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Testing. Advising. Assuring.

## Physical Testing on “Zafety Lug Lock” Samples

A Report to:

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Report No.:

10-03-C0152 Revision 2  
3 Pages, 18 Figures, 1 Appendix

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10-003-5936

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## 1.0 INTRODUCTION

At the request of Tafcan Consulting Ltd. (Tafcan), Exova performed Physical Testing on "Zafety Lug Lock" samples.

Tafcan submitted ten (10) "Zafety lug lock" samples for testing. The as received samples were allocated with Exova Sample Numbers as follows:

<u>Exova Sample #</u>	<u>Sample Description</u>	<u>Colour</u>
10-03-C0152-1	4-1/8" stud centres, intended for 33 mm nuts, 450°F high temperature	Red
10-03-C0152-2	4-1/8" stud centres, intended for 33 mm nuts, 450°F high temperature	Red
10-03-C0152-3	4-1/8" stud centres, intended for 33 mm nuts, 450°F high temperature	Red
10-03-C0152-4	4-1/8" stud centres, intended for 33 mm nuts, 450°F high temperature	Red
10-03-C0152-5	4-1/8" stud centres, intended for 33 mm nuts, 450°F high temperature	Red
10-03-C0152-6	3-1/2" stud centres, intended for 33 mm nuts, 300°F standard temperature	Orange
10-03-C0152-7	3-1/2" stud centres, intended for 33 mm nuts, 300°F standard temperature	Orange
10-03-C0152-8	3-1/2" stud centres, intended for 33 mm nuts, 450°F high temperature	Red
10-03-C0152-9	3-1/2" stud centres, intended for 33 mm nuts, 300°F standard temperature	Orange
10-03-C0152-10	3-1/2" stud centres, intended for 33 mm nuts, 450°F high temperature	Red

## 2.0 OBJECTIVES

The objective of the proposed work was to provide information needed to evaluate the serviceability of the "Zafety lug lock" samples when subjected to nut torque check and accidental nut torque with "Zafety log lock" installed.

## 3.0 INSTRUMENTATION

The following instruments were used to measure load and displacement values:

Torque wrench 600 ft-lb capacity	S/N 0DW021364 – copy of calibration in Appendix A
Torque wrench (20 – 100 ft-lb)	MII # B06873
Air gun	Picture of calibration sticker in Appendix A

## 4.0 TEST PROCEDURE

The tests were performed using an aluminium wheel drum, with 4-1/8" stud centres and counterpart hub, and a steel drum with 3-1/2" stud centres and counterpart hub. Each hub was placed on the test bed and the mating drum was seated on top. Each drum was securely attached to the test bed with four toe clamps in order to provide reaction for the torque applied on the nuts.

All nuts were installed onto the studs and a particular torque value was applied on each nut, then the "Zafety lug lock" samples were installed on top of each two consecutive nuts. The low torque values applied to the nuts simulates a loose nut tightened without removing the "Zafety lug lock" samples. The 450 ft-lb torque simulates the nuts at nominal torque with a torque check without removing the "Zafety lug lock" samples. The samples distribution and initial nuts torque values are presented in the Table 1 below.

Table 1: Initial test set-up conditions

Sample Number	Drum Material	Initial Applied Torque
10-03-C0152-1	Aluminium	Hand tight
10-03-C0152-2	Aluminium	20 ft-lb
10-03-C0152-3	Aluminium	40 ft-lb
10-03-C0152-4	Aluminium	450 ft-lb
10-03-C0152-5	Aluminium	450 ft-lb
10-03-C0152-6	Steel	Hand tight
10-03-C0152-7	Steel	20 ft-lb
10-03-C0152-8	Steel	40 ft-lb
10-03-C0152-9	Steel	450 ft-lb
10-03-C0152-10	Steel	450 ft-lb

The photos of the test set-up with the drums attached to the test bed, nuts at the initial test conditions and "Zafety lug locks" installed are presented in Figures 1 and 2. The photos of each sample installed onto the corresponding nuts are presented in Figures 3 to 12.

