TTI Testing Ltd

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Testing of Glen Waters Breakaway snare

Reference number TTI-IMLR-2021-5825

Date	Rev.	Description	Prepared by	Authorised by
16/11/21	0	For issue to customer	IMLR	REH

Distribution:

TTI Testing Ltd (author, file)

National Anti Snaring Campaign (NASC)

Attention:

IMLR, REH

Simon Wild

Contents

1 Introduction

The National Anti-Snaring Campaign (**NASC**) have approached **TTI Testing** for assistance in measuring the force required to break the "weak link" in a Glen Waters Breakaway snare.

This document describes the test methodology and presents the results of testing undertaken by **TTI Testing** in fulfilment of this requirement.

2 TTI Testing

Established in 2008, **TTI Testing Ltd** (www.tti-testing.com) is an independent research and testing company with ISO 9001, ISO 14001 and ISO 45001 accreditation. **TTI Testing** offers a full range of consultancy, research, development and forensic analysis in fields related to the design, inspection, operation, testing, appraisal and discard of tension elements. We have internationally recognised expertise in wire and fibre ropes, chains, electromechanical cables and related interface components in the onshore and offshore markets.

TTI Testing's premises are conveniently located in Wallingford, UK, 10 miles south of Oxford and about 40 miles west of London. The laboratory is within easy reach of London's Heathrow airport, major rail routes and the motorway network. As well as housing the testing laboratory, the 1000 m^2 building has conference and meeting rooms, wi-fi and ample parking, making it ideal for customer project meetings.

TTI Testing services include:

- Expert witness support in the field of wire, fibre and chain components.
- Forensic examination of failed or retired samples to determine condition and causes of degradation.
- Torsion, reverse bend and tensile testing on rope wires.
- Galvanising coat assessment.
- Metallurgical sections and hardness testing.
- Optical Microscope and Scanning Electron Microscope (SEM).
- Carefully designed testing to replicate a specific service condition, and particularly the way in which the rope interacts with other ropes or hardware.
- Breaking strength measurement.
- Standard fatigue characterisation of elements under Tension-Tension (T-T), Cyclic Bending over Sheave (CBoS), Bending-Tension (B-T) and Tension-Torsion loading.
- Yarn-on-yarn abrasion testing.
- Qualification testing of new products.
- Fibre optic and electrical continuity monitoring.

3 Background

The Independent Working Group on Snares (**IWGS**) report for DEFRA published in 2005 states that snares are employed in the UK as a means of wildlife management for capturing typically foxes and rabbits [1]. In a wide ranging report, the **IWGS** discusses the capture of non-target species, and the use of a breakaway device to allow them to free themselves [1, p71]:

> "A snare that is designed to break at the eye in the event of excessive pressure being applied to it might be effective in reducing the capture in fox snares of certain non-target species (e.g. badgers) although not others (e.g. hares) and it would seem likely that snares designed in such a way that the weakest link is at the eye, would greatly reduce the risk of any animals escaping whilst encircled by the noose. Several snares of this type are used in North America; although none have been rigorously field tested in the UK, the GCT [Game Conservancy Trust] has conducted small-scale pilot trials of one design."

It is noted that at time of writing already the IWGS report is over fifteen years old. It may well be that since it was written further research has been undertaken.

The work presented here describes the methodology and presents the results of testing a "breakaway snare" (such as shown in Figure 3.1) to measure the force which would need to be applied to break the weak link.

