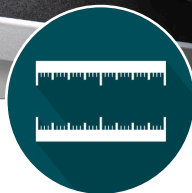


SPEED AND DISPLACEMENT VERIFICATION

Instron® Professional Services



Speed
Verification



Displacement
Verification

Instron has long been a leader in measuring and verifying speed and displacement and was an active participant in developing the ASTM Speed and Displacement Verification standards. These services ensure that testing parameters are being met and that associated results are being calculated accurately. To further maximize confidence, Instron is also accredited by NVLAP under lab code 200301-0 to ISO/IEC 17025.

ASTM E2309 OR ISO 9513:21012/COR 1:2013 - ANNEX H (DISPLACEMENT VERIFICATION):

- Displacement sensing devices verified as a system, in place, and operating as in actual use.
- Verification consists of at least two runs in the selected displacement range.
- Each run contains 5 or more displacement values (“points”) within the specified range with the difference between any two successive points being no larger than 1/3rd the difference between the selected minimum and maximum test displacement values.
- If test data is collected and reported in both directions, then verification shall be done in both directions.
- It is recommended that displacement measuring systems be verified annually or more frequently if required.

ASTM E2658 (SPEED VERIFICATION):

- Speed sensing devices verified as a system, in place, and operating as in actual use.
- Verification consists of at least two runs of data per selected speed.
- At a minimum, the most commonly used testing speeds should be chosen for verification.
- If test data is collected and reported in both directions, then verification shall be done in both directions.
- Verified at least every 18 months.

CALIBRATION CERTIFICATES

Instron calibration certificates provide you with the documentation necessary to prove compliance with industry testing standards and auditing authorities. On completion of your speed and displacement verification, you will receive one certificate for speed and a separate certificate for displacement.

Quality compliant and carry unique certificate number and date to meet program requirements.

The certificate contains a complete description of equipment being verified.

Method of conformance to relevant quality standards clearly stated for risk reduction during audits and other regulatory evaluations.

Scope of verification is always listed on the certificate.

CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 11-Nov-2020
CERTIFICATE NUMBER: 48111120134349

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

Type of Calibration: Speed
Relevant Standard: ASTM E265
Date of Calibration: 11-Nov-2021

Customer
Name: Customer Example
Address: 7 Random Road, Norwood, MA 02062
P.O. Number: 243
Contact: John Doe

Readout Verified
1. Digital Readout (mm/min)
Resolution of Indicator: 0.01 mm/min

Certification Statement
This certifies that each speed calibrated with m ASTM E2658 (Start and Stop Method) and Inst each speed was:

PASSED Class A - for 1 mm/min speed
PASSED Class A - for 50 mm/min speed
PASSED Class A - for 1000 mm/min speed

The Simple Acceptance decision rule has been metrological specification.

Methodology
The calibration and equipment used conform to outlined in ANSI/NCSL Z540.1-1994, ISO 100

The testing machine was calibrated on-site at condition with no adjustments or repairs carried out.

CalproSDS version 3.19
The results indicated on this certificate and the following report by the NVLAP accreditation it will be identified in the comments. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government. This report shall not be reproduced, except in full, without the approval of the issuing laboratory.

CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 11-Nov-2020
CERTIFICATE NUMBER: 48111120134349

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

Type of Calibration: Displacement
Relevant Standard: ASTM E2309/E2309M-20
Date of Calibration: 11-Nov-2020
Customer Requested Due Date: 11-Nov-2021

*** VERIFICATION RESULTS ***

System ID: 3365B19314
Indicator 1. - Service Port (mm)
Range: 10.0166 mm to 100.0164 mm - Asc Starting Position: 650.00 mm Maximum Error: -0.079%
The starting position is measured from the base beam to the bottom of the crosshead.

System Class: PASSED Class A

Customer
Name: Customer Example
Address: 7 Random Road, Norwood, MA 02062
Contact: John Doe
Email: JohnDoe@customerexample.com
Service Order No.: SV2009010023@@1
P.O./Contract No.: CONT0123

Machine/System
Manufacturer: Instron
Condition: Good

Temperature
Starting Temperature: 26.0 °C
Final Temperature: 25.9 °C

Methodology
The assessment of the testing machine was conducted on site at the above customer location in accordance with ASTM E2309/E2309M-20 "Standard Practices for Verification of Displacement Measuring Systems and Devices Used in Material Testing Machines" (Follow-the-Displacement Method) using Instron procedure ICA-8-07.

