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Physical Testing on "Zafety Lug Lock" Samples

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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:

Exova Sample #	Sample Description	Colour
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.

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Figures

(9 Pages)

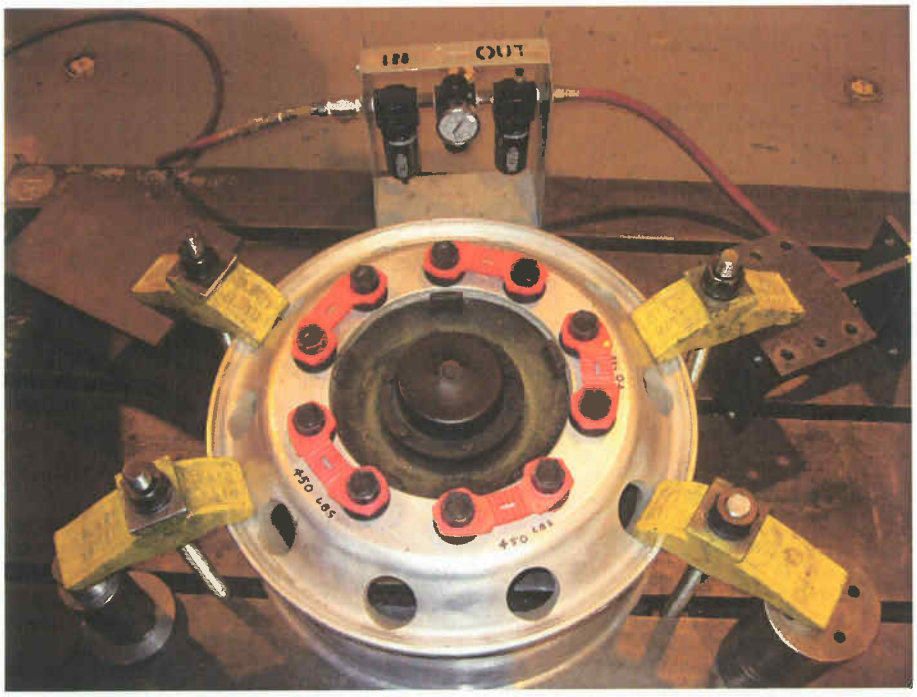

Figure 1 : Test set-up – Samples installed on nuts, aluminium drum

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