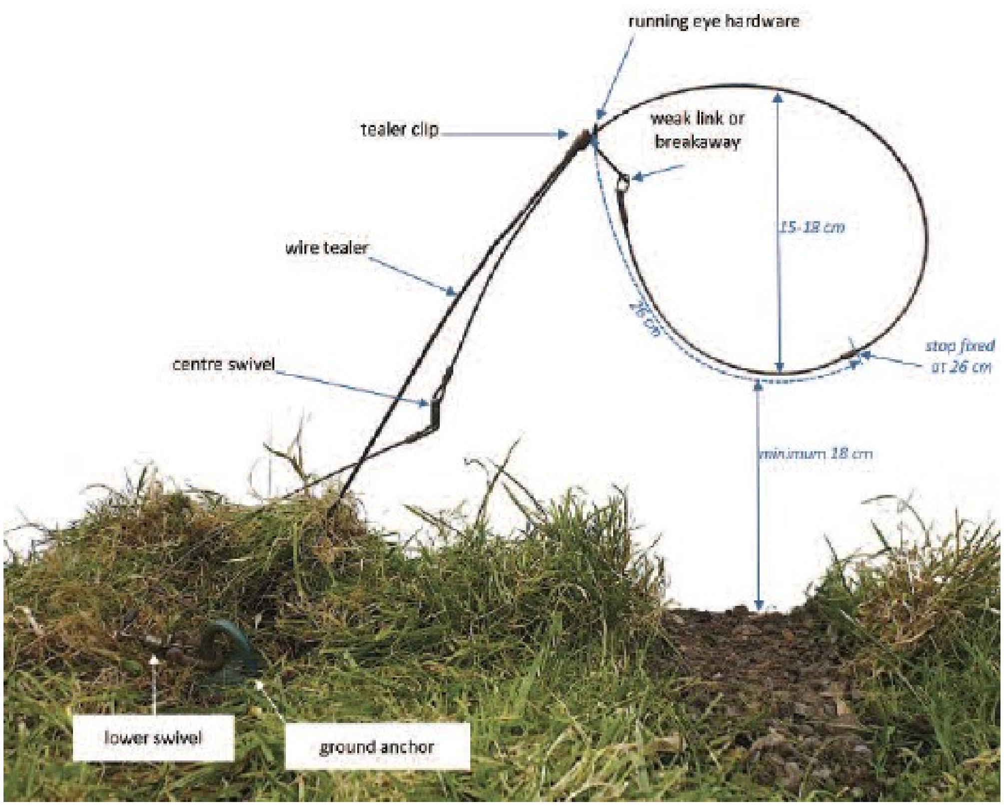


Figure 3.1: Example components and general arrangement of a breakaway snare (from [2]).

4 Sample

The focus of this study was the "Glen Waters Breakaway snare", three samples of which were supplied by **NASC** for testing. Figure 4.1 shows a general overview of the snare. Figure 4.2 shows the swaged[1] eye loop which would be used to secure the snare to the ground, and Figure 4.3 a detail view of the centre swivel, running eye hardware and assumed breakaway weak link.

The wire ropes were both Ø2 mm, but were of different construction, presumably designed with the correct operation (required flexibility etc.) of the snare in mind.

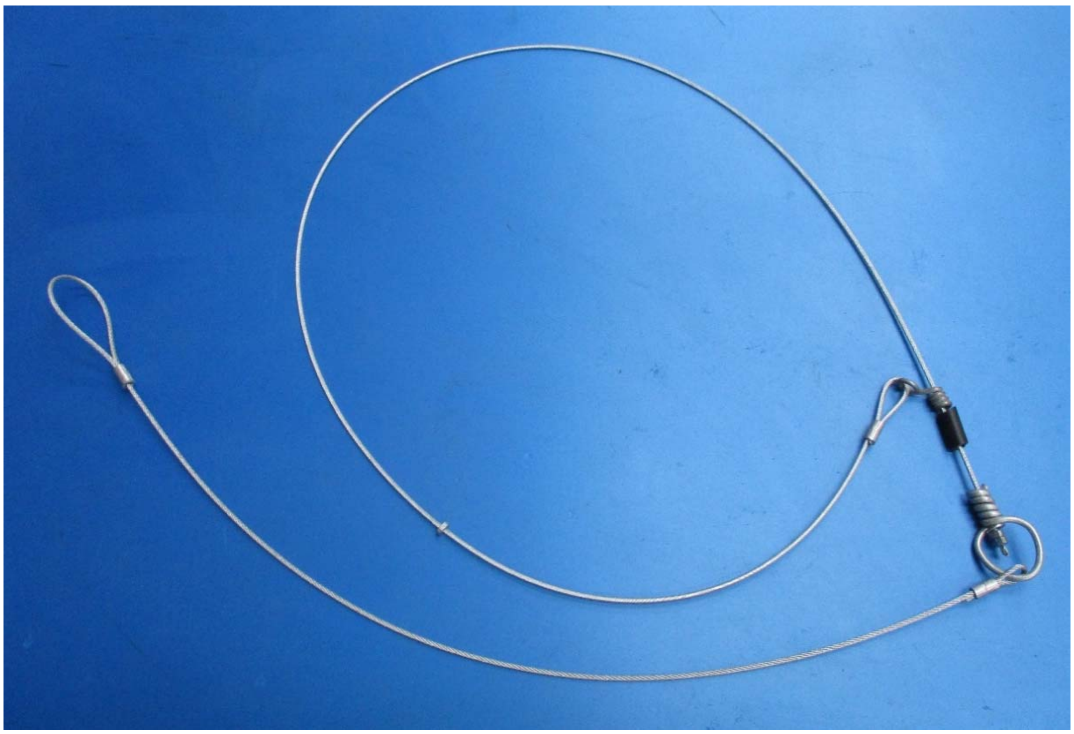


Figure 4.1: Overview of example snare supplied for testing.

