

Certificate of Calibration

THIS IS TO CERTIFY THAT UNITED TESTING SYSTEMS CANADA LTD., HAS
CALIBRATED THE FOLLOWING DESCRIBED EQUIPMENT IN ACCORDANCE
WITH ASTM-E74-XX AND UTS SOP-8076-Rev XX-XXXX.

CERTIFICATE NUMBER: CR#0002
CERTIFICATE ISSUED: June 5, 2019

CALIBRATION DATE: June 5, 2019
REQUESTED DUE DATE: June 5, 2020

CALIBRATION & CUSTOMER INFORMATION:

COMPANY: ANY COMPANY
ADDRESS: 123 ANY STREET
CITY/PROVINCE: ANY CITY, ANY PROVINCE
SYSTEM LOCATION: UTS CANADA LTD. FORCE LAB
SYSTEM CALIBRATED: SYSTEM #8 S/N 123456
LOAD CELL/TRANSDUCER: HBM RSC-10K 25100 S/N XXXXXX
ASSET NUMBER(S): UTS-LC ABC
DIRECTION: COMPRESSION
CALIBRATION RANGE(S): 11241 lbf
INDICATOR / RESOLUTION: HBM AD 101B S/N XXXX / 0.00001 mV/V
TEMPERATURE / HUMIDITY: 23.0 °C | 45%
METHOD / ZERO TREATMENT: SET THE FORCE / METHOD "a"
SYSTEM CONDITION: GOOD
READINGS AS FOUND: IN TOLERANCE
READINGS AS LEFT: IN TOLERANCE
CALIBRATION TECHNICIAN: TECHNICIAN

THE FOLLOWING NIST / PTB TRACEABLE STANDARDS WERE USED:

READOUT: HBM MGCPLUS S/N 105422002102.

STANDARD FILE:	Sn100kn	Sn10kn	HOBO
STANDARD S/N:	B68289-004	G28752-005	615410-286
MANUFACTURER:	HBM	HBM	HOBO
DATE DUE:	Month Day, Year	Month Day, Year	Month Day, Year
TRACEABILITY NO:	12367 PTB XX	12365 PTB XX	AC14081447
TYPE:	DEAD WEIGHTS	DEAD WEIGHTS	N / A
CAPACITY:	22481 lbf	2248 lbf	100 °C / 100 %RH
MODE:	COMPRESSION	COMPRESSION	UNCERTAINTY
CLASS A LIMIT:	1124 lbf	112 lbf	0.16 °C / 2.3 %RH
CLASS AA LIMIT:	2259 lbf	261 lbf	N / A

SECOND ORDER LEAST SQUARE RESULTS FOR THE DATA:

COEFFICIENTS:	A = 2.085959E-05	STD. DEVIATION:	0.29 lbf
	B = -2.007372E-04	LOWER LIMIT FACTOR:	0.71 lbf
	C = -4.791246E-12	CLASS A LIMIT:	300.0 lbf

UNCERTAINTY:

EXPANDED UNCERTAINTY OF THE APPLIED FORCE IS CERTIFIED TO BE LESS THAN 0.05% FOR A CONFIDENCE LEVEL OF 95% (k=2). EXPANDED UNCERTAINTIES ARE VALID FOR A TEMPERATURE RANGE OF 23°C ± 0.5°C. EXPRESSED MEASUREMENT UNCERTAINTIES USE A HYPERBOLIC FUNCTION CURVE FITTING.

CALIBRATED BY

United Testing Systems Canada Limited

21 - 225 Bradwick Drive, Concord, Ontario L4K 1K7

Tel.: (905) 669-5327 Fax: (905) 738-5051

E-mail: service@utscanada.com

AUTHORIZED SIGNATORY

ISO/IEC 17025

ANSI/NCSL Z540-1-1994; Part 1

Accredited by:

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NVLAP Lab Code: 200311-0

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UNITED CALIBRATION GROUP

Calibration Report

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LOAD CELL/TRANSDUCER: HBM RSC-10K 25100 S/N XXXXXX

CALIBRATION RESULTS:

OBSERVED DATA: MULTIPLE RUNS ARE SHOWN SERIALLY. UNLESS OTHERWISE NOTED, THE DATA SHOWN IS 'AS FOUND / AS LEFT' WITH NO ADJUSTMENT MADE. COMPUTED FORCES HAVE BEEN TEMPERATURE CORRECTED AS NECESSARY.

