CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE:
See signature

CERTIFICATE NUMBER:
062031425101804

NVLAP CALIBRATION
NVLAP Lab Code 200301-0

Instron
825 University Avenue
Norwood, MA 02062-2643
Telephone: (800) 473-7838
Fax: (781) 575-5750
Email: service_requests@instron.com

APPROVED SIGNATORY

Mike Spuzzillo

Digitally signed by Mike Spuzzillo
Reason: I attest to the accuracy and integrity of this document
Date: 2025.03.14 13:22:48 -07'00'

Type of Calibration: **Force**
Relevant Standard: **ASTM E4-21**
Date of Calibration: **14-Mar-2025**

Customer Requested Due Date: **14-Mar-2026**

* * * VERIFICATION RESULTS * * *

System ID: 34SC1B32396
Transducer ID: 2519-1KN/180359

Indicator 1. PASSED - Service Port (N)**

Range Full Scale (%)	Calibrated Range of Forces (N)	Mode	Max Error (%)	Max Repeatability (%)	Return to Zero	Resolution (N)	Lower Limit (N)
100	10.0026 to 1002.017	T	-0.33	0.19	Pass	0.0025	0.5
100	-10.0026 to -1000.721	C	-0.43	0.26	Pass	0.0025	0.5

The range(s) of forces calibrated are assessed for +/- 1% accuracy, 1% repeatability, and return to zero tolerance.
*** within +/- 0.5% accuracy and 0.5% repeatability.*

Customer

Name: Evergreen State College
Address: Science Support Center - NIST
2713 McCann Plaza Drive NW
Olympia, WA 98505
United States
Contact: Carri LeRoy
Email: leroyc@evergreen.edu
Service Order No.: SV2412100254@@1

Temperature

Starting Temperature: 67.1 °F
Ending Temperature: 67.2 °F

Machine

Manufacturer: Instron
Serial No.: 34SC1B32396
Range Type: Single
Condition: Good

Transducer

Manufacturer: Instron
Capacity: 1000 N
Type: Tension/Compression

Methodology

The assessment of the testing machine was conducted on site at the above customer location in accordance with ASTM E4-21 "Standard Practices for Force Calibration and Verification of Testing Machines" using Instron procedure ICA-8-69.

The system was calibrated using a combination of Methods A and C, Verification by Standard Weights and Force-Measuring Instrument(s).

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The system was calibrated in the 'As Found' condition with no adjustments or repairs carried out. This is also the 'As Left' condition.

The load cell indicated on this certificate was removed from the force measuring system and calibrated per ASTM E4, Annex A1.3.

System Classification

The calibration and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540.1-1994, ISO 10012:2003, ISO 9001:2015, ISO/IEC 17025:2017.

The force-measuring system has been calibrated for the forces indicated using equipment calibrated within the requirements of ASTM E4-21.

The Simple Acceptance decision rule has been agreed to and employed in the determination of conformance to the identified metrological specification.

The verification is based on runs 1 and 2 only. A third run is taken to satisfy uncertainty requirements according to ISO 17025 specifications.

Data Summary - Indicator 1. - Service Port (N)

TENSION

% of Range	Run 1 Error (N)	Run 1 Error (%)	Run 2 Error (N)	Run 2 Error (%)	Run 3 Error (N)	Run 3 Error (%)	Repeatability (%)
100% Range (Full Scale: 1002.017 N)							
1	-0.0006	-0.01	-0.0026	-0.03	-0.0016	-0.02	0.02
2	0.0025	0.01	0.0075	0.04	0.0095	0.05	0.03
4	-0.0950	-0.23	-0.1040	-0.25	-0.0830	-0.20	0.02
7	-0.2344	-0.33	-0.1013	-0.14	-0.1001	-0.14	0.19
10	-0.2980	-0.29	-0.3070	-0.30	-0.0600	-0.06	0.01
20	-0.3150	-0.16	-0.1180	-0.06	-0.2250	-0.11	0.10
40	-0.4620	-0.11	-0.3910	-0.10	-0.2260	-0.06	0.01
70	-1.0314	-0.15	-0.4549	-0.06	-0.5429	-0.08	0.09
100	-1.2250	-0.12	-0.9130	-0.09	-0.9500	-0.09	0.03

Data Summary - Indicator 1. - Service Port (N)

