

Exova
2395 Speakman Dr.
Mississauga
Ontario
Canada
L5K 1B3

T: +1 (905) 822-4111
F: +1 (905) 823-1446
E: sales@exova.com
W: www.exova.com



Testing. Advising. Assuring.

Temperature and Vibration Testing on Safety Lug Lock

A Report to:	TAFKAN Consulting Ltd. 2107 Pinevalley Crescent Oakville, ON L6H 6L8
Attention:	Mr. Taffy Davies
Telephone:	905-344-3771
Fax:	905-849-6607
Email:	tafcan@coqeco.ca
Report No.:	09-03-C0175 4 Pages, 2 Appendices
Proposal No.:	09-003-5651
Date:	August 18, 2009

1.0 INTRODUCTION

TAFKAN Consulting Ltd. submitted two (2) wheel samples for combined temperature and vibration testing. The samples were identified as follows:

<u>EXOVA Sample No.</u>	<u>Description</u>
09-03-C0175-1	26" Alloy Rim (Hub Piloted Rim & Nuts)
09-03-C0175-2	26" Steel Rim (Standard Nuts)

2.0 TEST EQUIPMENT

- *THERMOTRON DS-6842* vibration table, A/N 20041-1
- *THERMOTRON F-32-CHV* thermal chamber, A/N 11464
- *m + p* vibration controller, MII No. A13871
- *PCB* accelerometer (control), MII No. B04867
- *KISTLER* power supply, MII No. B05501
- *OMEGA* digital thermometer, MII No. A04387

3.0 PROCEDURE

A TAFKAN representative was present to install the Safety Lug Locks onto the hand tightened lug nuts of the wheel prior to attachment to the vibration platform. All nuts were hand tightened. The position of the nuts was indicated by lines made with a permanent marker pen on the Safety Lug Locks.

The vibration at temperature tests were performed on a vertical motion *THERMOTRON DS-640* shaker table situated inside a *THERMOTRON* thermal chamber. The wheel was attached to the vibration platform with its vertical axis parallel to the vibration platform's thrust direction. Hence, the sample was vibrated in the vertical direction (Z axis), as shown in Appendix A, Figure 1A and Figure 5A. One accelerometer which provided the control signal was attached to the vibration platform in thrust direction.

We were instructed to perform the vibration test as a sinusoidal vibration dwell at 30 Hz and 3 g acceleration amplitude at temperatures of -40°C and 120°C, employing a 60 minute dwell at each temperature. The internal chamber temperature was verified with an *OMEGA* digital thermometer.

4.0 RESULTS

The tests were performed on August 13, 2009, in the following sequence:

1. 26" Alloy Rim, vibration test at -40°C,
2. 26" Alloy Rim, vibration test at 120°C,
3. 26" Steel Rim, vibration test at -40°C,
4. 26" Steel Rim, vibration test at 120°C.

For the 26" Alloy Rim sample, the position of the lug nuts was documented with photographs prior to testing, as well as after the vibration test at 120°C. For the 26" Steel Rim sample, the position of the lug nuts was documented with photographs prior to testing, as well as after the vibration tests (-40°C as well as 120°C).

Post-test visual inspections indicated the Zafety Lug Locks did not sustain any external damages or physical degradation. Further, no looseness of any lug nuts was indicated. Photographic documentation is provided in Appendix A, as follows:

1. 26" Alloy Rim, prior to vibration testing: Figure 1A and Figure 2A,
2. 26" Alloy Rim, after vibration testing at 120°C: Figure 3A and Figure 4A,
3. 26" Steel Rim, prior to vibration testing: Figure 5A and Figure 6A,
4. 26" Steel Rim, after vibration testing at -40°C: Figure 7A and Figure 8A,
5. 26" Alloy Rim, after vibration testing at 120°C: Figure 9A and Figure 10A.

Vibration controller generated plots for the vibration tests are provided in Appendix B, Figures 1B to 4B.

The samples were returned to TAFCAN Consulting Ltd. for further assessment.

Reported by:



Andy Hansmann, B.Sc.
Scientist, Component Testing
Product Testing Group

Reviewed by:

For 

Steven Huynh, P.Eng.
Project Manager, Component Testing
Product Testing Group

This report and service are covered under Exova Canada Inc's. Standard Terms and Conditions of Contract which may be found on our company's website www.exova.com, or by calling 1-866-263-9268.

APPENDIX A

Photographs

(5 pages)

