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Testing. Advising. Assuring.

Physical Testing on Office Chair Sample
Sample ID – Core Office Chair
ANSI/BIFMA X5.1-2011

A Report to:	Inertia Engineering + Design 34 Kern Road, Unit 3 Toronto, Ontario M3B 1T1
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1.0 INTRODUCTION

At the request of Inertia Engineering + Design (Inertia Engineering), Exova performed Physical Testing on Office Chair sample, in accordance with ANSI/BIFMA X5.1-2011.

Inertia Engineering submitted one (1) office chair sample for testing. The as received sample was allocated with Exova Sample Number below:

<u>Exova Sample #</u>	<u>Sample Description</u>
14-06-C0182-1	Core Office Chair

2.0 OBJECTIVES

The objective of the proposed work was to provide information needed to evaluate the mechanical properties of the office chair sample in accordance with ANSI/BIFMA X5.1-2011.

3.0 INSTRUMENTATION

The following instruments were used to conduct the required measurements:

500 lbs load cell	MII # B12582
MTS 407 signal conditioner	MII # B06081
10,000 lbs load cell	MII # B06835
Weight scale	MII # A04941
Measuring tape	MII # B10834
SHIMPO force gage	MII # B07149
CMD	MII # B06435
Protractor	MII # B10836

4.0 TEST PROCEDURE

All required tests were performed in accordance with ANSI/BIFMA X5.1-2011. The details of the test procedure are presented below.

4.1 Backrest Strength – Static – Type I

The test was performed in accordance with Section 5 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test platform and the base was restrained from movement at its base. The required load was applied to the backrest using a servo-hydraulic actuator, through a form fitting device and a calibrated load cell, at the top of the backrest (height lower than 16 in above the seat surface) and 90 degrees with the backrest plane.

The photo of the test set-up is presented in Figure 1.

A functional load of 200 lbs and a proof load of 300 lbs was applied to the backrest and held for one minute.

4.2 Base Strength

The test was performed in accordance with Section 7 from ANSI/BIFMA X5.1-2011.

The chair base sample, without casters, was seated on the test platform, on five metal blocks using caster stems. A servo-hydraulic actuator, equipped with a 10Kip calibrated load cell, was configured to apply the required load to the sample, through a test fixture which simulates the taper/base interface.

The photo of the test set-up is presented in Figure 2.

A force of 2,500 lbs was applied twice to the base and held for one minute.

4.3 Drop Test - Dynamic

The test was performed in accordance with Section 8 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test platform. A 16 in diameter test bag was positioned at 6 in above the uncompressed seat, centred sideways and with its edge at 0.5 in from backrest. A quick release mechanism was configured to allow a free drop of the bag onto the seat.

The photo of the test set-up is presented in Figure 3.

For the functional load, a 225 lbs weight and for the proof load, a 300 lbs weight was used to conduct testing. Each functional and proof test was performed with the seat at its highest position and then repeated with the seat at its lowest position.

4.4 Swivel Test

The test was performed in accordance with Section 9 from ANSI/BIFMA X5.1-2011.

The chair sample was secured at its base on a fixed test platform, with the seat at its highest position. A 250 lbs weight was secured on the seat with the centre of the gravity between 2 and 2.5 in forward of the centreline of the spindle. An electric motor was configured to apply the unidirectional rotation to the sample.

The photo of the test set-up is presented in Figure 4.

The sample was tested to failure or up to 60,000 cycles, whichever occurs first. The test was repeated with the seat at its lowest position, for an additional 60,000 cycles.

4.5 Seating Durability

The test was performed in accordance with Section 11 from ANSI/BIFMA X5.1-2011.

4.5.1 Impact Test

The chair sample was placed onto the test platform and restrained in a manner that will maintain the impact location on the seat. A 16 in diameter bag with 125 lbs weight was configured to free drop on the seat from 1.2 in height from the uncompressed seat surface, with the edge at 0.5 inches from backrest and centred sideways.

The photo of the test set-up is presented in Figure 5.

The procedure was repeated to failure or up to 100,000 cycles, whichever occurs first.

4.5.2 Front Corner Ease-Load

The sample was placed onto the test platform and restrained in a manner that will maintain the load location on the seat. An 8 in diameter bag with 165 lbs weight was configured to apply and remove the load, without impact, on each of the front corners, with the edge of the bag flush to front and side seat edges, using a servo-hydraulic actuator. The procedure was repeated to failure or up to 20,000 cycles on each front corner, whichever occurs first.

The photo of the test set-up is presented in Figure 6.

4.6 Stability Tests

The test was performed in accordance with Section 12 from ANSI/BIFMA X5.1-2002.

4.6.1 Rear Stability

The chair sample at the least stable condition was placed onto the test platform and the base was restrained from sliding in rearward direction, using 0.5 in high stops. The support fixture was placed against the backrest and the chair was loaded with 13 disks (Section 12.3.2.2.1) while observing the chair for tipping.

The photo of the test set-up is presented in Figure 7.

