

CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 10-Sep-14

CERTIFICATE NUMBER: 019091014131109



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APPROVED SIGNATORY

**John
Dowd**

Digitally signed by John Dowd
DN: cn=John Dowd, c=US,
l=Norwood, st=MA, o=Instron,
ou=America's - MAR, Calibration
Laboratory, A division of Illinois
Tool Works, Inc. (ITW, Inc.),
email=John_Dowd@Instron.com
Date: 2014.09.12 08:57:16 -04'00'

Type of Calibration: Force
Relevant Standard: ASTM E4-14
Date of Calibration: 10-Sep-14

Customer Requested Due Date: 10-Mar-16

Customer

Name: US Army Rodman Test Center
Address: Bldg. 4600
Aberdeen Proving Grounds, MD 21005
David.Gray@army.mil

P.O./Contract No.:

Contact:

Machine

Manufacturer: Instron
Serial Number: 5500R11234665
System ID: 5500R11234665
Range Type: Single

Transducer

Manufacturer: Instron
Transducer ID: 2511-325/028
Capacity: 5620.2231 lbf
Type: Tension/Compression

Classification

1. Service Port - PASSED

Certification Statement

This certifies that the forces verified with machine indicator(s) (listed above) that passed are WITHIN $\pm 1\%$ accuracy, 1% repeatability, and zero return tolerance.

All machine indicators were verified on-site at customer location by Instron in accordance with ASTM E4.

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

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.

Method

The testing machine was verified in the 'as found' condition with no adjustments carried out.

Instron CalproCR Version 3.27

The results indicated on this certificate and the following 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 the issuing laboratory.

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Summary of Results

Temperature at start of verification: 74.60 °F.

Indicator 1. - Service Port (lbf)

Range	Tested Force Range	Mode	ASTM E4 Max Error (%)	ASTM E4 Max Repeat Error (%)	Zero Return	Resolution (lbf)	ASTM E4 Lower Limit (lbf)
Full Scale (%)	(lbf)						
100	55.2622 to 5500.5	T	0.96	0.19	Pass	0.05620223	11.240446
	-57.33 to -5474.6	C	0.67	0.08	Pass	0.05620223	11.240446

Temperature at end of verification: 74.80 °F.

Data Point Summary - Indicator 1. - Service Port (lbf)

TENSION

% of Range	Run 1 Error (%)	Run 2 Error (%)	Run 3 Error (%)	ASTM E4 Repeat Error (%)	Relative Uncertainty* (%)	Uncertainty of Measurement* (± lbf)
100% Range (Full Scale: 5500.5 lbf)						
1	0.44	0.50	0.41	0.06	0.15	0.086
2	0.49	0.30	0.44	0.19	0.17	0.19
4	0.85	0.88	0.66	0.03	0.19	0.42
7	0.77	0.65	0.69	0.12	0.15	0.57
10	0.72	0.68	0.61	0.04	0.14	0.80
20	0.71	0.65	0.74	0.06	0.14	1.5
40	0.75	0.75	0.73	0.00	0.13	2.9
70	0.87	0.84	0.86	0.03	0.13	5.0
100	0.96	0.94	0.93	0.02	0.13	7.1

Data Point Summary - Indicator 1. - Service Port (lbf)

COMPRESSION

% of Range	Run 1 Error (%)	Run 2 Error (%)	Run 3 Error (%)	ASTM E4 Repeat Error (%)	Relative Uncertainty* (%)	Uncertainty of Measurement* (± lbf)
100% Range (Full Scale: -5474.6 lbf)						
1	0.37	0.45	0.11	0.08	0.25	0.14
2	0.13	0.12	0.24	0.01	0.15	0.17
4	0.26	0.29	0.25	0.03	0.13	0.29
7	0.37	0.39	0.30	0.02	0.14	0.55
10	0.45	0.40	0.37	0.05	0.14	0.76
20	0.56	0.51	0.44	0.05	0.15	1.6
40	0.60	0.54	0.58	0.06	0.13	3.0
70	0.64	0.65	0.64	0.01	0.13	5.0
100	0.67	0.66	0.65	0.01	0.13	7.0

* 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%.

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Data - Indicator 1. - Service Port (lbf)

TENSION

% of Range	Run 1		Run 2		Run 3	
	Indicated (lbf)	Applied (lbf)	Indicated (lbf)	Applied (lbf)	Indicated (lbf)	Applied (lbf)
100% Range (Full Scale: 5500.5 lbf)						
0 Return	-0.019		-0.029		0.133	
1	55.504	55.2622	58.278	57.9866	58.734	58.4913
2	114.623	114.0622	111.026	110.6959	113.024	112.5285
4	220.100	218.25	221.976	220.05	226.746	225.25
7	385.959	383	392.119	389.6	394.650	391.95
10	559.485	555.5	567.672	563.85	557.370	554
20	1126.590	1118.6	1121.138	1113.95	1114.607	1106.45
40	2238.585	2221.95	2237.506	2220.95	2256.360	2240
70	3947.310	3913.45	3962.504	3929.6	3942.761	3909.25
100	5522.153	5469.55	5551.937	5500.5	5585.546	5534.1

Data - Indicator 1. - Service Port (lbf)