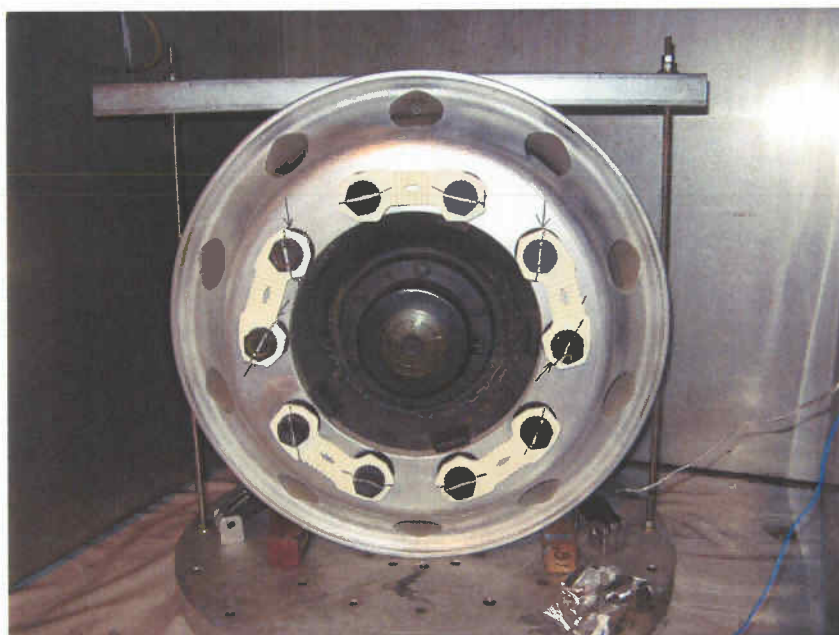


Figure 1A

Vibration test set-up inside the *THERMOTRON* chamber (26 in. Alloy Rim)

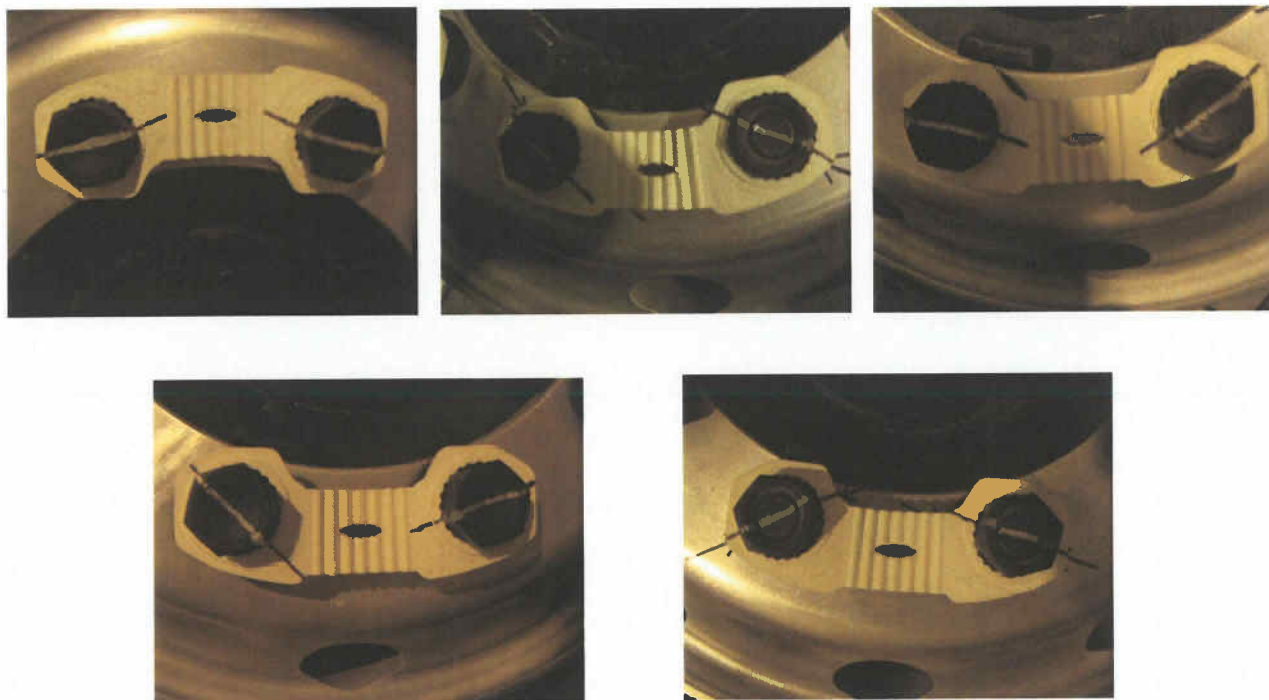


Figure 2A

The various lug nuts and Safety Lug Lock units, indicating the position of the lug nuts prior to testing

