

# CERTIFICATE OF CALIBRATION

ISSUED BY : INSTRON CALIBRATION LABORATORY

DATE OF ISSUE : 21-Aug-2014

CERTIFICATE NUMBER: 22082114123000



Lab code: 200301-0

Page 1 of 3



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APPROVED SIGNATORY

**Walt  
Szymanowski**

Digitally signed by Walt Szymanowski  
DN: cn=Walt Szymanowski, o=US,  
ou=Norwood, st=MA, o=Instron, ou=America's -  
MAR, Calibration Laboratory, A division of  
Illinois Tool Works, Inc. (ITW, Inc.),  
email=Walt\_Szymanowski@Instron.com  
Date: 2014.08.21 13:05:25 -04'00'

**Type of Calibration:** Displacement

**Relevant Standard:** ASTM E2309/E2309M-05(2011)e1

**Date of Calibration:** 21-Aug-2014

**Customer Requested Due Date:** 21-Feb-2016

<b>Customer</b>	US Army ARL 4600 Rodman Test Ctr Aberdeen Proving Grounds, Md 21005	<b>Machine</b>	Serial No : 6677 Make : Instron Model : 5500R1125
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P.O. Number :

Contact :

## Readout Verified

1. Digital Readout (in)

## Certification Statement

This certifies that the displacements verified with machine indicator 1 (listed above) were verified by Instron in accordance with ASTM E2309/E2309M (Follow-the-Displacement Method) and Instron work instruction ICA-8-07.

The verification and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540-1, ISO 10012, ISO 9001:2008, and ISO/IEC 17025:2005. The Instron measurement equipment used for verification is traceable to NIST.

The testing machine was verified on-site at customer location. The testing machine was verified in the 'As Found' condition with no adjustments or repairs carried out. This is also the 'As Left' condition.

## Summary of Results

Indicator 1- Digital Readout (in)

Verified Range (in)	Max Error (in)	Max Error (%)	Max Repeat Error (in)	Max Repeat Error (%)	System Class*	Resolution (in)	Resolution Class	ASTM Lower Limit (in)
2 - 10	0.00049	0.021	0.00008	0.001	A	.0001	A	2

*\*System Class is derived from assessment of the following: error, repeatability, resolution, and standard device classification.*

*The Verified Range of Displacement includes only those displacements which are greater than or equal to the ASTM Lower Limit.*

The results indicated on this certificate and report relate only to the items verified. 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 verification will be indicated in the comments. This report must not be used to claim product endorsement by NVLAP or the United States government. This report shall not be reproduced, except in full, without the approval of Instron.

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Direction of Displacement : Ascending

## Datapoint Summary - Indicator 1 - Digital Readout (in)

Suggested Value (in)	Run 1 Error (in)	Run 1 Error (%)	Run 2 Error (in)	Run 2 Error (%)	Run 3 Error (in)	Run 3 Error (%)	Repeat Error (in)	Uncertainty (in)*	Coverage Factor = k
2	0.00040	0.020	0.00040	0.020	0.00041	0.021	0.00001	0.00077	2.26
4	0.00016	0.004	0.00017	0.004	0.00018	0.005	0.00002	0.0010	2.26
6	0.00015	0.003	0.00015	0.003	0.00018	0.003	0.00003	0.0014	2.26
8	0.00021	0.003	0.00021	0.003	0.00024	0.003	0.00003	0.0018	2.26
10	0.00041	0.004	0.00046	0.005	0.00049	0.005	0.00008	0.0068	2.26

\*The reported expanded uncertainty of measurement is based on a combined uncertainty multiplied by a coverage factor  $k$  to provide a level of confidence of approximately 95 %.

Runs 1 and 2 are performed to comply with the requirements of ASTM E2309/E2309M, run 3 is performed to calculate the uncertainty of measurement.

## Data - Indicator 1 - Digital Readout (in)

Temperature at start of verification : 65.6 °F

Suggested Value	Run 1			Run 2			Run 3	
	Applied	Indicated	Error Class	Applied	Indicated	Error Class	Applied	Indicated
2	1.99960	2.000	A	1.99960	2.000	A	1.99959	2.000
4	3.99984	4.000	A	3.99983	4.000	A	3.99982	4.000
6	5.99985	6.000	A	5.99985	6.000	A	5.99982	6.000
8	7.99979	8.000	A	7.99979	8.000	A	7.99976	8.000
10	9.99959	10.00	A	9.99954	10.00	A	9.99951	10.00

For runs 1 and 2: the worst Resolution Class is A and the worst Repeatability Class is A.