Figure 4.2: Swaged eye loop to secure snare to the ground "ground eye loop" (either directly or via a swivel).

[1] A swaged fitting is typically a sleeve which is pressed onto the (rope) to secure it in place.

Figure 4.3: Detailed view on the centre swivel (middle right), and assumed breakaway weak link (top) on the sample supplied for testing. Note that the snare loop and lower securing section of wire rope are of different construction.

5 Equipment

After some initial trials, testing was undertaken in **TTI Testing's** INSTRON 5967 tensile testing machine using the 30 kN load cell, a calibration certificate for which is presented in Appendix A.

In the first instance, the whole snare assembly was tested, secured at one end through the ground eye loop by a Ø½" pin (Figure 5.2). At the other end of the assembly, the loop at the end of the snare was mounted on a plastic spool (Ø67 mm), Figure 5.3, which was intended to approximate to the diameter of an animal's neck.

Figure 5.1: INSTRON tensile testing machine with breakaway snare mounted ready for testing.

Figure 5.2: Ground eye loop mounted on the 30 kN load cell by Ø½” steel pin.

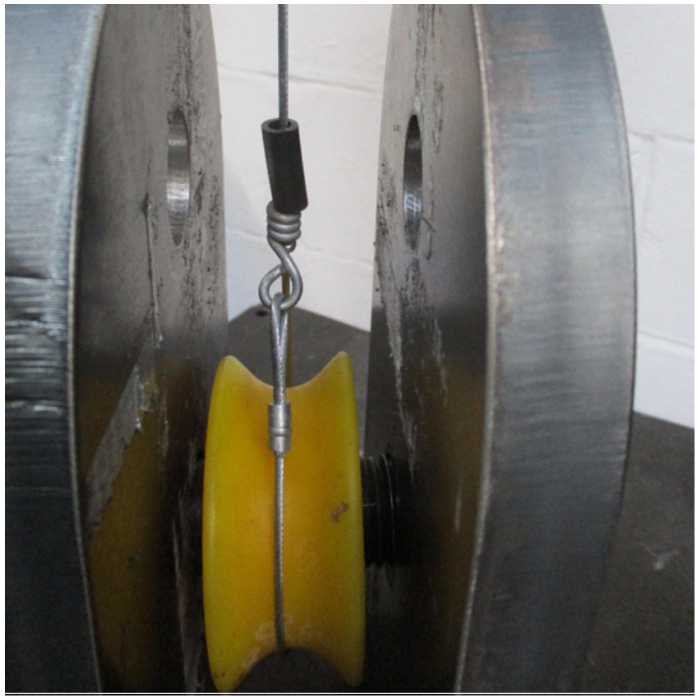


Figure 5.3: Snare loop on plastic spool mounted in clevis arrangement.

6 Test procedure

Once mounted in the test machine as shown in §5 above, any slack was removed before the start of the test. The sample was then loaded at a rate of 0.5 mm/s until it was unable to support any further increase in load.

It is noted that this is not how a snare would be loaded in practice, with the animal struggling to free itself, but in terms of measuring the breaking load was considered acceptable.

7 Results

Table 7.1 summarises the results of the tensile tests on the snares. The force sustained at failure is measured in Newtons, N. For ease of reference, 9.81 N is equivalent to the force applied by 1 kg, so for example, 711 N equates to 72 kg force [kgf].

The first point to note is that in all cases, when testing the whole assembly, that the snare did not fail at the “weak link”, instead in each case breaking at the swaged eye loops on the ground wire. An average failure load of 615 N or 62.7 kgf was measured.

The samples were then returned to the test machine, this time mounting between the centre swivel and snare loop in an attempt to measure the force required to break the weak link (Figure 7.1). In one test the centre swivel pulled off the snare loop wire, whilst in the ither two tests the weak link failed, at an average load of 972 N or 99.1 kgf.