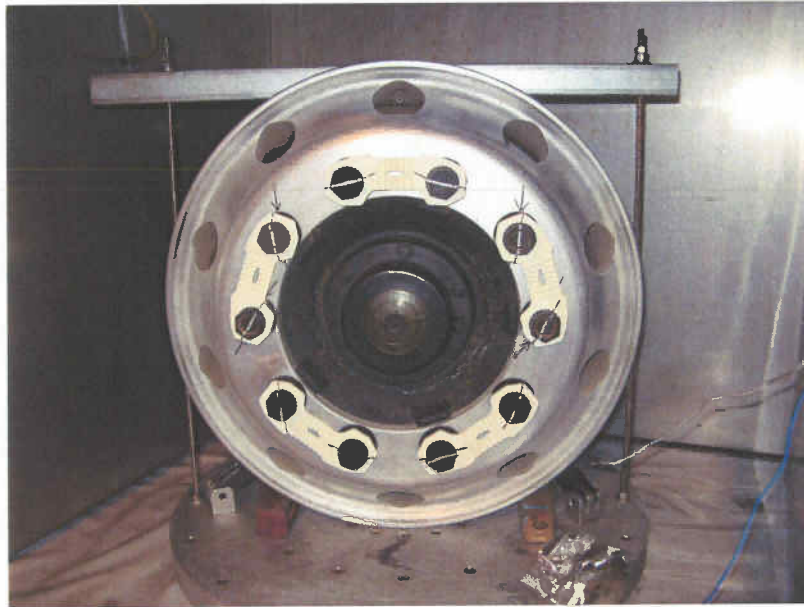


Figure 3A

The 26 in. Alloy Rim after vibration testing at 120°C

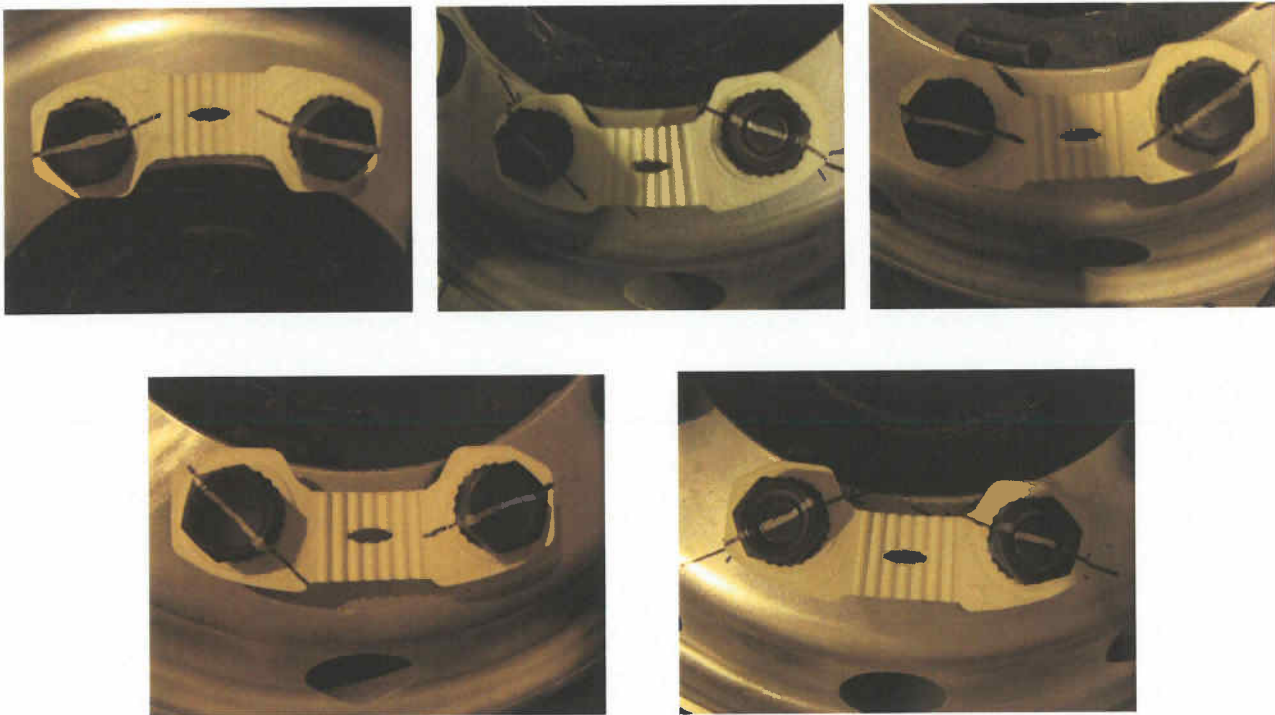


Figure 4A

The various lug nuts and Safety Lug Lock units, indicating the position of the lug nuts after testing at 120°C

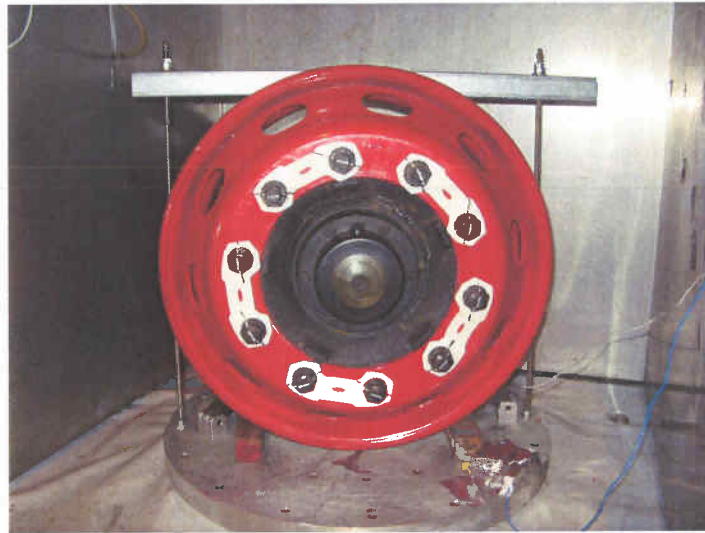


Figure 5A

Vibration test set-up inside the *THERMOTRON* chamber (26 in. Steel Rim)