Temperature at end of verification : 65.1 °F

Starting Point of crosshead : 10 in

## Verification Equipment

Make/Model	Serial No.	Description	Cal Agency	Cal Date	Due Date
Instron LDS-10	080712B	Linear Gage	A.A. Janson	11-Aug-14	11-Aug-16
Extech 445580	1001333	Thermometer	Masy	10-Feb-13	10-Feb-15

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## Verification Equipment Specifications

Serial No.	Resolution	Accuracy (+/-)
080712B	0.00001 in	0.000200 in
1001333	0.1 °F	2 °F

*Instron standards are traceable to the SI (The International System of Units) through standards maintained by the National Institute of Standards and Technology (NIST) or other internationally recognized National Metrology Institutes (NMIs).*

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

## Comments

Tensile Displacement, test area below the moving crosshead, crosshead moving up

Verified By: Walt Szymanowski  
Field Systems Engineer



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**Walt  
Szymanowski**

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DN: cn=Walt Szymanowski, c=US, o=Norwood,  
st=MA, ou=Instron, ou=America's - MAR,  
Calibration Laboratory, A division of Illinois  
Tool Works, Inc. (ITW, Inc.),  
email=Walt\_Szymanowski@Instron.com  
Date: 2014.08.21 13:36:20 -0400

**Type of Calibration:** Displacement

**Relevant Standard:** ASTM E2309/E2309M-05(2011)e1

**Date of Calibration:** 21-Aug-2014

**Customer Requested Due Date:** 21-Feb-2016

**Customer** US Army ARL  
4600 Rodman Test Ctr  
Aberdeen Proving Grounds, Md 21005

**Machine**  
Serial No : 6677  
Make : Instron  
Model : 5500R1125

P.O. Number :

Contact :

## Readout Verified

1. Digital Readout (in)

## Certification Statement

This certifies that the displacements verified with machine indicator 1 (listed above) were verified by Instron in accordance with ASTM E2309/E2309M (Follow-the-Displacement Method) and Instron work instruction ICA-8-07.

The verification and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540-1, ISO 10012, ISO 9001:2008, and ISO/IEC 17025:2005. The Instron measurement equipment used for verification is traceable to NIST.

The testing machine was verified on-site at customer location. The testing machine was verified in the 'As Found' condition with no adjustments or repairs carried out. This is also the 'As Left' condition.

## Summary of Results

Indicator 1- Digital Readout (in)

Verified Range (in)	Max Error (in)	Max Error (%)	Max Repeat Error (in)	Max Repeat Error (%)	System Class*	Resolution (in)	Resolution Class	ASTM Lower Limit (in)
2 - 10	0.00050	0.017	0.00032	0.006	A	.00001	A	2

*\*System Class is derived from assessment of the following: error, repeatability, resolution, and standard device classification.*

*The Verified Range of Displacement includes only those displacements which are greater than or equal to the ASTM Lower Limit.*

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Direction of Displacement : Descending

## Datapoint Summary - Indicator 1 - Digital Readout (in)

Suggested Value (in)	Run 1 Error (in)	Run 1 Error (%)	Run 2 Error (in)	Run 2 Error (%)	Run 3 Error (in)	Run 3 Error (%)	Repeat Error (in)	Uncertainty (in)*	Coverage Factor = k
2	0.00028	0.014	0.00034	0.017	0.00032	0.016	0.00006	0.00078	2.26
4	0.00019	0.005	-0.00006	-0.001	0.00020	0.005	0.00026	0.0011	2.26
6	0.00005	0.001	0.00002	0.000	0.00034	0.006	0.00032	0.0014	2.26
8	0.00009	0.001	-0.00017	-0.002	0.00012	0.002	0.00029	0.0018	2.26
10	0.00048	0.005	0.00021	0.002	0.00050	0.005	0.00029	0.0068	2.26

\*The reported expanded uncertainty of measurement is based on a combined uncertainty multiplied by a coverage factor  $k$  to provide a level of confidence of approximately 95 %.

Runs 1 and 2 are performed to comply with the requirements of ASTM E2309/E2309M, run 3 is performed to calculate the uncertainty of measurement.

## Data - Indicator 1 - Digital Readout (in)

Temperature at start of verification : 65.1 °F

Suggested Value	Run 1			Run 2			Run 3	
	Applied	Indicated	Error Class	Applied	Indicated	Error Class	Applied	Indicated
2	1.99972	2.000	A	1.99966	2.000	A	1.99968	2.000
4	3.99981	4.000	A	4.00006	4.000	A	3.99980	4.000
6	5.99995	6.000	A	5.99998	6.000	A	5.99966	6.000
8	7.99991	8.000	A	8.00017	8.000	A	7.99988	8.000
10	9.99952	10.00	A	9.99979	10.00	A	9.99950	10.00

For runs 1 and 2: the worst Resolution Class is A and the worst Repeatability Class is A.