COMPRESSION

% of Range	Run 1 Error (N)	Run 1 Error (%)	Run 2 Error (N)	Run 2 Error (%)	Run 3 Error (N)	Run 3 Error (%)	Repeatability (%)
100% Range (Full Scale: -1000.721 N)							
1	0.0186	-0.19	-0.0074	0.07	0.0136	-0.14	0.26
2	0.0365	-0.18	0.0235	-0.12	0.0285	-0.14	0.06
4	0.1604	-0.35	0.1720	-0.43	0.1840	-0.40	0.08
7	0.2113	-0.28	0.1759	-0.25	0.2400	-0.32	0.03
10	0.4040	-0.40	0.4170	-0.41	0.2500	-0.24	0.01
20	0.4930	-0.24	0.1160	-0.06	0.0860	-0.04	0.18
40	-0.1170	0.03	0.4090	-0.10	0.8640	-0.22	0.13
70	-0.7820	0.11	-0.2736	0.04	0.0274	0.00	0.07

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Data Summary - Indicator 1. - Service Port (N)

COMPRESSION

% of Range	Run 1 Error (N)	Run 1 Error (%)	Run 2 Error (N)	Run 2 Error (%)	Run 3 Error (N)	Run 3 Error (%)	Repeatability (%)
100% Range (Full Scale: -1000.721 N)							
100	-1.2630	0.13	-0.7720	0.08	-0.5900	0.06	0.05

Data - Indicator 1. - Service Port (N)

TENSION

	Run 1		**Run 2**		**Run 3**		Uncertainty of Measurement*	
% of Range	Indicated (N)	Applied (N)	Indicated (N)	Applied (N)	Indicated (N)	Applied (N)	Relative %	(+/- N)
100% Range (Full Scale: 1002.017 N)								
0 Return	-0.089		-0.084		-0.046			
1	10.002	10.0026	10.000	10.0026	10.001	10.0026	0.13	0.013
2	19.998	19.9955	20.003	19.9955	20.005	19.9955	0.13	0.026
4	40.781	40.876	41.360	41.464	41.523	41.606	0.13	0.054
7	71.023	71.2574	71.342	71.4433	71.490	71.5901	0.18	0.13
10	100.924	101.222	100.534	100.841	101.476	101.536	0.20	0.20
20	201.215	201.53	201.598	201.716	201.408	201.633	0.14	0.28
40	401.433	401.895	401.255	401.646	401.385	401.611	0.13	0.53
70	700.592	701.6234	701.237	701.6919	701.149	701.6919	0.14	0.97
100	1000.763	1001.988	1001.104	1002.017	1001.028	1001.978	0.13	1.3

Data - Indicator 1. - Service Port (N)

COMPRESSION

	Run 1		**Run 2**		**Run 3**		Uncertainty of Measurement*	
% of Range	Indicated (N)	Applied (N)	Indicated (N)	Applied (N)	Indicated (N)	Applied (N)	Relative %	(+/- N)
100% Range (Full Scale: -1000.721 N)								
0 Return	-0.293		0.165		-0.056			
1	-9.984	-10.0026	-10.010	-10.0026	-9.989	-10.0026	0.21	0.021
2	-19.959	-19.9955	-19.972	-19.9955	-19.967	-19.9955	0.13	0.027
4	-45.888	-46.0484	-40.269	-40.441	-45.468	-45.652	0.14	0.060
7	-75.166	-75.3773	-70.646	-70.8219	-74.511	-74.751	0.13	0.098
10	-100.128	-100.532	-102.254	-102.671	-102.577	-102.827	0.17	0.17
20	-201.815	-202.308	-201.057	-201.173	-200.847	-200.933	0.18	0.36
40	-401.900	-401.783	-401.618	-402.027	-400.884	-401.748	0.19	0.77
70	-701.510	-700.728	-701.623	-701.3494	-701.136	-701.1634	0.14	1.00
100	-1001.577	-1000.314	-1001.493	-1000.721	-1001.046	-1000.456	0.13	1.3