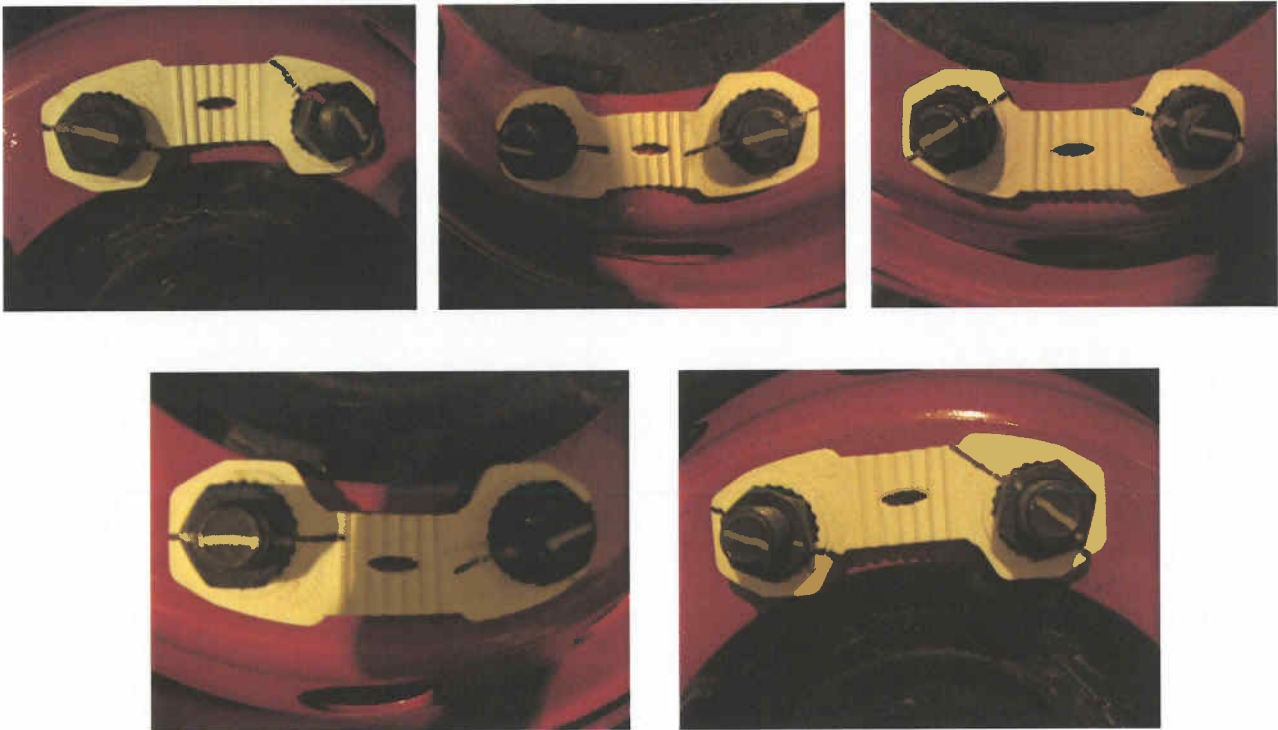


Figure 6A

The various lug nuts and Safety Lug Lock units, indicating the position of the lug nuts prior to testing



Figure 7A

The 26 in. Steel Rim after vibration testing at -40°C

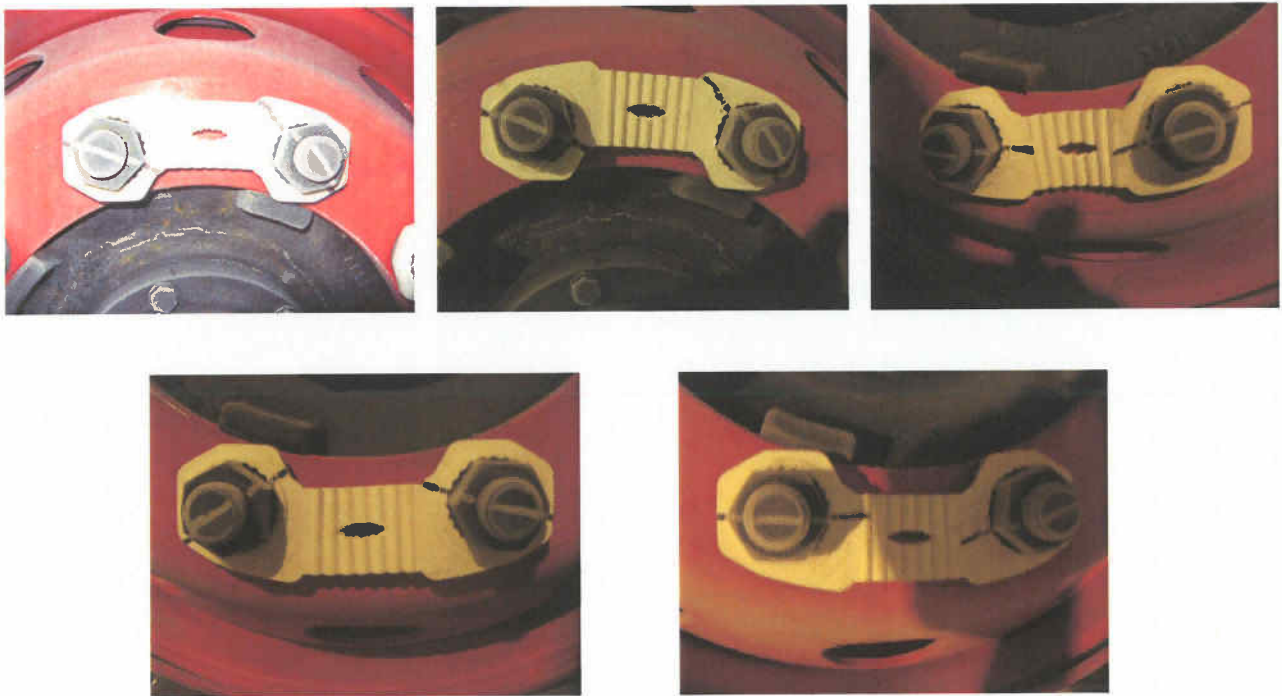


Figure 8A

The various lug nuts and Safety Lug Lock units, indicating the position of the lug nuts after testing at -40°C



