CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 07-Mar-11 CERTIFICATE NUMBER: **22111610145723A**

NVLAP

Lab code: 200301-0

INSTRON

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

APPROVED SIGNATORY

Justin Fry

Digitally signed by Justin Fry
DN: cn=Justin Fry, c=US, ou=Instron
Reason: I am approving this document
Date: 2011.03.07 08:06:41 -05'00'

Type of Calibration: **Force**
Relevant Standard: **ASTM E4 - 10**
Date of Calibration: **16-Nov-10**

Customer Requested Due Date: **16-May-12**

Customer

Name: US Army Rodman Test Center
Address: Bldg. 4600
Aberdeen Proving Grounds, Md. 21005

P.O./Contract No.:
Contact:

Machine

Manufacturer: Instron
Serial Number: 5500R1125 / 6677
System ID: 5500R1125 / 6677
Range Type: Single

Transducer

Manufacturer: Instron
Transducer ID: 2511-301 / 216
Capacity: 1124 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 verification and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540-1, ISO 10012, ISO 9001:2000 and ISO/IEC 17025:2005.
The certification is based on runs 1 and 2 only. A third run is taken to satisfy uncertainty requirements according to ISO 17025 specifications.

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

Method

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

The load cell indicated on this certificate was removed and interchangeability has been established, demonstrated and verified per ASTM E4, section 7.3.

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.

CERTIFICATE OF CALIBRATION

NVLAP ACCREDITED CALIBRATION LABORATORY No. 200301-0

CERTIFICATE NUMBER:
22111610145723A

Summary of Results

Temperature at start of verification: 75.60 °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	11.0685 to 999.5648	T	0.32	0.15	Pass	0.01124	2.248
	-12.4155 to -997.3392	C	0.38	0.11	Pass	0.01124	2.248

Temperature at end of verification: 75.70 °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: 999.5648 lbf)						
1	0.11	0.22	0.00	0.11	0.20	0.025
2	-0.16	-0.07	0.32	0.09	0.33	0.080
4	-0.20	-0.27	-0.18	0.07	0.14	0.066
7	-0.22	-0.22	-0.14	0.00	0.14	0.109
10	-0.21	-0.06	-0.02	0.15	0.17	0.196
20	0.06	0.03	0.12	0.03	0.14	0.301
40	0.07	0.16	0.25	0.09	0.17	0.744
70	0.27	0.25	0.41	0.02	0.16	1.274
100	0.32	0.29	0.44	0.03	0.16	1.568

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: -997.3392 lbf)						
1	0.00	0.07	0.02	0.07	0.16	-0.020
2	0.02	-0.05	0.04	0.07	0.16	-0.042
4	-0.17	-0.08	0.17	0.09	0.24	-0.114
7	-0.14	-0.06	0.29	0.08	0.29	-0.231
10	-0.03	-0.03	0.33	0.00	0.27	-0.333
20	0.06	0.04	0.38	0.02	0.26	-0.563
40	0.07	0.18	0.43	0.11	0.25	-1.082
70	0.25	0.19	0.72	0.06	0.36	-2.745
100	0.38	0.37	0.87	0.01	0.35	-3.525

** 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%.*

CERTIFICATE OF CALIBRATION

NVLAP ACCREDITED CALIBRATION LABORATORY No. 200301-0

CERTIFICATE NUMBER:
22111610145723A

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: 999.5648 lbf)						
0 Return	0.216		-0.205		-0.010	
1	12.108	12.0945	11.093	11.0685	13.953	13.953
2	25.154	25.194	23.501	23.5185	24.486	24.408
4	49.291	49.3896	45.684	45.8068	46.356	46.4412
7	79.190	79.3676	77.394	77.5684	77.193	77.3032
10	110.680	110.9108	109.848	109.9124	118.921	118.9448
20	220.035	219.8924	224.373	224.3072	211.112	210.86
40	448.031	447.7044	458.400	457.6832	448.767	447.6368
70	782.527	780.4472	780.618	778.6532	789.779	786.5728
100	1002.750	999.5648	1001.007	998.1036	1002.280	997.9164