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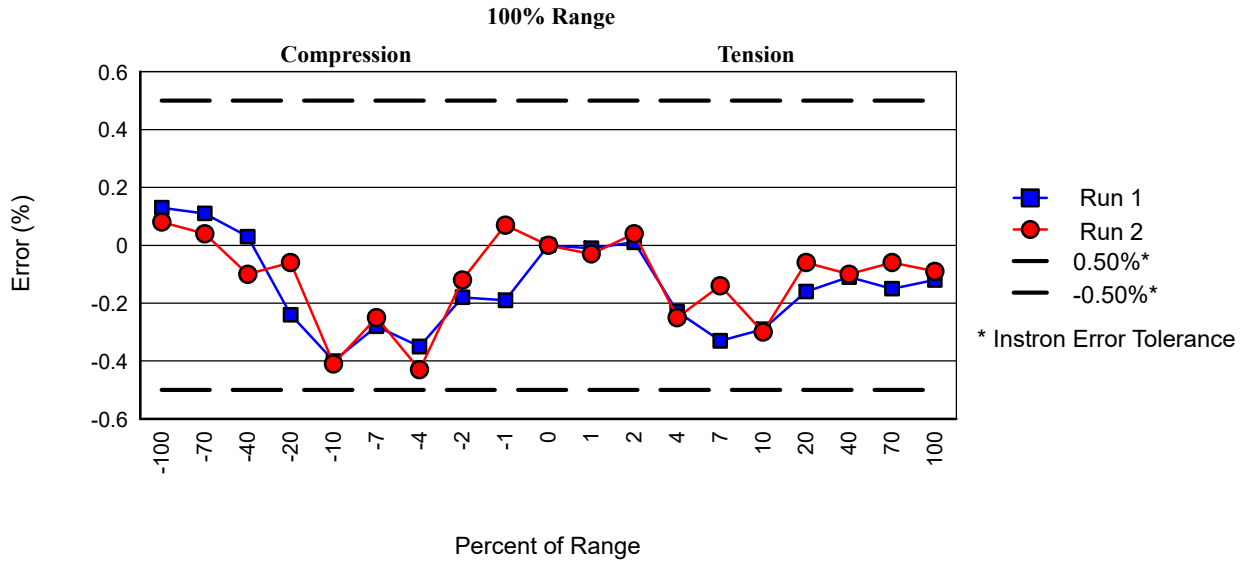
** The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor, k = 2, providing a level of confidence of approximately 95%.*

The uncertainty stated refers to values obtained during the calibration and makes no allowances for factors such as long-term drift, temperature and alignment effects - the influence of such factors should be taken into account.

The Return to Zero tolerance is 0.1% of the maximum force calibrated in the range or 1% of the lowest force calibrated in the range, whichever is greater.

Graphical Data - Indicator 1. - Service Port (N)



Calibration Equipment

The measurement results produced with Instron standards are traceable to the SI (The International System of Units) through internationally recognized National Metrology Institutes (NIST, NPL, PTB, Inmetro, etc.).

Manufacturer/Model	Serial No.	Description	Calibration Agency	Capacity	Cal Date	Cal Due
Extech 445580	1103444	temp. indicator	Masy	NA	25-Jul-2024	25-Jul-2025
Flintec 13249279	13249279	load cell	Instron	244.09 lbf	22-Jul-2024	22-Jul-2026
Tovey 9260-USB-5	17786478	force indicator	Instron	NA	19-Feb-2025	19-Feb-2026
Troemner Dead Weights - Metric	119	dead weight set	Instron	NA	10-Mar-2022	10-Mar-2027

The value of acceleration due to gravity used to calculate the force exerted by the mass was 9.80801 m/s².

Calibration Equipment Usage

Range Full Scale (%)	Mode	Serial No.	Percent(s) of Range	Lower Limit for Standard (N)	Accuracy (+/-)
100	T	119	1/ 2	NA	0.1% of nominal mass
		13249279	4/ 7/ 10/ 20/ 40/ 70/ 100	Class A1: 22	0.1% of reading

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Calibration Equipment Usage

Range Full Scale (%)	Mode	Serial No.	Percent(s) of Range	Lower Limit for Standard (N)	Accuracy (+/-)
100	C	119	1/ 2	NA	0.1% of nominal mass
		13249279	4/ 7/ 10/ 20/ 40/ 70/ 100	Class A1: 18	0.1% of reading
All	T/C	1103444	All	NA	1.8 °F

The standard Class A lower limit is used for systems with an accuracy of +/-1.0% and the standard Class A1 lower limit is used for systems with an accuracy of +/-0.5%.

The accuracy of the force indicator used with an elastic device is incorporated into the device's stated accuracy.

The accuracy of the calibration equipment used was equal to or better than the accuracy indicated in the table above.

Standard forces have been temperature compensated as necessary.

Comments

New Installation

Performed by: Mike Spuzzillo
Field Service Engineer

NOTE: Clause 17 of ASTM E4 states; It is recommended that testing machines be calibrated and verified annually or more frequently if required. In no case shall the time interval between verifications exceed 18 months (except for machines in which long term test runs beyond the 18 month period). Testing machines shall be calibrated and verified immediately after repairs (this includes new or replacement parts, or mechanical or electrical adjustments) that may in any way affect the operation of the force-measuring system or the values displayed. Calibration and verification is required immediately after a testing machine is relocated (except for machines designed to be moved from place to place in normal use), and whenever there is a reason to doubt the measurement accuracy of the force-measuring system, regardless of the time interval since the last verification.