Figure 7.2 shows the appearance of the snare failures.

Test no.	Failure load [N]	Failure location
1	711*	Eye loop pulled out of swaged fitting connecting ground wire to centre swivel
2	622.8	Ground eye loop swage failed (wire pulled out)
3	511.9	Ground eye loop swage failed (wire pulled out)
		Secondary tests on samples centre swivel – snare loop
1A	949.3	“Weak link”
2A	995.5	“Weak link”
3A	837.3	Centre swivel pulled off the end of the snare loop wire

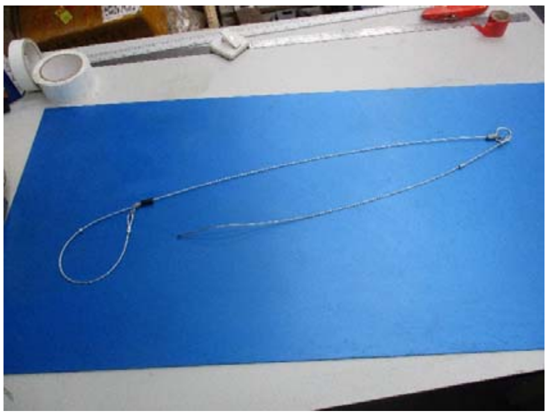
*preliminary test conducted on a different machine with loadcell of lower resolution, therefore this result is not considered to be as accurate at the others.

Table 7.1: Summary of measured failure loads of snare assemblies / sub-assemblies.

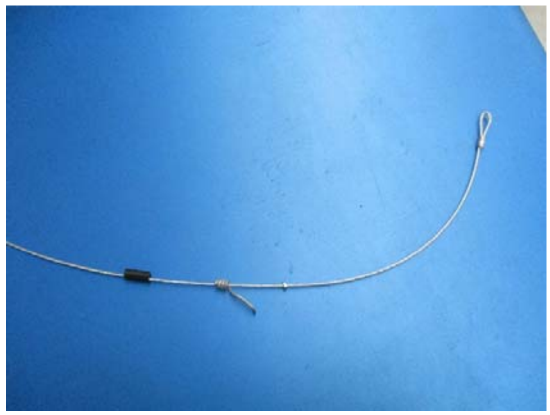
Figure 7.1: Showing the arrangement employed to test the sub-assembly strength (Test 3A). The bottom arrangement is as before and the swivel is mounted in the top fitting.

Test 1 – eye loop pulled out of swaged fitting at centre swivel

Test 1A – failure of weak link



Test 2 – ground eye loop pulled out of swaged fitting



Test 2A – failure of weak link

Test 3 – failure of ground eye loop swage

Test 3A – failure of centre swivel swage (note one clip and the washer were lost when the sample failed).

Figure 7.2: Appearance of the snare failures.

8 Discussion and Conclusions

This report has detailed the testing of three Glen Waters break away snares supplied to TTI Testing by NASC.

In initial tests the whole snare assembly was tested, and the swaged (crimped) fittings on the eye loops of the ground wire failed. The average breaking load was 62.7 kgf. Two points are noted here:

1. It is not known how much force a trapped animal might apply, but 62.7 kgf seems quite high.
2. If the snared animal were to break the snare by causing failure of the eye loops, then the main snare wire would still be in place on the animal (as mentioned as undesirable in the **IWGS** report [1]). It is noted that the animal might be able to work itself free, but the “release” would not be as straightforward as if the weak link had failed.

The failure load of the weak links was subsequently measured at an average value of 99.1 kgf. It is noted that this figure is very high and needs to be considered in the context of how much force an animal might be able to apply (bearing in mind that the Ø2 mm wire will be around the neck), to determine whether it is suitable for the intended purpose.

9 References

[**1**] **Kirkwood, J. et al.**, *Report of the Independent Working Group on Snares*, published by UK Government Department for Environment, Food and Rural Affairs (DEFRA), August 2005.

[**2**] **Anon**, Code of best practice on the use of snares for fox control in England, undated.