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

Prior to verification, a pre-calibration inspection was conducted. During the inspection, the testing system was found to be in Good condition.

The calibrated range of displacement includes only those displacements which are greater than or equal to the ASTM Lower Limit.

Three calibration tests were made with the testing machine in the vertical position.

System Classification
The calibration and equipment used conform to a controlled Quality Assurance program which meets the specifications

Instron CalproCR Version 3.45
The results indicated on this certificate and the following report relate only to the items calibrated. If there are methods or data included that are not covered by the NVLAP accreditation it will be identified in the comments. Any limitations of use as a result of this calibration will be indicated in the comments. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government. This report shall not be reproduced, except in full, without the approval of the issuing laboratory.

NVLAP symbol and the Accredited Laboratory Combined ILAC MRA Mark provides international recognition and acceptance.

All calibration standards used provide metrological traceability to National Standards (e.g. NIST, NPL, etc).

Each readout device classified pass/fail on the certificate.

All uncertainties are calculated per guidelines established by ASTM.

CERTIFICATE OF CALIBRATION

NVLAP ACCREDITED CALIBRATION LABORATORY No. 200301-0

outlined in ANSI/NCSL Z540.1-1994, ISO 10012:2003, ISO 9001:2015, ISO/IEC 17025:2017.

The displacement-measuring system has been verified for the displacements indicated using equipment calibrated within the requirements of ASTM E2309/E2309M-20.

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

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

% of Range	Run 1 Error		Run 2 Error		Run 3 Error		Repeat Error	
	(mm)	(%) Class	(mm)	(%) Class	(mm)	(%) Class	(mm)	Class
Verified Range: 10.0166 mm to 100.0164 mm - Ascending								
10	-0.0075	-0.075 A	-0.0069	-0.069 A	-0.0079	-0.079 A	0.00100	A
20	-0.0088	-0.044 A	-0.0086	-0.043 A	-0.0088	-0.044 A	0.00020	A
30	-0.0077	-0.026 A	-0.0074	-0.025 A	-0.0076	-0.025 A	0.00030	A
40	-0.0078	-0.019 A	-0.0074	-0.018 A	-0.0070	-0.017 A	0.00080	A
50	-0.0077	-0.015 A	-0.0071	-0.014 A	-0.0066	-0.013 A	0.00110	A
60	-0.0082	-0.014 A	-0.0086	-0.014 A	-0.0070	-0.012 A	0.00160	A
70	-0.0072	-0.010 A	-0.0072	-0.010 A	-0.0068	-0.010 A	0.00040	A
80	-0.0073	-0.009 A	-0.0070	-0.009 A	-0.0072	-0.009 A	0.00030	A
90	-0.0058	-0.006 A	-0.0056	-0.006 A	-0.0063	-0.007 A	0.00070	A
100	-0.0069	-0.007 A	-0.0073	-0.007 A	-0.0067	-0.007 A	0.00060	A

CERTIFICATE NUMBER:
48111120134349

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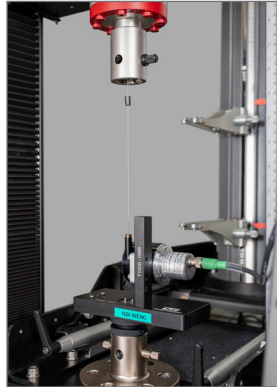
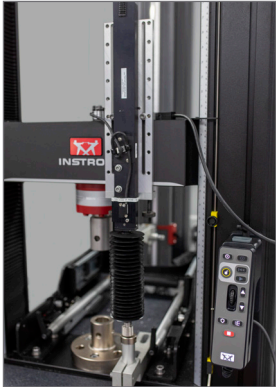
Maintain 6 years of factory backup data.

Data summary table provided for ease of data understanding.



WHAT IS THE DIFFERENCE IN THE USE OF CROSSHEAD DISPLACEMENT VS. EXTENSOMETRY?