STANDARD I.D.	STANDARD lbf	READING mV/V	INDICATED lbf	ERROR lbf	ERROR %	Un (k=2) %
FIRST RUN COMPRESSION (0 DEGREES ROTATION)						
Sn10kn	299.40	-0.06010	299.50	0.10	0.033	0.094
Sn10kn	500.06	-0.10037	500.10	0.04	0.009	0.078
Sn10kn	1000.07	-0.20072	999.99	-0.08	-0.008	0.060
Sn10kn	2000.14	-0.40146	1999.94	-0.20	-0.010	0.047
Sn100kn	3000.3	-0.60232	3000.4	0.1	0.004	0.040
Sn100kn	4000.0	-0.80300	4000.0	0.0	-0.001	0.036
Sn100kn	5000.4	-1.00385	5000.3	-0.1	-0.002	0.033
Sn100kn	6000.5	-1.20459	6000.1	-0.4	-0.007	0.031
Sn100kn	7000.1	-1.40535	6999.9	-0.2	-0.003	0.029
Sn100kn	8000.2	-1.60614	7999.8	-0.4	-0.005	0.028
Sn100kn	9000.3	-1.80695	8999.7	-0.6	-0.006	0.027
Sn100kn	10001.1	-2.00799	10000.8	-0.3	-0.003	0.026
Sn100kn	11241.5	-2.25705	11240.9	-0.6	-0.005	0.025
SECOND RUN COMPRESSION (120 DEGREES ROTATION)						
Sn10kn	299.77	-0.06017	299.85	0.08	0.026	0.094
Sn10kn	500.05	-0.10034	499.96	-0.09	-0.019	0.078
Sn10kn	1000.02	-0.20066	999.70	-0.32	-0.032	0.060
Sn10kn	2000.21	-0.40147	1999.99	-0.22	-0.011	0.047
Sn100kn	3000.9	-0.60246	3001.1	0.2	0.008	0.040
Sn100kn	4000.4	-0.80312	4000.6	0.2	0.004	0.036
Sn100kn	5000.2	-1.00388	5000.5	0.3	0.005	0.033
Sn100kn	6000.8	-1.20476	6000.9	0.1	0.002	0.031
Sn100kn	7000.3	-1.40543	7000.3	0.0	0.000	0.029
Sn100kn	8000.8	-1.60633	8000.7	-0.1	-0.001	0.028
Sn100kn	9001.1	-1.80719	9000.9	-0.2	-0.002	0.027
Sn100kn	10000.1	-2.00783	10000.0	-0.1	-0.001	0.026
Sn100kn	11241.1	-2.25709	11241.1	0.0	0.000	0.025

NOTES: FIRST RUN ZERO: BEGIN = 0.00000 mV/V, END = -0.00007 mV/V.
SECOND RUN ZERO: BEGIN = 0.00000 mV/V, END = -0.00003 mV/V.
THIRD RUN ZERO: BEGIN = 0.00000 mV/V, END = -0.00007 mV/V.
ZERO OFFSET = -0.00416 mV/V.

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UNITED CALIBRATION GROUP

Calibration Report

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COMPANY: ANY COMPANY
SYSTEM CALIBRATED: SYSTEM #8 S/N 123456
LOAD CELL/TRANSDUCER: HBM RSC-10K 25100 S/N XXXXXX

CALIBRATION RESULTS:

OBSERVED DATA: MULTIPLE RUNS ARE SHOWN SERIALLY. UNLESS OTHERWISE NOTED, THE DATA SHOWN IS 'AS FOUND / AS LEFT' WITH NO ADJUSTMENT MADE. COMPUTED FORCES HAVE BEEN TEMPERATURE CORRECTED AS NECESSARY.

STANDARD I.D.	STANDARD lbf	READING mV/V	INDICATED lbf	ERROR lbf	ERROR %	Un (k=2) %
THIRD RUN COMPRESSION (240 DEGREES ROTATION)						
Sn10kn	299.77	-0.06019	299.95	0.18	0.059	0.094
Sn10kn	490.16	-0.09839	490.24	0.08	0.017	0.078
Sn10kn	1000.06	-0.20072	999.99	-0.07	-0.007	0.060
Sn10kn	2000.10	-0.40147	1999.99	-0.11	-0.006	0.047
Sn100kn	3000.2	-0.60226	3000.1	-0.1	-0.002	0.040
Sn100kn	4000.1	-0.80307	4000.3	0.2	0.006	0.036
Sn100kn	5000.7	-1.00399	5001.0	0.3	0.006	0.033
Sn100kn	6000.5	-1.20473	6000.8	0.3	0.005	0.031
Sn100kn	7000.0	-1.40538	7000.0	0.0	0.000	0.029
Sn100kn	8000.3	-1.60628	8000.5	0.2	0.002	0.028
Sn100kn	9000.1	-1.80709	9000.4	0.3	0.004	0.027
Sn100kn	10000.8	-2.00812	10001.4	0.6	0.006	0.026
Sn100kn	11241.2	-2.25727	11242.0	0.8	0.007	0.025

NOTES: FIRST RUN ZERO: BEGIN = 0.00000 mV/V, END = -0.00007 mV/V.
SECOND RUN ZERO: BEGIN = 0.00000 mV/V, END = -0.00003 mV/V.
THIRD RUN ZERO: BEGIN = 0.00000 mV/V, END = -0.00007 mV/V.
ZERO OFFSET = -0.00416 mV/V.