Each nut was tightened from the initial test condition to 450 ft-lb (samples 10-03-C0152-1 to 3 and 10-03-C0152-6 to 8) and a torque check was performed on all remaining nuts, without removing the "Zafety lug lock" samples, using the impact gun and torque wrench. Each pair of nuts holding a sample were tightened using the air gun on the first nut and the torque wrench on the second nut, in clockwise direction.

The photos with examples of torque applied using the air gun and the torque wrench are presented in Figures 13 and 14.

After all the nuts were tightened to 450 ft-lb torque, each "Zafety lug lock" sample was visually inspected without being removed from the set-up and then removed and inspected again using a magnifying lamp.

## 5.0 RESULTS

No failure was observed during visual examination of the tested samples. No deformations of the entire unit were observed, all samples maintained the initial shape. No cracks or wear were observed on the tooth saw section (area in contact with the nut) on any tested samples.


The photos of the samples at the test completion are presented in Figures 15 and 16. The photos of the samples 10-03-C0152-1 and 6 (worse case scenario, lowest initial torque) are presented in Figures 17 and 18.

Reported by:



Daniel Chira, P.Eng., C.E.T.  
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Product Technology Group

Reviewed by:



Steven Huynh, P.Eng.  
Project Manager, Component Testing  
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## **Figures**

(9 Pages)