Appendix A – Calibration certificate for INSTRON machine

CERTIFICATE OF CALIBRATION

ISSUED BY: INSTRON CALIBRATION LABORATORY

DATE OF ISSUE: 18-Oct-2021

CERTIFICATE NUMBER: **E323101821092801**

CALIBRATION
NVLAP Lab Code 200301-0

Instron
825 University Avenue
Norwood, MA 02062-2643
Telephone: +44 (0) 1494 456815
Fax: +44 (0) 1494 456667
Email: Calibration_Europe@Instron.com

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APPROVED SIGNATORY

Ryan Whitney

Digitally signed by Ryan Whitney
DN: c=US, st=MA, l=Norwood, o=Instron, ou=Europe - UK, ou=Calibration Laboratory, ou=A division of Illinois Tool Works, Inc. (ITW, Inc.), cn=Ryan Whitney, email=ryan_whitney@instron.com
Reason: I attest to the accuracy and integrity of this document
Date: 2021.10.22 09:43:29 +01'00'

Type of Calibration: **Force**
Relevant Standard: **ISO 7500-1:2018**
Date of Calibration: **18-Oct-2021**

* * * VERIFICATION RESULTS * * *

System ID: 5967B10738 — **Customer Asset No.:** 000444
Transducer ID: 2580-202/303243 — **Customer Asset No.:** 000498

Indicator 1. - Service Port: Bluehill Universal v4.23.27859 (kN)

PASSED Class 0.5: 100% Range in Tension mode (0.6006502 to 30.06431)
PASSED Class 0.5: 100% Range in Compression mode (-0.6015678 to -30.04814)

System Class for a range is derived from assessment of the following: error, repeatability, return to zero, resolution, proving device classification, and reversibility if applicable.

Customer

Name:	TTI Testing Ltd
Address:	Unit 2, Hithercroft Road, Wallingford, Oxfordshire, OX10 9DG United Kingdom
Contact:	Rob Carr
Email:	carr@tensiontech.com
P.O./Contract No.:	SV2110010012

Temperature

Minimum Temperature:	21.2 °C
Maximum Temperature:	21.6 °C

Machine

Manufacturer:	Instron
Type:	Electro-Mechanical Single Range
Year of Mfg.:	2015

Transducer

Manufacturer:	Instron
Capacity:	30 kN
Type:	Tension/Compression

Methodology

The assessment of the testing machine was conducted on site at the above customer location in accordance with ISO 7500-1:2018 "Metallic materials -- Calibration and verification of static uniaxial testing machines -- Part 1: Tension/compression testing machines -- Calibration and verification of the force-measuring system" using Instron procedure ICA-8-19.

The system was calibrated in the 'As Found' condition with no adjustments or repairs carried out. This is also the 'As Left' condition.

Instron CalproCR Version 3.48

The results indicated on this certificate and the following report relate only to the items calibrated. 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 calibration will be indicated in the comments. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. 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:
E323101821092801

Prior to verification, a pre-calibration inspection was conducted in accordance with the guidelines of section 5 and Annex A of ISO 7500-1. During the inspection, the testing system was found to be in Good condition.

No mechanically linked accessories were fitted while performing this calibration.

System Classification

The calibration and equipment used conform to a controlled Quality Assurance program which meets the specifications outlined in ANSI/NCSL Z540.1-1994, ISO 10012:2003, ISO 9001:2015, ISO/IEC 17025:2017.

The force-measuring system has been verified for the forces indicated using equipment calibrated within the requirements of ISO 7500-1:2018.

The Simple Acceptance decision rule has been agreed to and employed in the determination of conformance to the identified metrological specification.

Data Summary - Indicator 1. - Service Port: Bluehill Universal v4.23.27859 (kN)

TENSION

% of Range	Relative error of (%) Indication Run 1	Run 2	Run 3	Repeatability Error (%)	Error Class	Resolution (+/- kN)	Standard Class
100% Range (30 kN)							
0 Return	-0.005	-0.008	-0.006		0.5	0.000075	
2	-0.083	-0.095	-0.058	0.037	0.5	0.000075	0.5
4	-0.052	-0.062	-0.088	0.036	0.5	0.000075	0.5
7	-0.053	-0.078	-0.049	0.029	0.5	0.000075	0.5
10	-0.061	-0.063	-0.069	0.008	0.5	0.000075	0.5
20	-0.037	-0.045	-0.046	0.009	0.5	0.000075	0.5
20	0.188	0.177	0.229	0.052	0.5	0.000075	0.5
40	0.236	0.241	0.243	0.007	0.5	0.000075	0.5
60	0.239	0.223	0.244	0.021	0.5	0.000075	0.5
80	0.239	0.220	0.239	0.019	0.5	0.000075	0.5
100	0.241	0.243	0.247	0.006	0.5	0.000075	0.5