Temperature at end of verification : 65.3 °F

Starting Point of crosshead : 22 in

## Verification Equipment

Make/Model	Serial No.	Description	Cal Agency	Cal Date	Due Date
Instron LDS-10	080712B	Linear Gage	A.A. Janson	11-Aug-14	11-Aug-16
Extech 445580	1001333	Thermometer	Masy	10-Feb-13	10-Feb-15

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## Verification Equipment Specifications

Serial No.	Resolution	Accuracy (+/-)
080712B	0.00001 in	0.000200 in
1001333	0.1 °F	2 °F

*Instron standards are traceable to the SI (The International System of Units) through standards maintained by the National Institute of Standards and Technology (NIST) or other internationally recognized National Metrology Institutes (NMIs).*

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

## Comments

Compressive Displacement, test area under moving crosshead, crosshead moving down

Verified By: Walt Szymanowski  
Field Systems Engineer



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j=Norwood, st=MA, o=Instron,  
ou=America's - MAR, Calibration  
Laboratory, A division of Illinois Tool Works,  
Inc. (ITW, Inc.),  
email=Walt\_Szymanowski@Instron.com  
Date: 2014.08.21 14:07:51 -04'00'

**Type of Calibration:** Speed

**Relevant Standard:** ASTM E2658-11

**Date of Calibration:** 21-Aug-2014

**Customer Requested Due Date:** 21-Feb-2016

<b>Customer</b>	US Army ARL 4600 Rodman Test Ctr Aberdeen Proving Grounds, Md 21005	<b>Machine</b>	Serial No : 6677 Make : Instron Model : 5500R1125
P.O. Number :		Ambient Temperature :	65.4 °F
Contact :			

## Readout Verified

1. Digital Readout (in/min)

Resolution of Indicator: .00001 in/min

## Certification Statement

This certifies that each speed verified with machine indicator 1 (listed above) was verified by Instron in accordance with ASTM E2658 (Start and Stop Method) and Instron work instruction ICA-8-07, and that the ASTM E2658 classification for each speed was:

PASSED Class A - for .05 in/min speed

PASSED Class A - for 2 in/min speed

PASSED Class A - for 12 in/min speed

## Method of Verification

The verification and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540-1, ISO 10012, ISO 9001:2008, and ISO/IEC 17025:2005. The Instron measurement equipment used for verification is traceable to NIST.

The testing machine was verified on-site at customer location. The testing machine was verified in the 'As Found' condition with no adjustments or repairs carried out. This is also the 'As Left' condition.

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## Datapoint Summary - Indicator 1 - Digital Readout( in/min )

Indicated Speed ( in/min )	Run1 Error(%)	Run2 Error(%)	Run3 Error(%)	Repeat Error (%)	Uncertainty ( in/min )*	Coverage Factor = k
.05	-.020	.168	.009	.188	0.000066	2.45
2	-.008	.035	.048	.056	0.00093	2.06
12	-.034	-.012	-.020	.022	0.0090	2

\*The reported expanded uncertainty of measurement is based on a combined uncertainty multiplied by a coverage factor  $k$  to provide a level of confidence of approximately 95 %.

## Data - Indicator 1 - Digital Readout( in/min )

Temperature at start of verification : 65.4 °F

Indicated Speed ( in/min )	Run 1			Run 2			Run 3		
	Disp. (in)	Time (min)	Actual Speed ( in/min )	Disp. (in)	Time (min)	Actual Speed ( in/min )	Disp. (in)	Time (min)	Actual Speed ( in/min )
.05	.15894	3.17817	.0500100	.15984	3.20217	.0499162	.17890	3.57833	.0499953
2	1.50846	.75417	2.0001680	1.11328	.55683	1.9993056	.45445	.22733	1.9990469
12	2.20675	.18383	12.0040798	2.65831	.22150	12.0013995	3.48469	.29033	12.0023766

Temperature at end of verification : 65.4 °F

Direction of Displacement: Tensile Direction, Test Area under moving crosshead, crosshead moving UP