The use of extensometry is often the best solution for determination of precise measurement of specimen strain or displacement in 'under load' conditions. The standard displacement verification service is done under 'no-load' conditions. A 'no-load' displacement verification shows that the displacement transducer and related electronics and software are working properly and are capable of making accurate measurements. Operators need to use caution, however, when comparing 'no-load' displacement data to displacement data taken during a test.



WHAT SYSTEMS CAN INSTRON SERVICES VERIFY ON SITE?

Instron can verify a variety of other testing systems including Satec™, Dynatup®, Wilson® Instruments, Wolpert™, Schenk®, MTS®, Instron IST, Tinius Olsen, Bose, TA Instruments, Zwick, United, Lloyds Instruments, Mayes, Dennison, Shimadzu®, Rhiele, Baldwin®, ATS, Mecmesin, Galdabini, Servotest, Hegewald & Peschke, and more.

DO I NEED ENHANCED SERVICES IF THE ASTM REQUIREMENTS ARE MET WITH THE STANDARD SERVICE?

Instron's Enhanced Verification Services are helping organizations mitigate additional risk by providing additional and more thorough verifications. This service may benefit you if:

- Your testing methods are changing frequently.
- Your requirements are changing frequently.
- You collect test data near the boundaries of your verification.
- Covering the range of system capabilities is important that represents the difference between the two, commonly referred to as the "error."



WHAT ARE TEST SYSTEM DEFLECTIONS?

Because of frame and load string issues, you cannot always make a direct comparison of 'no-load' data to actual specimen displacement. The displacement calibration under 'no-load' must be correct as a minimum if you want good performance under load. Potential errors can vary widely depending on the design and manufacturing specifications of the testing machine.

TESTS DONE AT LOW LOADS AND/OR HIGH ELONGATIONS?

This condition is normally where the use of crosshead displacement readings is most valid as long as the load frame is of high quality and in good condition. Non-specimen deflections should be either predicted or measured, then compared to the accuracy requirements of the application.

TESTING DONE AT HIGHER LOADS OR LOW ELONGATIONS?

Displacement data may still be valid if care is taken to understand what the data means and how it related to the deflection of the specimen. Use of an extensometer is usually recommended.

WHY VERIFY SPEED AND DISPLACEMENT?

You should calibrate your machine's displacement measuring system if any of the following apply to you:

- Displacement is critical to your testing needs and is reported in the test results.
- Use of an extensometer is impractical or impossible, and using crosshead displacement is an acceptable alternative.
- Crosshead or actuator displacement to characterize displacement of a specimen or component.
- LVDTs commonly found in servohydraulic systems are often not linear throughout their range.
- Displacement reading or crosshead/ actuator position must be precise and repeatable.

If any of the following apply to you, then verifying the speed accuracy of your system is highly recommended:

- The material or component under test is strain rate or speed sensitive.
- You are required to report test speed with your results.
- Your test method calls for a specific speed.
- Even if speed is not a critical parameter, it is good testing practice to ensure that the speed is constant, stable, and repeatable.

ENHANCED SPEED AND DISPLACEMENT VERIFICATION SERVICE

- 5 speeds total, 3 customer selected test speeds as well as the lowest reasonable and maximum speed of the system.
- Lowest reasonable speed is typically 0.04 in/min (1 mm/min), but lower speeds can be verified via custom services. Similarly, typical maximum speed is 50 in/min (1270 mm/min), but higher ones can be verified with unaccredited custom services.
- Customer selects displacement range between 0.8 in (20 mm) and 40 in (1000 mm).
- Customer specifies starting point within the range (no smaller than 0.02 inches (0.5mm)) and verification of 5 points per decade up to 100% of range is provided. Data is collected with 3 data runs.
- Data is collected with 3 runs for both Speed and Displacement verifications.

STANDARD SPEED AND DISPLACEMENT VERIFICATION SERVICE

- 3 customer selected test system speeds.
- Lowest reasonable speed is typically 0.04 in/min (1 mm/min), but lower speeds can be verified via custom services. Similarly, typical maximum speed is 50 in/min (1270 mm/min), but higher ones can be verified with unaccredited custom services.
- Customer selects displacement range between 0.8 in (20 mm) and 40 in (1000 mm).
- Verification of 10 points between 10% and 100% of the selected range.
- Data is collected with 3 runs for both speed and displacement verifications.

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