4.6.2 Front Stability

The chair sample was placed onto the test platform and the base was restrained from sliding in forward direction, using 0.5 in high stops. A vertical downward load of 135 lbs was applied at 2.4 in rearward from the front edge and centred side-to-side. Then a second horizontal force of 4.5 lbs was applied at front edge of the seat, centred side-to-side, using the SHIMPO force gauge.

The photo of the test set-up is presented in Figure 8.

4.7 Backrest Durability – Cyclic – Type I

The test was performed in accordance with Section 15 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test bed and the base was restrained from movement. A weight of 225 lbs was secured on the centre of the seat. The cyclic load of 0/100 lbs was applied using a pneumatic actuator and a dead weight, at the top of the backrest (height lower than 16 in above the seat) and 90 degrees with the backrest plane.

The photo of the test set-up is presented in Figure 9.

The load was applied for 80,000 cycles centred sideways, and 4 inches offset on each left and right side for additional 20,000 cycles (40,000 cycles total offset cycles) or to failure, whichever occurs first.

4.8 Caster Durability

The test was performed in accordance with Section 17 from ANSI/BIFMA X5.1-2011.

The chair base sample, with casters installed, was seated on the test platform and 250 lbs weight was securely attached to the centre of the seat. A robotic arm was configured to apply a forward-rearward movement to the sample, at a total stroke of 30 inches. Three obstacles 0.125 in thick were configured as per Figures 17a and 17b from ANSI/BIFMA X5.1-2011, Section 17.

The photos of the test set-up are presented in Figures 10 and 11.

The sample was tested for 2,000 cycles over the obstacles and 98,000 cycles with the obstacles removed.

Also, a pull force test was performed on each caster, at the completion of the caster durability. The force required to remove each caster from base shall be minimum 5 lbs.

5.0 RESULTS

The results for all the tests performed are presented in the Table 1 below.

Table 1: Test Results

Test Description	Standard Section	Test Results
Backrest Strength (Type I)	5	The backrest sustained the 200 lbs functional and 300 lbs proof loads without failure and passed the test requirements
Base Strength	7	The base sustained the required load twice without failure and passed the test requirement
Drop Test – Dynamic	8	The chair sample sustained the 225 lbs and proof 300 lbs drop loads, with the seat at both highest and lowest positions, without failure and passed the test requirements
Swivel Test	9	The chair sample completed 60,000 cycles of 360 degrees of rotation with the seat at highest and lowest positions (total of 120,000 cycles) without failure and passed the test requirement
Seating Durability Impact	11	The chair sample completed 100,000 cycles of impacts without failure and passed the test requirement
Seating Durability Front Load Ease	11	The chair sample completed 20,000 cycles of load-ease, on both front corners, without failure and passed the test requirement
Front Stability	12	The chair did not tip over as a result of the downward weight/forward applied force and passed the test requirement
Rear Stability	12	The chair did not tip over as a result of the downward weight/rearward applied force and passed the test requirement
Backrest Durability (Type I)	15	The chair sample completed 120,000 cycles without failure and passed the test requirement
Caster/ Chair Base Durability	17	The base and casters completed the 98,000 cycles without obstacles and 2,000 cycles with obstacles without failures; The force required to remove each caster was higher than 5 lbs; The sample passed the test requirements

The sample passed all the tests described on Chapter 4 of the present report.

The tests were performed at Exova Mississauga facility between October 20 and November 11, 2014.

Reported by:


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FIGURES

(6 Pages)



Figure 1 : Backrest strength test set-up (Type I)