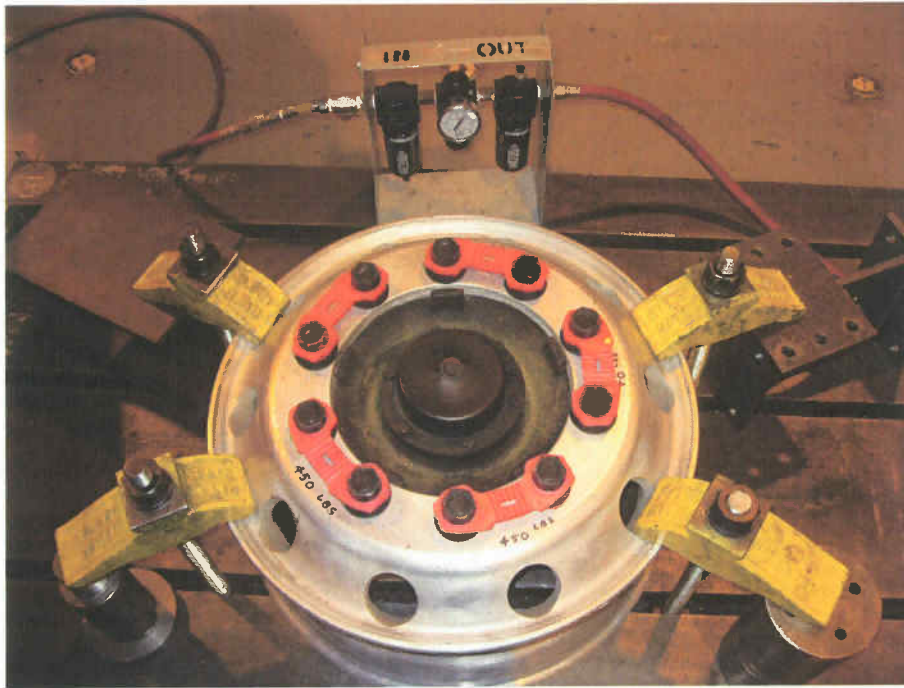


Figure 1 : Test set-up – Samples installed on nuts, aluminium drum

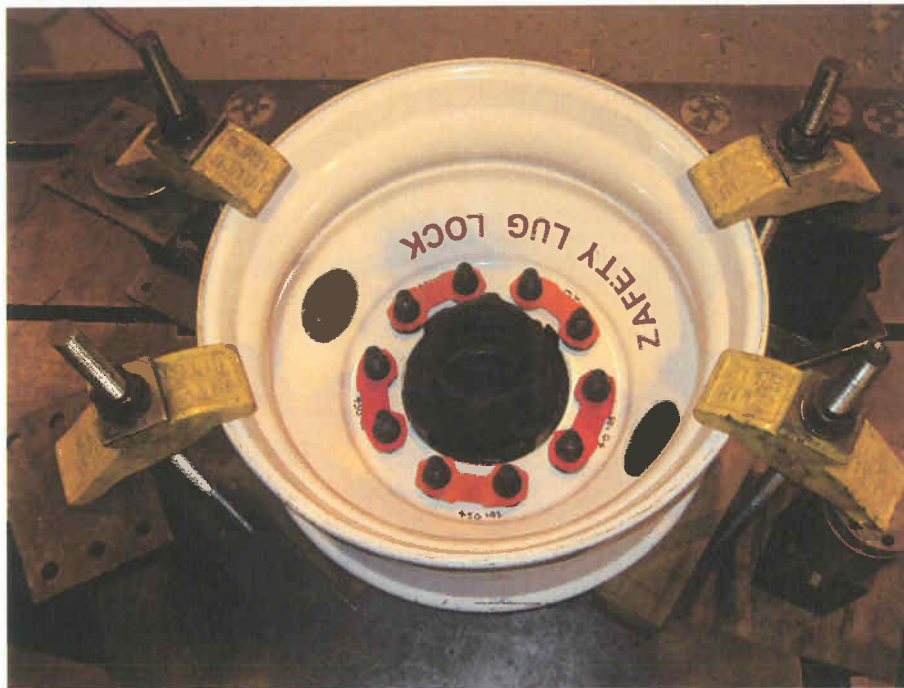


Figure 2 : Test set-up – Samples installed on nuts, steel drum



Figure 3 : Sample 10-03-C0152-1 installed on hand tight nuts



Figure 4 : Sample 10-03-C0152-2 installed on 20 ft-lb torque nuts





Figure 5 : Sample 10-03-C0152-3 installed on 40 ft-lb torque nuts



Figure 6 : Sample 10-03-C0152-4 installed on 450 ft-lb torque nuts



Figure 7 : Sample 10-03-C0152-5 installed on 450 ft-lb torque nuts



Figure 8 : Sample 10-03-C0152-6 installed on hand tight nuts





Figure 9 : Sample 10-03-C0152-7 installed on 20 ft-lb torque nuts



Figure 10 : Sample 10-03-C0152-8 installed on 40 ft-lb torque nuts

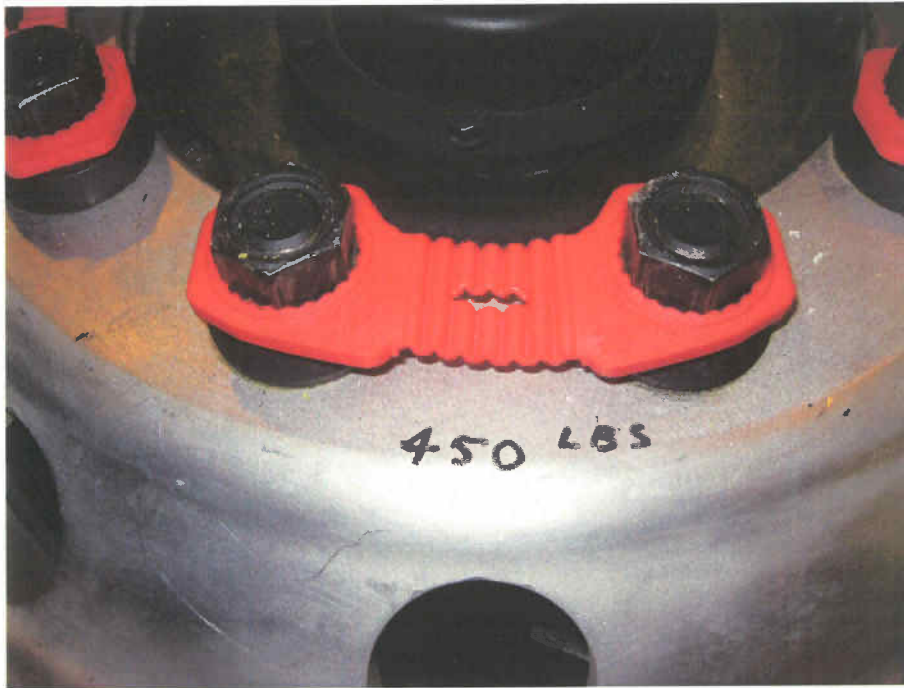


Figure 11 : Sample 10-03-C0152-9 installed on 450 ft-lb torque nuts



Figure 12 : Sample 10-03-C0152-10 installed on 450 ft-lb torque nuts



Figure 13 : Example of torque applied with the air gun

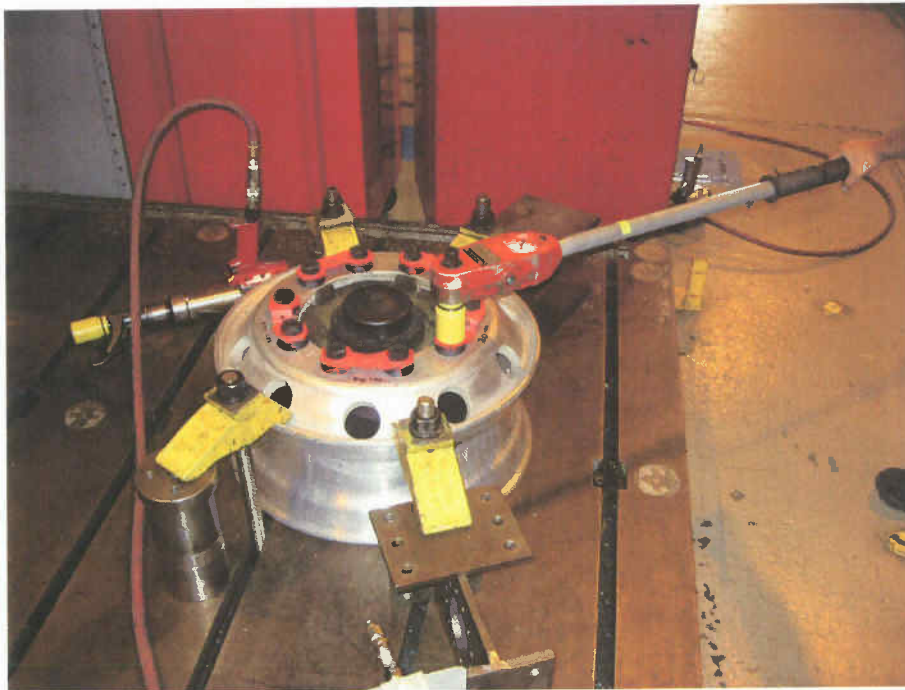


Figure 14 : Example of torque applied with the torque wrench



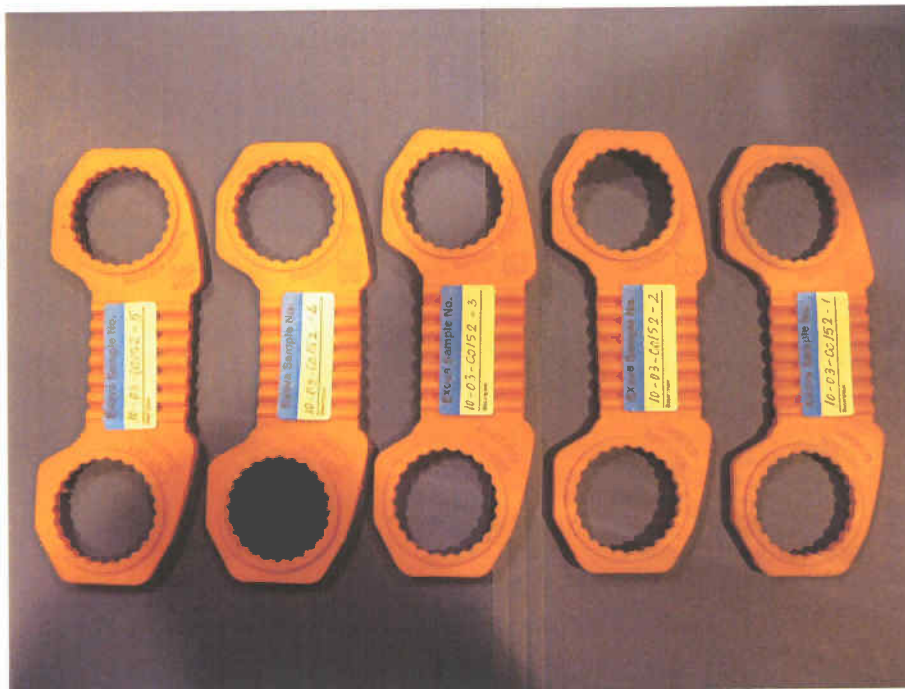


Figure 15 : Samples 10-03-C0152-1 to 5 after test



Figure 16 : Samples 10-03-C0152-6 to 10 after test



