CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 21-Mar-11 CERTIFICATE NUMBER: 22011011151132A

NVLAP

Lab code: 200301-0

INSTRON

Instron
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APPROVED SIGNATORY

Justin Fry

Digitally signed by Justin Fry
DN: cn=Justin Fry, c=US, ou=Instron
Reason: I am approving this document
Date: 2011.03.21 19:36:38 -04'00'

Type of Calibration: Force
Relevant Standard: ASTM E4 - 10
Date of Calibration: 10-Jan-11

Customer Requested Due Date: 10-Jul-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 / 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 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.

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Summary of Results

Temperature at start of verification: 72.40 °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	52.8112 to 5191	T	0.11	0.10	Pass	0.0562	11.24
	-57.46 to -5206.8	C	-0.26	0.09	Pass	0.0562	11.24

Temperature at end of verification: 72.80 °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: 5191 lbf)						
1	-0.09	0.01	0.00	0.10	0.16	0.092
2	0.04	-0.04	0.06	0.08	0.15	0.174
4	-0.06	-0.06	0.01	0.00	0.14	0.325
7	-0.06	-0.05	0.06	0.01	0.15	0.579
10	-0.09	-0.09	-0.09	0.00	0.13	0.756
20	-0.05	-0.05	-0.10	0.00	0.13	1.520
40	0.03	0.01	-0.04	0.02	0.14	3.113
70	0.07	0.09	0.02	0.02	0.14	5.283
100	0.11	0.11	0.11	0.00	0.13	6.699

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: -5206.8 lbf)						
1	-0.21	-0.19	-0.27	0.02	0.15	0.088
2	-0.21	-0.23	-0.25	0.02	0.13	0.146
4	-0.26	-0.17	-0.27	0.09	0.14	0.321
7	-0.20	-0.18	-0.21	0.02	0.13	0.496
10	-0.13	-0.22	-0.22	0.09	0.14	0.814
20	-0.15	-0.16	-0.17	0.01	0.13	1.506
40	-0.11	-0.12	-0.13	0.01	0.13	2.892
70	-0.15	-0.12	-0.13	0.03	0.13	5.168
100	-0.13	-0.15	-0.14	0.02	0.13	6.714

** 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: 5191 lbf)						
0 Return	0.042		-0.037		0.142	
1	61.646	61.7032	52.815	52.8112	63.517	63.518
2	107.250	107.2084	136.412	136.4636	116.737	116.6724
4	255.201	255.3616	227.729	227.864	229.153	229.1328
7	384.431	384.6648	395.654	395.8604	385.143	384.904
10	598.119	598.65	577.305	577.85	581.112	581.65
20	1256.134	1256.8	1071.319	1071.9	1097.896	1098.95
40	2450.813	2450.1	2260.917	2260.8	2206.150	2207.05
70	3974.680	3972.05	3905.990	3902.6	3866.694	3865.8
100	5195.448	5189.55	5196.707	5191	5204.311	5198.65

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: -5206.8 lbf)						
0 Return	0.029		-0.006		-0.007	
1	-57.339	-57.46	-65.409	-65.5356	-59.796	-59.956
2	-103.851	-104.0676	-114.048	-114.3064	-110.198	-110.474
4	-227.304	-227.9056	-211.651	-212.0092	-227.661	-228.28
7	-393.934	-394.7164	-400.858	-401.5752	-355.310	-356.07
10	-554.960	-555.7	-579.550	-580.85	-581.270	-582.55
20	-1121.310	-1123	-1193.740	-1195.6	-1180.751	-1182.75
40	-2197.322	-2199.75	-2255.877	-2258.55	-2264.687	-2267.65
70	-3951.379	-3957.3	-3959.183	-3964.1	-4000.461	-4005.75
100	-5195.513	-5202.5	-5199.084	-5206.8	-5197.985	-5205.5

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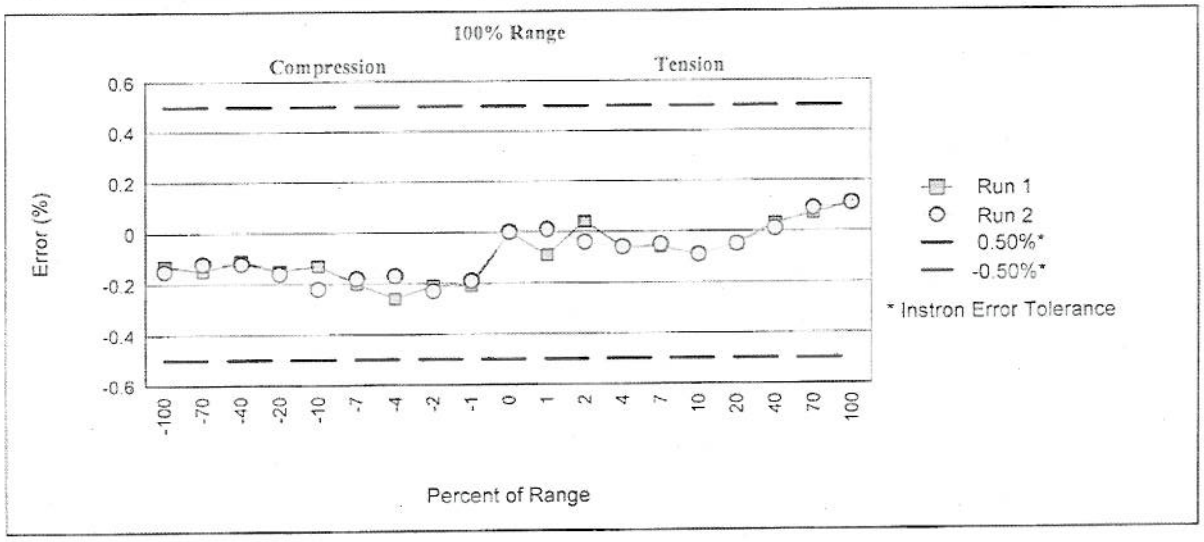
Graphical Data - Indicator 1. - Service Port (lbf)



Verification Equipment

Make/Model	Serial Number	Description	Calibration Agency	Capacity	Cal Date	Cal Due
Flintec 10KFMM	198353	load cell	Instron	12000 lbf	27-Apr-10	27-Apr-12
Flintec 3401588	3401588	load cell	Instron	1200 lbf	22-Jan-10	22-Jan-12
Extech K4458CF	00561	temp. indicator	Sypris	NA	26-Mar-10	26-Mar-12
HBM DK38	29480	force indicator	Instron	NA	25-Aug-10	25-Aug-12

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	10/20/40/70/100	200 / 200
100	3401588	T	1/2/4/7	20 / 28
100	198353	C	10/20/40/70/100	200 / 248
100	3401588	C	1/2/4/7	20 / 31

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 22011011151132A replaces 22011011151132 to reflect an 18 month calibration cycle due date.

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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.