Figure 9A

The 26 in. Steel Rim after vibration testing at 120°C

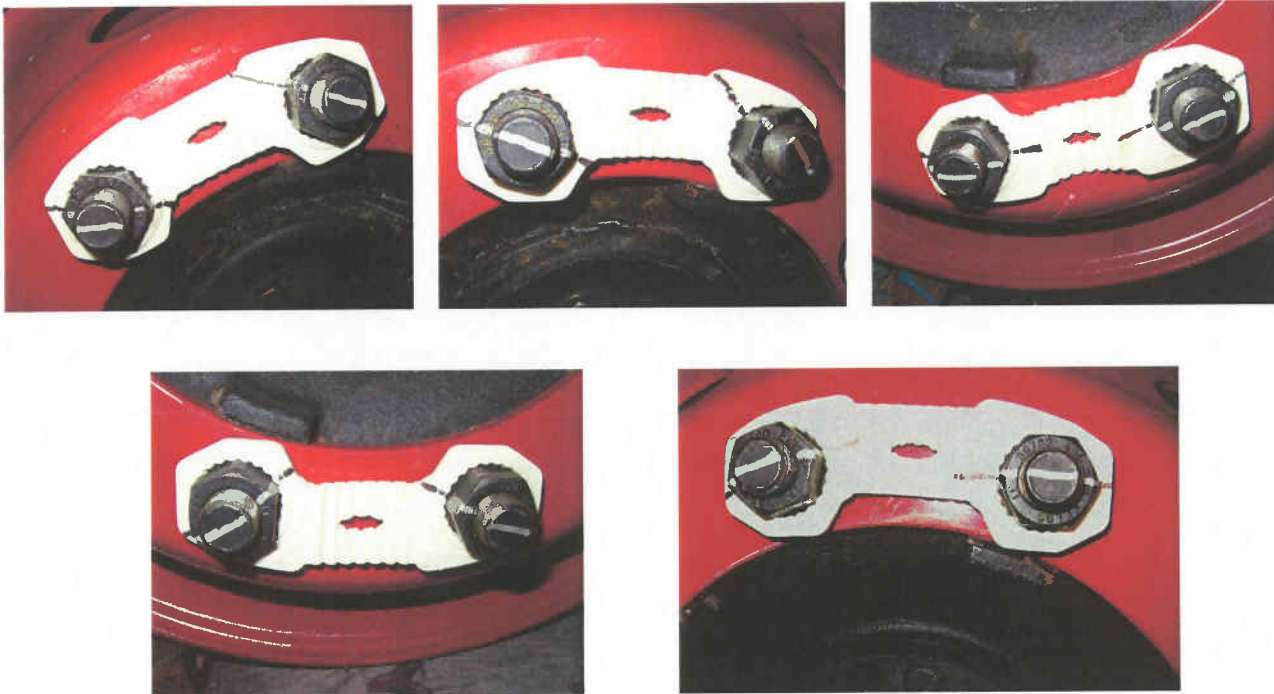


Figure 10A

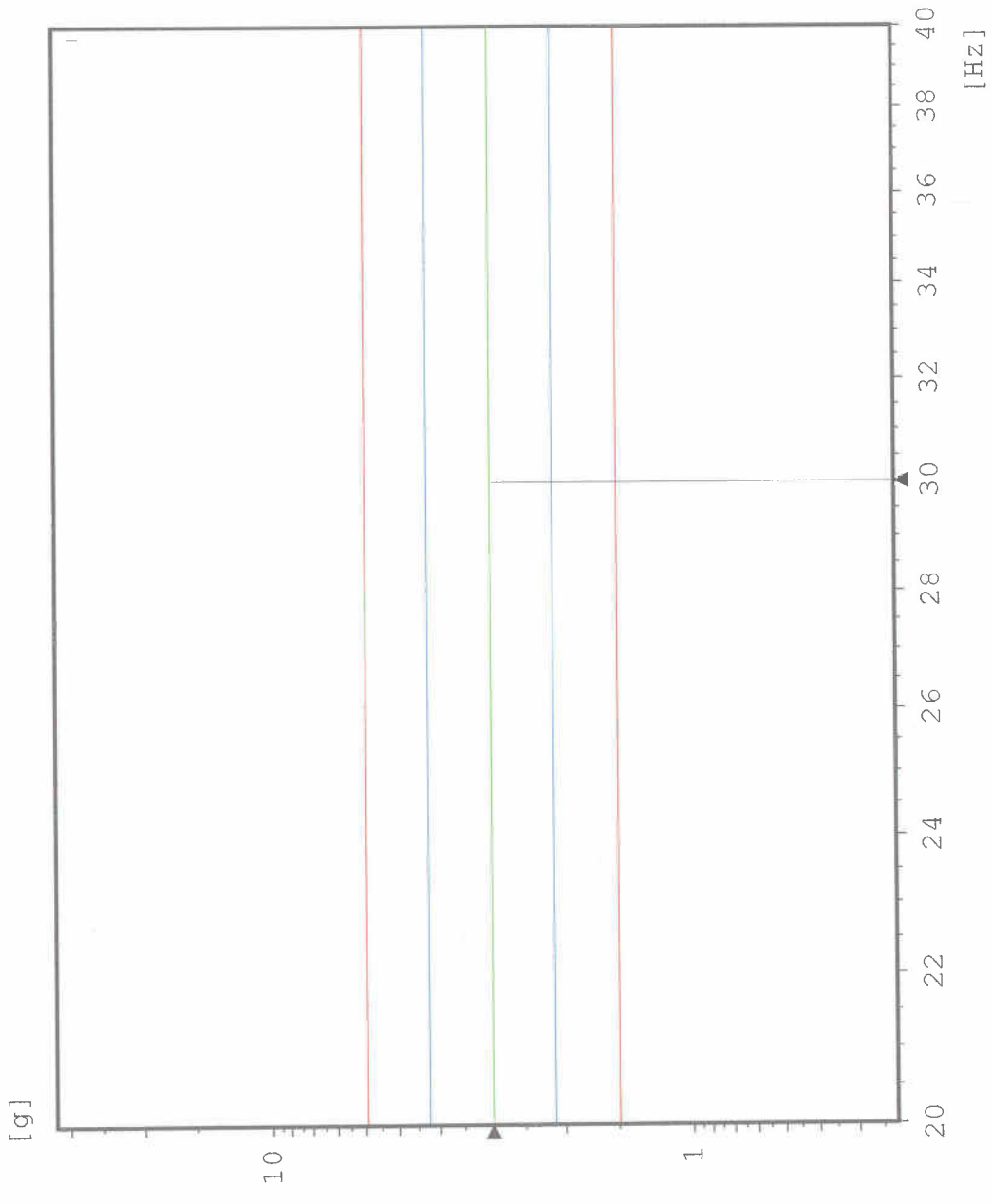
The various lug nuts and Zafety Lug Lock units, indicating the position of the lug nuts after testing at 120°C

APPENDIX B

Figures 1B to 4B
(4 pages)

Sine Dwell Control channel

Vertical Direction, At -40 C



Sweep type : log
 Sweeps done : 0
 Sweeps req. : 1
 Sweep dir. : up
 Contr.strat.: Average
 Contr.mode : Closed Loop