Figure 17 : Sample 10-03-C0152-1 after test (right nut tightened with air gun)



Figure 18 : Sample 10-03-C0152-6 after test (left nut tightened with air gun)



## **Appendix A**

(2 Pages)



Figure 1A : Photo of air gun calibration sticker

Customer Name.: MCCANN EQUIPMENT LTD. (RENTAL TOOL)

Cert No.: 57328

Address.: 2178 TORQUAY MEWS, MISSISSAUGA, ONTARIO

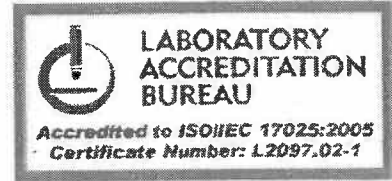
Issue No.: 01

**CERTIFICATE OF CALIBRATION**  
McCANN EQUIPMENT LTD.



2178 Torquay Mews  
Mississauga, ON.

www.torquetools.com



Tel: (905) 542 1333

1 800 287 5714

Fax: (905) 542 1335

Manufacturer: Torqueleader  
Model: DDS800S  
Tool Capacity: 600  
Accuracy of set torque ±: 4%  
Technician: David McLaren  
Quality Supervisor: Kathy Quart **KQ**

Serial No.: 0DW021364  
Asset No.: T3129  
Unit of Measure: lbf.ft  
Ambient Temperature: 23 °C  
Humidity: 49%  
Procedure No.: MCC 6.00

CW    X    CCW

Set Torque
120.00
360.00
600.00

Lower Limit	Upper Limit
115.20	124.80
345.60	374.40
576.00	624.00

As Found	As Left
122.36	122.36
364.71	364.71
611.94	611.94

Readings are derived from the average of five readings taken at the "set torque" as indicated.  
Statistical information is available upon request.

**Transfer Standards**

Display Model: 43228

Transducer: 50012ETS

Serial No.: 60241

Serial No.: 34021ETS

**STATEMENT OF COMPLIANCE:**

McCann Equipment Limited hereby certifies that the above described instrument has been calibrated in compliance with the requirements and specifications in the Purchase Order, using measurement equipment and standards that are traceable to the NRC/CANADA and / or the NIST/USA.

McCann Equipment Limited Quality System meets or exceeds the requirements of ISO 17025.

The estimated uncertainty of measurement is ± 0.48% of applied load, K=2, 95% confidence level.

The Test Equipment used for this calibration complies with the requirements of ISO 10012.

The limits shown for this calibration comply, or exceed the requirements of ISO 6789.

This certificate is not to be considered as a "guarantee of accuracy" for the indicated Calibration Interval.

This certificate shall not be reproduced, except in full, without written approval of McCann Equipment Limited.

Received Date:	14-Jun-10
Calibration Date:	14-Jun-10
Calibration Due Date:	14-Jun-11

Condition	Out of Spec.	In Spec.
Received		X
Returned		X

**Remarks:**

Before and after readings remain the same.

For information, please contact:

Kathy Quart