CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 17-Oct-12 CERTIFICATE NUMBER: **22101712151546**

NVLAP

Lab code: 200301-0

Instron
825 University Avenue
Norwood, MA 02062-2643
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APPROVED SIGNATORY

Walt Szymanowski

Digitally signed by Walt Szymanowski
DN: cn=Walt Szymanowski, c=US, l=Norwood, st=MA, ou=MAR
Date: 2012.10.17 16:50:09 -04'00'

Type of Calibration: **Force**
Relevant Standard: **ASTM E4-10**
Date of Calibration: **17-Oct-12**

Customer Requested Due Date: **17-Apr-14**

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: 5500R1125 / 6539
System ID: 5500R1125 / 6539
Range Type: Single

Transducer

Manufacturer: Instron
Transducer ID: 2511-325 / 356
Capacity: 5620 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 ± 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.

**** within ± .5% accuracy and .5% repeatability.**

Method

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

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: 74.50 °F.

Indicator 1. - Service Port (lbf)

Range Full Scale (%)	Tested Force Range (lbf)	Mode	ASTM E4 Max Error (%)	ASTM E4 Max Repeat Error (%)	Zero Return	Resolution (lbf)	ASTM E4 Lower Limit (lbf)
100	109.252 to 5485.05	T	0.19	0.08	Pass	0.0562	11.24
	-116.1784 to -5503.35	C	-0.08	0.07	Pass	0.0562	11.24

Temperature at end of verification: 75.20 °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: 5485.05 lbf)						
2	-0.13	-0.07	-0.14	0.06	0.14	0.155
4	-0.14	-0.15	-0.24	0.01	0.14	0.327
8	-0.02	-0.10	-0.12	0.08	0.14	0.662
14	-0.08	-0.06	-0.11	0.02	0.13	1.042
20	-0.03	-0.04	-0.05	0.01	0.13	1.410
40	0.06	0.05	0.04	0.01	0.13	2.873
60	0.13	0.11	0.10	0.02	0.13	4.315
80	0.16	0.14	0.15	0.02	0.13	5.699
100	0.19	0.18	0.19	0.01	0.13	7.016

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: -5503.35 lbf)						
2	0.02	0.00	0.09	0.02	0.14	0.166
4	-0.01	-0.08	-0.11	0.07	0.14	0.312
8	-0.05	-0.06	-0.09	0.01	0.13	0.593
14	-0.02	-0.03	-0.05	0.01	0.13	1.033
20	-0.01	-0.06	-0.04	0.05	0.13	1.484
40	-0.02	-0.03	-0.05	0.01	0.13	2.882
60	-0.04	-0.04	-0.03	0.00	0.13	4.297
80	-0.03	-0.04	-0.04	0.01	0.13	5.723
100	-0.04	-0.04	-0.05	0.00	0.13	7.041

** 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 Indicated (lbf)	Run 1 Applied (lbf)	Run 2 Indicated (lbf)	Run 2 Applied (lbf)	Run 3 Indicated (lbf)	Run 3 Applied (lbf)
100% Range (Full Scale: 5485.05 lbf)						
0 Return	0.213		0.103		0.014	
2	112.953	113.1	109.179	109.252	113.837	113.9944
4	226.091	226.4	237.931	238.3	216.427	216.95
8	455.703	455.8	467.905	468.35	474.027	474.6
14	783.944	784.55	814.984	815.5	785.319	786.15
20	1095.515	1095.8	1150.724	1151.15	1056.764	1057.3
40	2245.471	2244.1	2239.430	2238.2	2252.229	2251.3
60	3355.445	3351.15	3337.581	3333.85	3352.315	3349
80	4480.810	4473.75	4410.333	4404.05	4485.444	4478.9
100	5495.623	5485.05	5493.289	5483.4	5486.379	5476.15

Data - Indicator 1. - Service Port (lbf)