--- Testing Time ---
 elapsed : 1:00:00
 remaining : 0:00:00

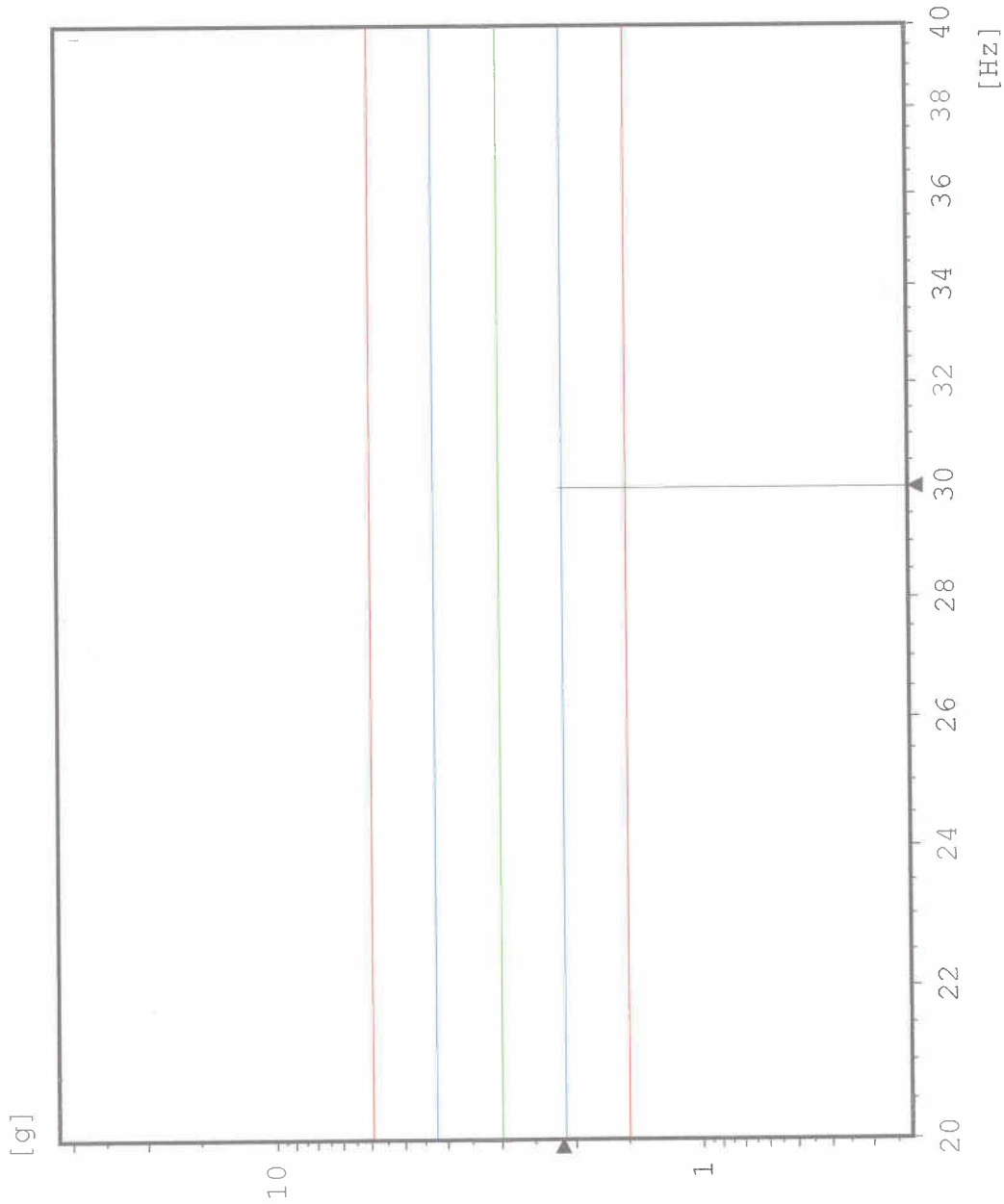
Date: 08-13-09
 10:52:04

Exova
 for Tafcan Consulting Ltd.
 Sample # 09-03-C0175-1
 Alloy Rim

Figure 1B *[Signature]*

Sine Dwell Control channel

Vertical Direction, At 120 C



Sweep type : log
Sweeps done : 0
Sweeps req. : 1
Sweep dir. : up
Contr.strat.: Average
Contr.mode : Closed Loop