COMPRESSION

% of Range	Run 1		Run 2		Run 3	
	Indicated (lbf)	Applied (lbf)	Indicated (lbf)	Applied (lbf)	Indicated (lbf)	Applied (lbf)
100% Range (Full Scale: -5474.6 lbf)						
0 Return	-0.042		-0.099		-0.007	
1	-57.587	-57.3741	-57.589	-57.33	-58.709	-58.6432
2	-113.411	-113.2684	-113.635	-113.4938	-113.426	-113.1508
4	-220.265	-219.7	-230.369	-229.7	-226.667	-226.1
7	-398.519	-397.05	-391.663	-390.15	-393.295	-392.1
10	-558.374	-555.85	-566.775	-564.5	-556.417	-554.35
20	-1121.420	-1115.2	-1114.151	-1108.45	-1136.827	-1131.9
40	-2252.824	-2239.3	-2252.921	-2240.8	-2253.365	-2240.35
70	-3928.629	-3903.65	-3929.892	-3904.5	-3962.657	-3937.5
100	-5499.079	-5462.6	-5510.985	-5474.6	-5572.549	-5536.6

The Return to Zero tolerance is \pm the indicator resolution, 0.1% of the maximum force verified in the range, or 1% of the lowest force verified in the range, whichever is greater.

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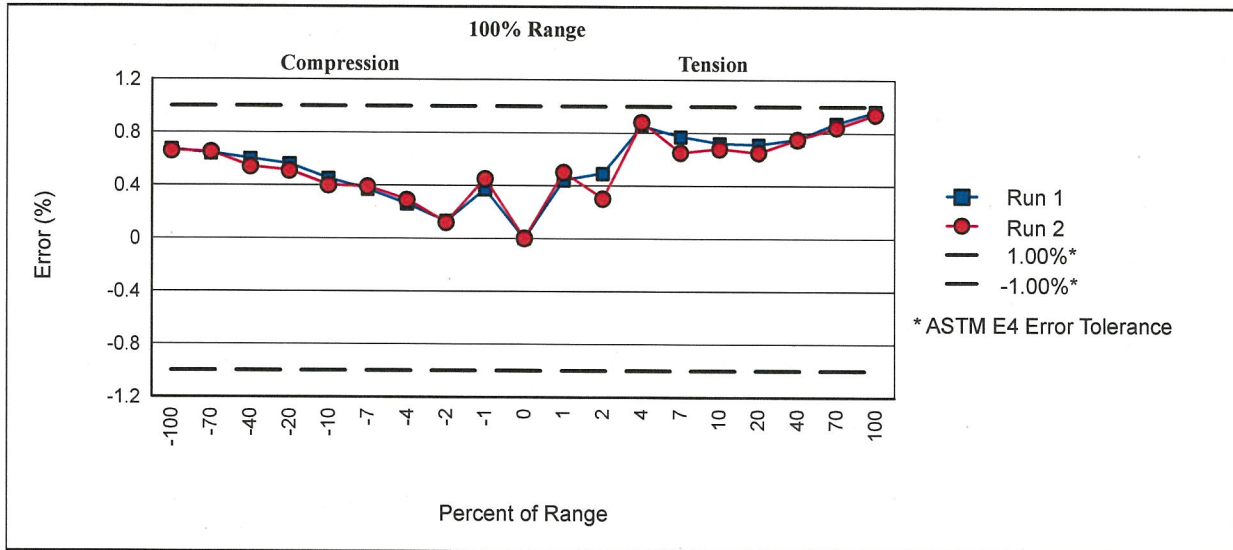
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Graphical Data - Indicator 1. - Service Port (lbf)



Verification Equipment

Make/Model	Serial Number	Description	Calibration Agency	Capacity	Cal Date	Cal Due
Exttech 445580	1057123	temp. indicator	Masy SYstems Inc	NA	22-Jul-14	22-Jul-16
Flintec 198335	198335	load cell	Instron	12000 lbf	20-May-13	20-May-15
Flintec 3402768	3402768	load cell	Instron	1200 lbf	03-Oct-13	03-Oct-15
Interface 9840	93020	force indicator	Instron	NA	31-Jul-13	31-Jul-15

Verification Equipment Usage

Range	Full Scale	Standard		Lower Limit for	
(%)	Mode	Serial Number	Percent(s) of Range	Standard (lbf)	Accuracy (+/-)
100	T	3402768	1/ 2	Class A1: 29	0.1% of reading
		198335	4/ 7/ 10/ 20/ 40/ 70/ 100	Class A1: 205	0.1% of reading
100	C	3402768	1/ 2	Class A1: 31	0.1% of reading
		198335	4/ 7/ 10/ 20/ 40/ 70/ 100	Class A1: 200	0.1% of reading
All	T/C	1057123	All	NA	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 standard Class A lower limit is used for systems with an accuracy of $\pm 1.0\%$ and the standard Class A1 lower limit is used for systems with an accuracy of $\pm 0.5\%$.

The accuracy of the force indicator used with elastic devices is incorporated into the devices stated accuracy.

Standard forces have been temperature compensated as necessary.

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

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Comments

Verified by: Daniel Dehay
Field Service Engineer

NOTE: Clause 19 of ASTM E4 states; It is recommended that testing machines be 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 verified immediately after repairs that may in any way affect the operation of the weighing system or values displayed. Verification is required immediately after a testing machine is relocated and where there is a reason to doubt the accuracy of the force indicating system, regardless of the time interval since the last verification.