COMPRESSION

% of Range	Run 1 Indicated (lbf)	Run 1 Applied (lbf)	Run 2 Indicated (lbf)	Run 2 Applied (lbf)	Run 3 Indicated (lbf)	Run 3 Applied (lbf)
100% Range (Full Scale: -5503.35 lbf)						
0 Return	0.021		0.012		0.032	
2	-116.199	-116.1784	-118.931	-118.9292	-117.234	-117.13
4	-223.382	-223.4	-223.413	-223.6	-211.028	-211.25
8	-458.985	-459.2	-456.219	-456.5	-453.355	-453.75
14	-796.822	-797	-796.222	-796.45	-807.739	-808.15
20	-1139.599	-1139.7	-1128.135	-1128.85	-1129.770	-1130.2
40	-2240.892	-2241.3	-2218.623	-2219.2	-2241.889	-2242.95
60	-3369.369	-3370.65	-3343.904	-3345.1	-3353.903	-3355
80	-4464.683	-4466.2	-4451.045	-4452.65	-4493.351	-4495.2
100	-5501.019	-5503.35	-5493.175	-5495.2	-5500.865	-5503.75

The Return to Zero tolerance is ± 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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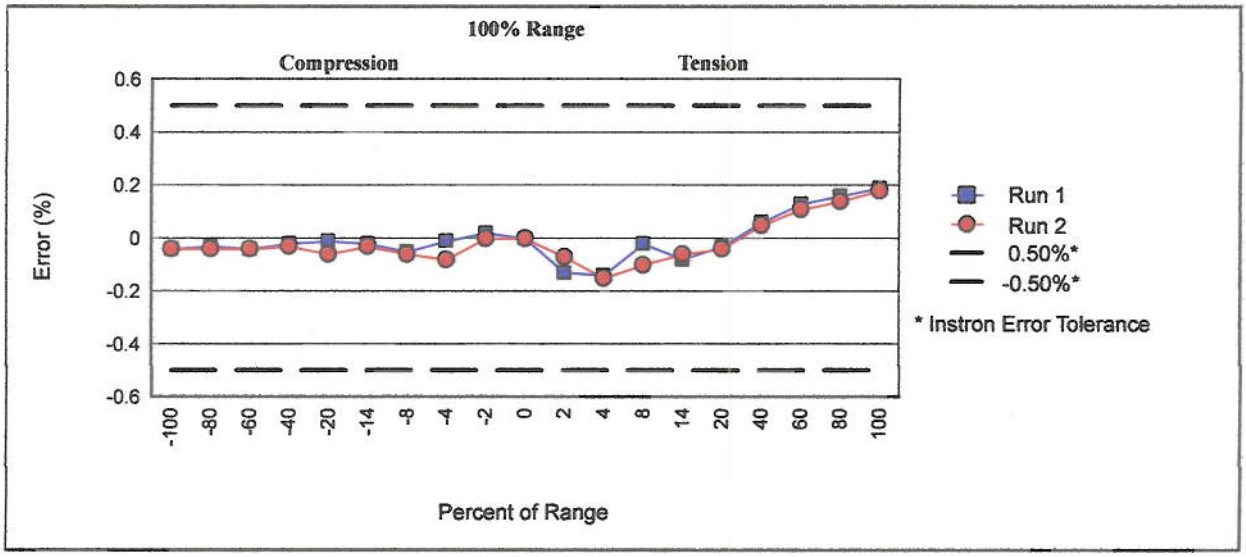
Graphical Data - Indicator 1. - Service Port (lbf)



Verification Equipment

Make/Model	Serial Number	Description	Calibration Agency	Capacity	Cal Date	Cal Due
Extech K4458CF	086	temp. indicator	Tektronix	NA	29-Feb-12	28-Feb-14
HBM DK38	29480	force indicator	Instron	NA	23-Aug-12	23-Aug-14
Flintec 10KFMM	198353	load cell	Instron	12000 lbf	09-May-12	09-May-14
Flintec 3401588	3401588	load cell	Instron	1200 lbf	04-Feb-12	04-Feb-14

Verification Equipment Usage

Range Full Scale (%)	Standard Serial Number	Mode	Percent(s) of Range	Lower Limit for Standard Class A / A1 (lbf)
100	198353	T	4/8/14/20/40/60/80/100	200 / 200
100	3401588	T	2	20 / 25
100	198353	C	4/8/14/20/40/60/80/100	200 / 200
100	3401588	C	2	20 / 23

Instron standards are traceable to NIST.

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%.

Standard forces have been temperature compensated as necessary.

Comments

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Verified by: Walt Szymanowski
Field Service Engineer

NOTE: Clause 20 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.