights, NIST HB 44, and internal calibration procedure utilized for the calibration of the weighing system.
Force – Tension/Compression ¹	(0.1 to 100) lb (100 to 500) lb (500 to 1 000) lb (1 000 to 10 000) lb	0.22 % of reading 0.3 % of reading 0.33 % of reading 0.3 % 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	(0 to 99) %RH	2 %RH	Temperature/Humidity Monitor
Dew Point (Ambient Air, Compressed Air, Dry Nitrogen)	(-61 to 69) °F	0.72 °F	Dew Point Analyzer
Temperature – Measure ¹ (System Accuracy)	(0 to 800) °C (800 to 1 300) °C	0.37 °C 1.8 °C	Fluke 725/Fluke 744 Process Calibrators with Reference Thermocouple Wire in accordance with AMS 2750, AIAG CQI-9 or internal calibration procedure.
Ovens – Temperature Uniformity Surveys ¹	(100 to 1 200) °F (1 200 to 2 000) °F	1.1 °F 0.9 °F	SSI 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 36 000 s	0.56 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