## Verification Equipment

Make/Model	Serial No.	Description	Cal Agency	Cal Date	Due Date
Instron LDS-10	080712B	Linear Gage	A.A. Janson	11-Aug-14	11-Aug-16
Extech 445580	1001333	Thermometer	Masy	10-Feb-13	10-Feb-15
---	JHG5GV1	Computer Clock	Instron Calibration	2-Jul-14	2-Jul-16



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## Verification Equipment Specifications

Serial No.	Resolution	Accuracy (+/-)
080712B	0.00001 in	0.000200 in
1001333	0.1 °F	2 °F
JHG5GV1	0.01 ms	10 ms

*Instron standards are traceable to the SI (The International System of Units) through standards maintained by the National Institute of Standards and Technology (NIST) or other internationally recognized National Metrology Institutes (NMI).*

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

*The Standard Reference Speed ("Actual Speed") is derived from the combined effect of the Displacement and Computer Clock Time references with a Performance Specification of +/- .125% of reading.*

## Comments

Tensile Speeds

Verified By: Walt Szymanowski  
Field Systems Engineer

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email=Walt\_Szymanowski@instron.com  
Date: 2014.08.21 14:41:24 -04'00'

Type of Calibration: Speed

Relevant Standard: ASTM E2658-11

Date of Calibration: 21-Aug-2014

Customer Requested Due Date: 21-Aug-2016

<b>Customer</b>	US Army ARL 4600 Rodman Test Ctr Aberdeen Proving Grounds, Md 21005	<b>Machine</b>	Serial No : 6677 Make : Instron Model : 5500R1125
P.O. Number :		Ambient Temperature :	65.4 °F
Contact :			

## Readout Verified

1. Digital Readout (in/min)

Resolution of Indicator: .00001 in/min

## Certification Statement

This certifies that each speed verified with machine indicator 1 (listed above) was verified by Instron in accordance with ASTM E2658 (Start and Stop Method) and Instron work instruction ICA-8-07, and that the ASTM E2658 classification for each speed was:

PASSED Class A - for .05 in/min speed

PASSED Class A - for 2 in/min speed

PASSED Class A - for 12 in/min speed

## Method of Verification

The verification and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540-1, ISO 10012, ISO 9001:2008, and ISO/IEC 17025:2005. The Instron measurement equipment used for verification is traceable to NIST.

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## Datapoint Summary - Indicator 1 - Digital Readout( in/min )

Indicated Speed ( in/min )	Run1 Error(%)	Run2 Error(%)	Run3 Error(%)	Repeat Error (%)	Uncertainty ( in/min )*	Coverage Factor = k
.05	.108	-.182	-.074	.290	0.000097	2.78
2	.028	-.001	-.039	.067	0.0015	2
12	.043	-.024	.005	.067	0.010	2

\*The reported expanded uncertainty of measurement is based on a combined uncertainty multiplied by a coverage factor k to provide a level of confidence of approximately 95 %.

## Data - Indicator 1 - Digital Readout( in/min )

Temperature at start of verification : 65.4 °F

Indicated Speed ( in/min )	Run 1			Run 2			Run 3		
	Disp. (in)	Time (min)	Actual Speed ( in/min )	Disp. (in)	Time (min)	Actual Speed ( in/min )	Disp. (in)	Time (min)	Actual Speed ( in/min )
.05	.16215	3.24650	.0499461	.16242	3.24250	.0500910	.16247	3.24700	.0500370
2	.47420	.23717	1.9994378	.57467	.28733	2.0000116	.46718	.23350	2.0007709
12	2.12509	.17717	11.9948636	2.53861	.21150	12.0028842	2.90586	.24217	11.9994219

Temperature at end of verification : 65.8 °F

Direction of Displacement: Compressive Speeds, Test Area under moving crosshead, crosshead moving down

## Verification Equipment

Make/Model	Serial No.	Description	Cal Agency	Cal Date	Due Date
Instron LDS-10	080712B	Linear Gage	A.A. Janson	11-Aug-14	11-Aug-16
Extech 445580	1001333	Thermometer	Masy	10-Feb-13	10-Feb-15
---	JHG5GV1	Computer Clock	Instron Calibration	2-Jul-14	2-Jul-16



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## Verification Equipment Specifications

Serial No.	Resolution	Accuracy (+/-)
080712B	0.00001 in	0.000200 in
1001333	0.1 °F	2 °F
JHG5GV1	0.01 ms	10 ms

*Instron standards are traceable to the SI (The International System of Units) through standards maintained by the National Institute of Standards and Technology (NIST) or other internationally recognized National Metrology Institutes (NMIs).*

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## Comments

Compressive Speeds

Verified By: Walt Szymanowski  
Field Systems Engineer