--- Testing Time ---
elapsed : 1:03:11
remaining : 0:03:11

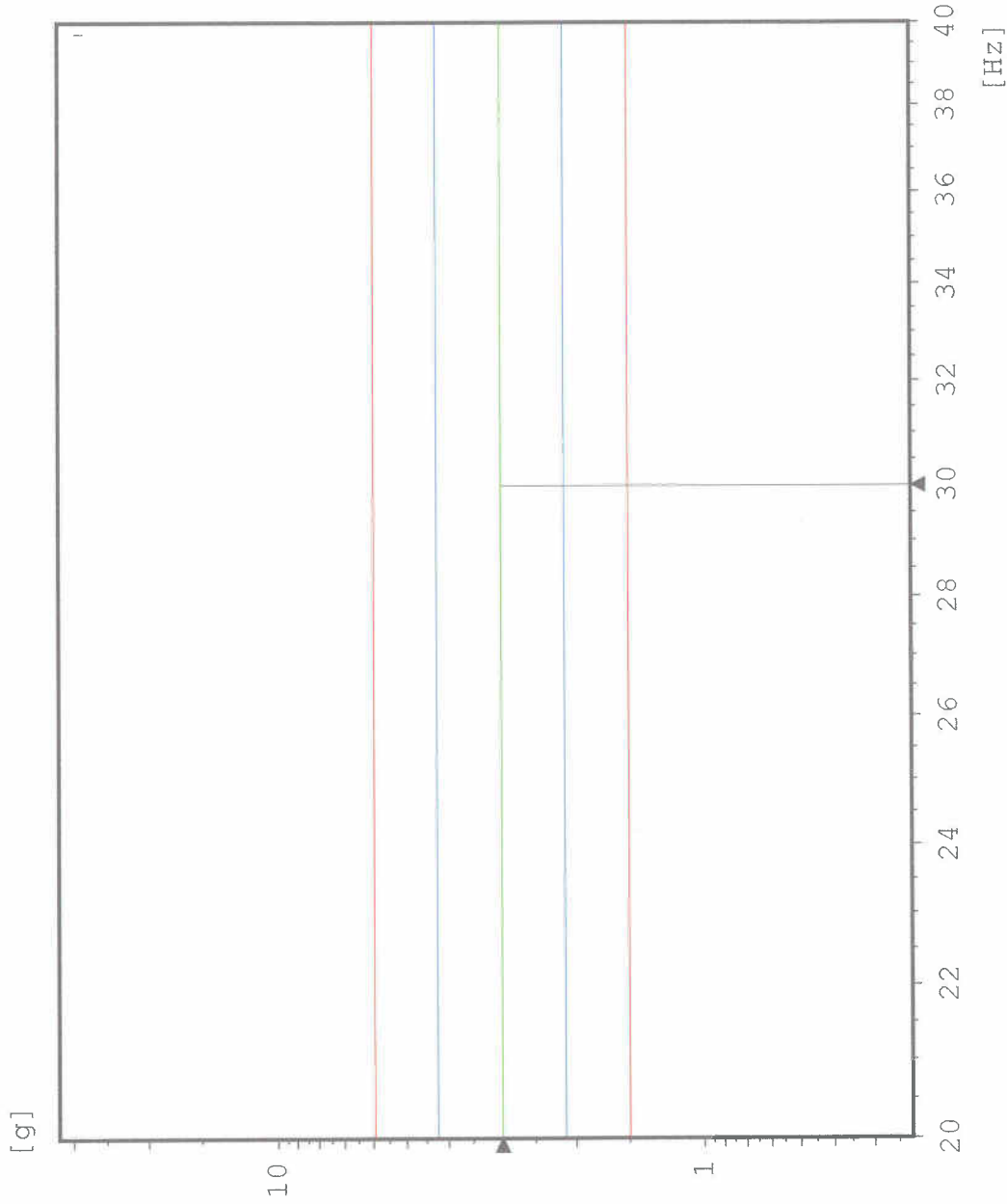
Date: 08-13-09
13:13:37

Exova
for Tafcan Consulting Ltd.
Sample # 09-03-C0175-1
Alloy Rim

Figure 2B *Q. C.*

Sine Dwell Control channel

Vertical Direction, At -40 C



Sweep type : log
Sweeps done : 0
Sweeps req. : 1
Sweep dir. : up
Contr.strat.: Average
Contr.mode : Closed Loop