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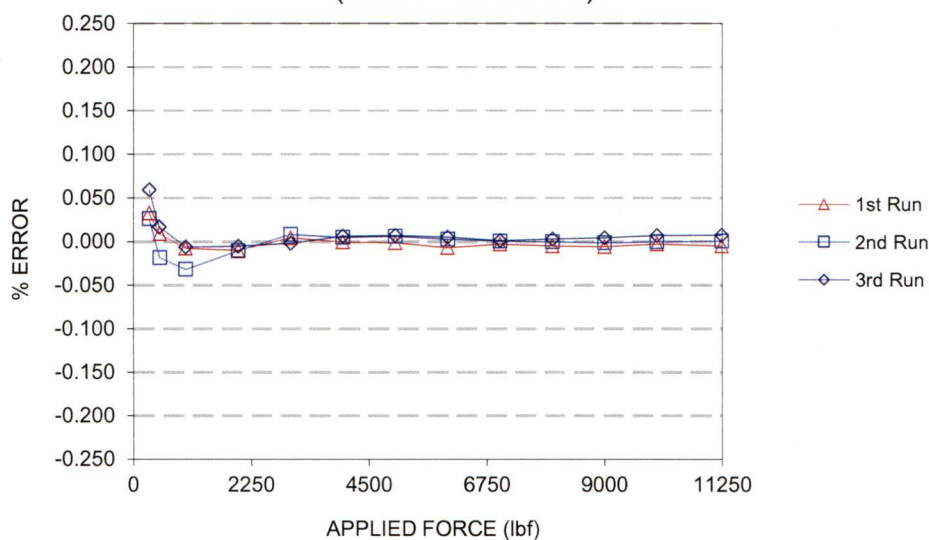
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CALIBRATION RESULTS:

DEVIATION OF CALIBRATION RUNS
(COMPRESSION)



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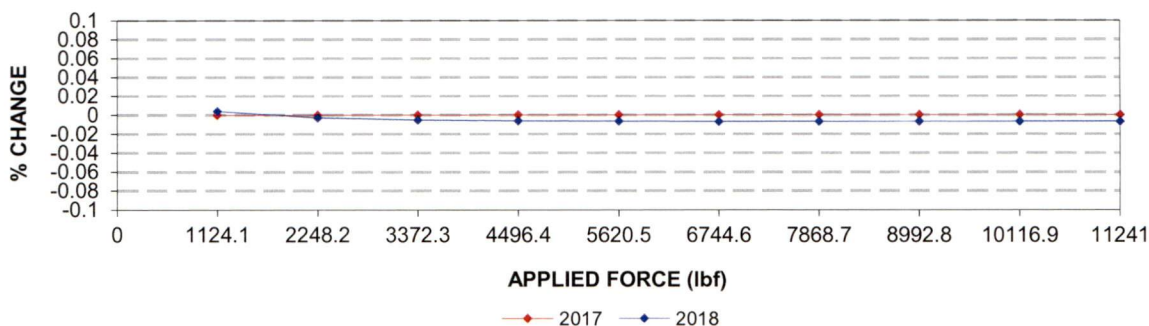
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CALIBRATION RESULTS:

NOMINAL VALUE lbf	PREVIOUS PREDICTED RESPONSE (2017)	CURRENT PREDICTED RESPONSE (2019)	CHANGE mV/V	CHANGE %
1124.1	-0.22562	-0.22563	-0.00001	0.004
2248.2	-0.45131	-0.45130	0.00001	-0.003
3372.3	-0.67702	-0.67698	0.00004	-0.005
4496.4	-0.90273	-0.90267	0.00006	-0.006
5620.5	-1.12845	-1.12837	0.00008	-0.007
6744.6	-1.35418	-1.35409	0.00010	-0.007
7868.7	-1.57993	-1.57982	0.00011	-0.007
8992.8	-1.80569	-1.80556	0.00013	-0.007
10116.9	-2.03145	-2.03131	0.00015	-0.007
11241.0	-2.25723	-2.25707	0.00016	-0.007



PRELOAD #1: INITIAL ZERO: 0.00000 mV/V
RETURN ZERO: -0.00002 mV/V

PRELOAD #2: INITIAL ZERO: 0.00000 mV/V
RETURN ZERO: -0.00002 mV/V

CREEP RECOVER ERROR, ZERO RETURN ERROR:

INITIAL ZERO OUTPUT: 0.00000 mV/V
OUTPUT AT MAXIMUM FORCE: -2.25711 mV/V @ 11241 lbf
ZERO RETURN OUTPUT AFTER 30 sec: -0.00017 mV/V
ZERO RETURN OUTPUT AFTER 5 min: -0.00007 mV/V

CREEP RECOVERY ERROR: 0.0075 % $\leq \pm 0.05\%$ PASS
ZERO RETURN ERROR @ 11241 lbf: -0.0031 % $\leq \pm 0.025\%$ PASS

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