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: -997.3392 lbf)						
0 Return	-0.462		-0.149		0.004	
1	-13.195	-13.1955	-12.424	-12.4155	-12.489	-12.486
2	-30.439	-30.432	-24.787	-24.7995	-24.339	-24.33
4	-48.170	-48.2508	-49.705	-49.7432	-44.221	-44.148
7	-79.102	-79.2168	-79.073	-79.118	-77.242	-77.0224
10	-116.839	-116.8752	-120.393	-120.432	-130.480	-130.0572
20	-217.215	-217.0844	-221.571	-221.4888	-225.070	-224.2136
40	-426.678	-426.3792	-447.794	-447.0024	-437.280	-435.4064
70	-790.551	-788.6008	-753.173	-751.7796	-759.260	-753.8076
100	-1001.170	-997.3392	-1000.718	-997.0324	-1001.870	-993.2104

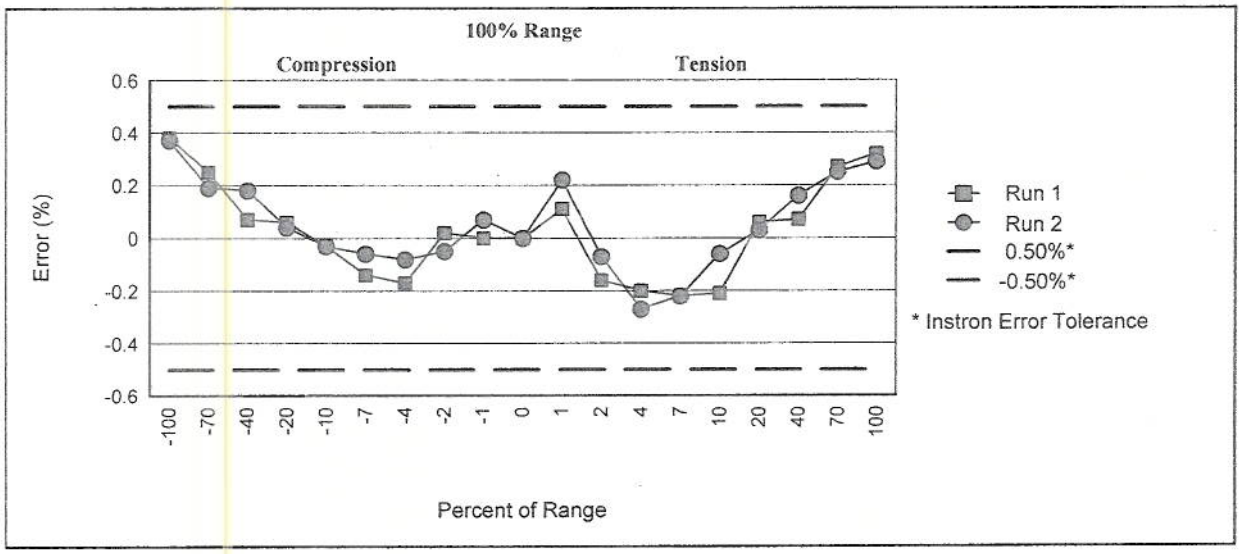
The Return to Zero tolerance is ± the indicator resolution, 0.1 % of the maximum force verified in the range, or 1% of the lowest force verified in the range, whichever is greater.

CERTIFICATE OF CALIBRATION

NVLAP ACCREDITED CALIBRATION LABORATORY No. 200301-0

CERTIFICATE NUMBER:
22111610145723A

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



Verification Equipment

Make/Model	Serial Number	Description	Calibration Agency	Capacity	Cal Date	Cal Due
HBM DK38	29480	force indicator	Instron	NA	25-Aug-10	25-Aug-12
Flintec 3401588	3401588	load cell	Instron	1200 lbf	22-Jan-10	22-Jan-12
Revere 300FMM	54626	load cell	Instron	335 lbf	04-Mar-10	04-Mar-11
Extech K4458CF	00561	temp. indicator	Sypris	NA	26-Mar-10	26-Mar-12

Verification Equipment Usage

Range Full Scale (%)	Standard Serial Number	Mode	Percent(s) of Range	Lower Limit for Standard Class A / A1 (lbf)
100	3401588	T	4/7/10/20/40/70/100	20 / 28
100	54626	T	1/2	5 / 8
100	3401588	C	4/7/10/20/40/70/100	20 / 31
100	54626	C	1/2	5 / 9

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

Certificate 22111610145723A replaces 22111610145723 to reflect an 18 month calibration cycle.

CERTIFICATE OF CALIBRATION

NVLAP ACCREDITED CALIBRATION LABORATORY No. 200301-0

CERTIFICATE NUMBER:
22111610145723A

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.