--- Testing Time ---
elapsed : 1:00:00
remaining : 0:00:00

Date: 08-13-09
15:14:55

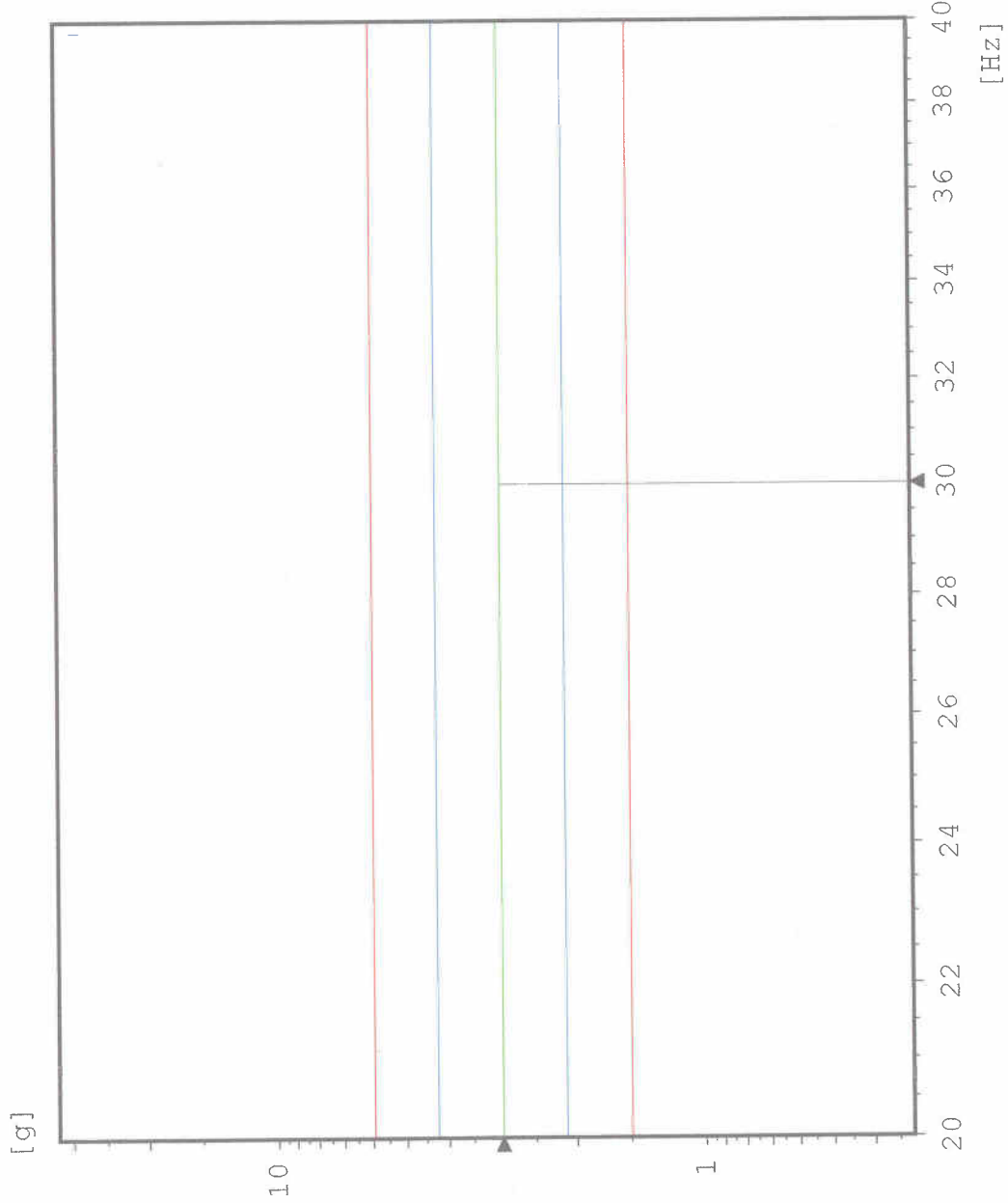
Exova
for Tafcan Consulting Ltd.
Sample # 09-03-C0175-2
Steel Rim

Cursor: 29.99 Hz

3 g

Sine Dwell Control channel

Vertical Direction, At 120 C



Sweep type : log
 Sweeps done : 1
 Sweeps req. : 1
 Sweep dir. : up
 Contr.strat.: Average
 Contr.mode : Closed Loop

--- Testing Time ---
 elapsed : 1:00:00
 remaining : 0:00:00

Date: 08-13-09
 17:27:21

Exova
 for Tafcan Consulting Ltd.
 Sample # 09-03-C0175-2
 Steel Rim

Figure 4 B *[Handwritten Signature]*