Data Summary - Indicator 1. - Service Port: Bluehill Universal v4.23.27859 (kN)

COMPRESSION

% of Range	Relative error of (%) Indication Run 1	Run 2	Run 3	Repeatability Error (%)	Error Class	Resolution (+/- kN)	Standard Class
100% Range (30 kN)							
0 Return	-0.007	-0.004	-0.009		0.5	0.000075	
2	-0.128	-0.144	-0.130	0.016	0.5	0.000075	0.5
4	-0.131	-0.108	-0.105	0.026	0.5	0.000075	0.5
7	-0.149	-0.134	-0.071	0.078	0.5	0.000075	0.5
10	-0.143	-0.128	-0.063	0.080	0.5	0.000075	0.5
20	-0.117	-0.114	-0.035	0.082	0.5	0.000075	0.5
20	-0.145	-0.136	-0.170	0.034	0.5	0.000075	0.5
40	-0.046	-0.037	-0.041	0.009	0.5	0.000075	0.5
60	-0.003	0.003	-0.017	0.020	0.5	0.000075	0.5
80	0.001	-0.016	0.002	0.018	0.5	0.000075	0.5
100	0.018	0.019	0.017	0.002	0.5	0.000075	0.5

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CERTIFICATE NUMBER:
E323101821092801

Worst Resolution Class: 0.5 for 100% Range (Indicator 1: Tension), 0.5 for 100% Range (Indicator 1: Compression).

Data - Indicator 1. - Service Port: Bluehill Universal v4.23.27859 (kN)

TENSION

% of Range	Run 1 Indicated (kN)	Run 1 Applied (kN)	Run 2 Indicated (kN)	Run 2 Applied (kN)	Run 3 Indicated (kN)	Run 3 Applied (kN)	Uncertainty of Measurement* Relative %	Uncertainty of Measurement* (+/- kN)
100% Range (30 kN)								
0 Return	-0.0014		-0.0025		-0.0018			
2	0.6028	0.60330096	0.6012	0.60177168	0.6003	0.60065020	0.19	0.0011
4	1.2044	1.20502166	1.2056	1.20634704	1.2035	1.20456288	0.19	0.0023
7	2.1041	2.10520684	2.1006	2.10225024	2.1025	2.10352464	0.19	0.0040
10	3.0028	3.00462739	3.0064	3.00829766	3.0084	3.01048963	0.19	0.0057
20	6.0041	6.00629817	6.0054	6.00813331	6.0003	6.00308668	0.19	0.011
20	6.0100	5.99871129	6.0220	6.01134654	6.0094	5.99567883	0.19	0.012
40	12.0050	11.97670077	12.0993	12.07020162	12.0939	12.06464211	0.19	0.023
60	18.0558	18.0128124	18.0323	17.99209059	18.0072	17.96328222	0.19	0.034
80	24.0957	24.03831042	24.0492	23.99636139	24.0268	23.96957466	0.19	0.046
100	30.0217	29.94958578	30.0164	29.94352086	30.1386	30.06431385	0.19	0.057

Data - Indicator 1. - Service Port: Bluehill Universal v4.23.27859 (kN)

COMPRESSION

% of Range	Run 1 Indicated (kN)	Run 1 Applied (kN)	Run 2 Indicated (kN)	Run 2 Applied (kN)	Run 3 Indicated (kN)	Run 3 Applied (kN)	Uncertainty of Measurement* Relative %	Uncertainty of Measurement* (+/- kN)
100% Range (30 kN)								
0 Return	0.0020		0.0012		0.0028			
2	-0.6008	-0.60156777	-0.6036	-0.60447340	-0.6017	-0.60248534	0.19	0.0011
4	-1.2178	-1.21939689	-1.2029	-1.20420604	-1.2007	-1.20196310	0.19	0.0023
7	-2.1034	-2.10653222	-2.1008	-2.10362659	-2.1056	-2.10709296	0.19	0.0040
10	-3.0019	-3.00620764	-3.0249	-3.02879001	-3.0146	-3.0165048	0.19	0.0057
20	-6.0146	-6.02164195	-6.0087	-6.01557580	-6.0116	-6.01368969	0.19	0.011
20	-6.0334	-6.04217655	-6.0254	-6.03358458	-6.0450	-6.05531721	0.19	0.012
40	-12.0894	-12.09496671	-12.0759	-12.08030982	-12.0940	-12.09900999	0.19	0.023
60	-18.0098	-18.01028535	-18.0022	-18.00169338	-18.0674	-18.07042914	0.19	0.035
80	-24.0967	-24.09643257	-24.0088	-24.01253451	-24.0979	-24.09744339	0.19	0.046
100	-30.0165	-30.0112458	-30.0059	-30.00012678	-30.0531	-30.04814073	0.19	0.058

**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%.*

The uncertainty stated refers to values obtained during the calibration and makes no allowances for factors such as long-term drift, temperature and alignment effects - the influence of such factors should be taken into account.

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CERTIFICATE NUMBER:
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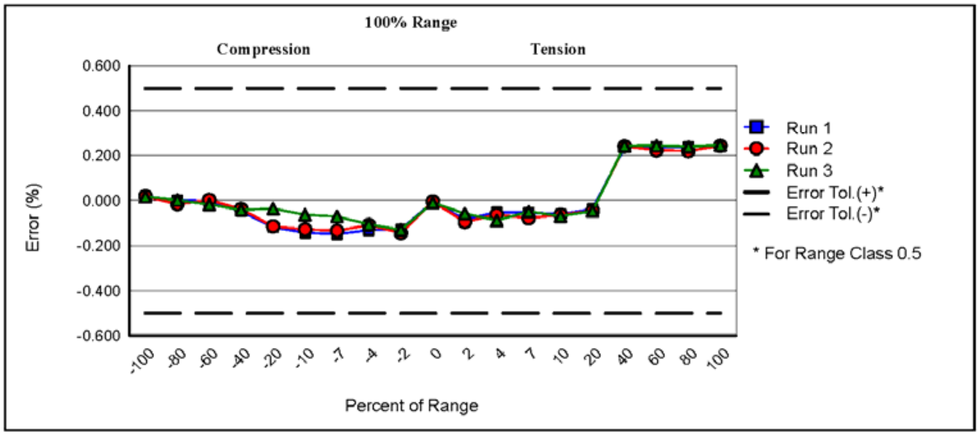
Graphical Data - Indicator 1. - Service Port: Bluehill Universal v4.23.27859 (kN)



Calibration Equipment

The measurement results produced with Instron standards are traceable to the SI (The International System of Units) through internationally recognized National Metrology Institutes (NIST, NPL, PTB, Inmetro, etc.).

Equipment ID	Description	Capacity	Cal Date	Cal Due	Certificate Ref.
N122-100K	load cell	100000 N	01-Dec-2020	02-Dec-2022	E327120120152924
N122-10K	load cell	10000 N	16-Nov-2020	17-Nov-2022	E258111620155545
N122-READOUT	force indicator	NA	07-Jun-2021	07-Jun-2023	E258060721165002
N6B-T	temp. indicator	NA	03-Jan-2020	03-Jan-2022	20200103A

The class of the calibration equipment was equal to or better than the class to which this testing machine has been calibrated.

Calibration Equipment Usage

Range Full Scale (%)	Mode	Equipment ID	Percent(s) of Range	Accuracy (+/-)
100	Tension	N122-10K	2/ 4/ 7/ 10/ 20	0.16% of reading
		N122-100K	20/ 40/ 60/ 80/ 100	0.16% of reading
100	Compression	N122-10K	2/ 4/ 7/ 10/ 20	0.16% of reading
		N122-100K	20/ 40/ 60/ 80/ 100	0.16% of reading
All	Tension-Compression	N6B-T	All	1 °C

The accuracy of the force indicator used with an elastic device is incorporated into the device's stated accuracy.

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

Comments

No comments

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NVLAP ACCREDITED CALIBRATION LABORATORY No. 200301-0

CERTIFICATE NUMBER:
E323101821092801

Verified by: Witek Sulikowski
Field Service Engineer

NOTE: Clause 9 of ISO 7500-1 states; The time between verifications depends on the type of testing machine, the standard of maintenance and the amount of use. Unless otherwise specified, it is recommended that verification be carried out at intervals not exceeding 12 months. The machine shall in any case be verified if it is moved to a new location necessitating dismantling or if it is subject to major repairs or adjustments.