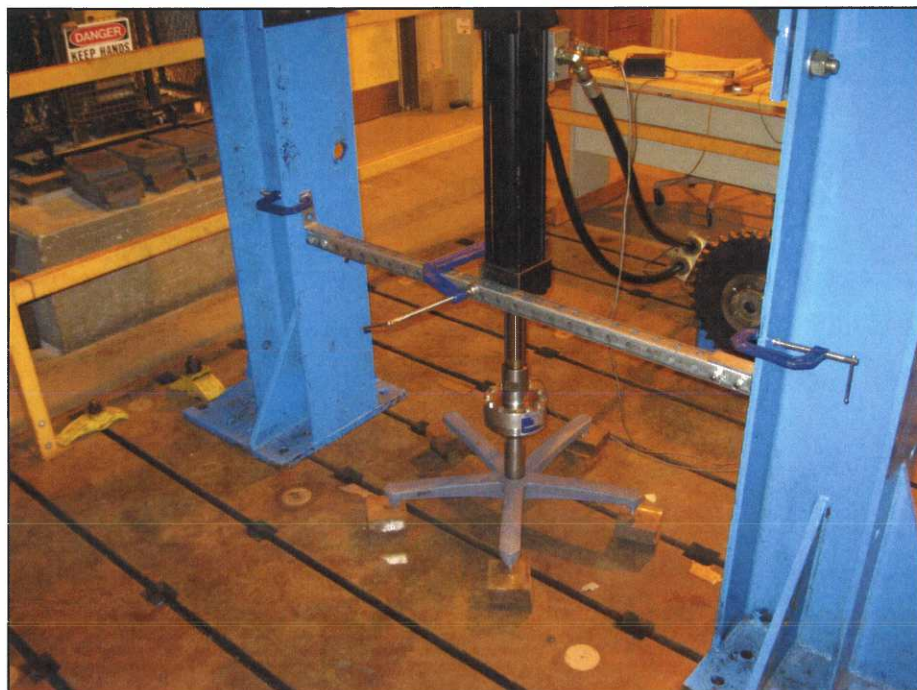


Figure 2 : Base strength test set-up



Figure 3 : Dynamic drop test set-up

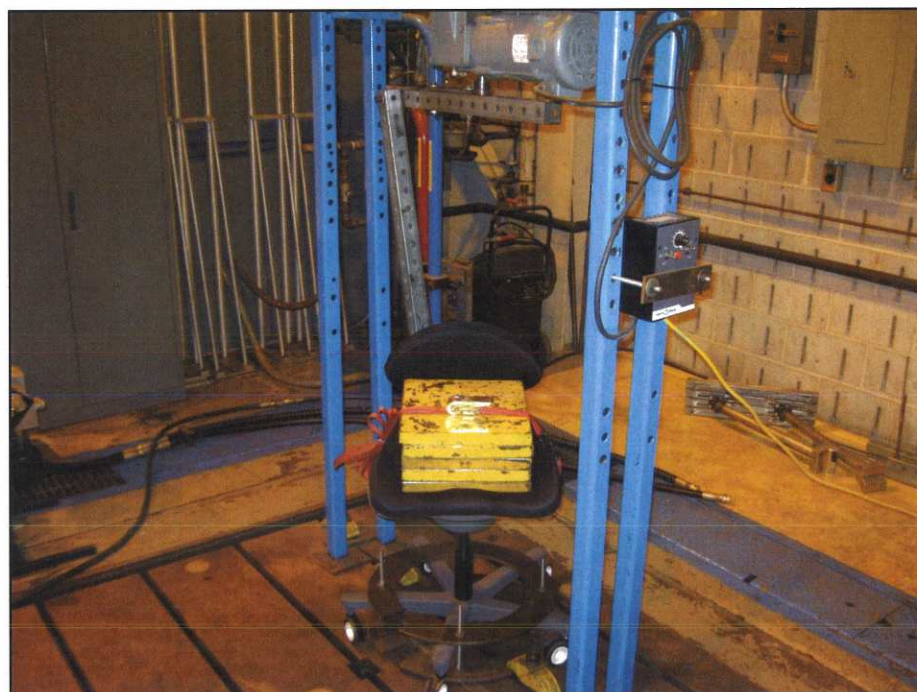


Figure 4 : Swivel test set-up

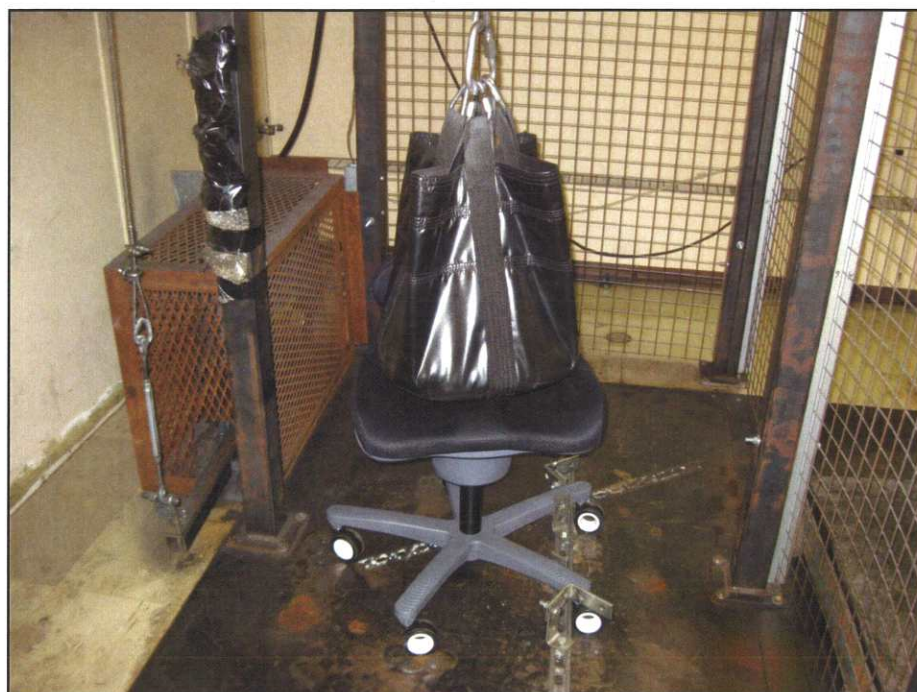


Figure 5 : Seating durability – Impact test set-up



Figure 6 : Seating durability – Front load-ease test set-up



Figure 7 : Rear stability test set-up (Type I)



Figure 8 : Front stability test set-up

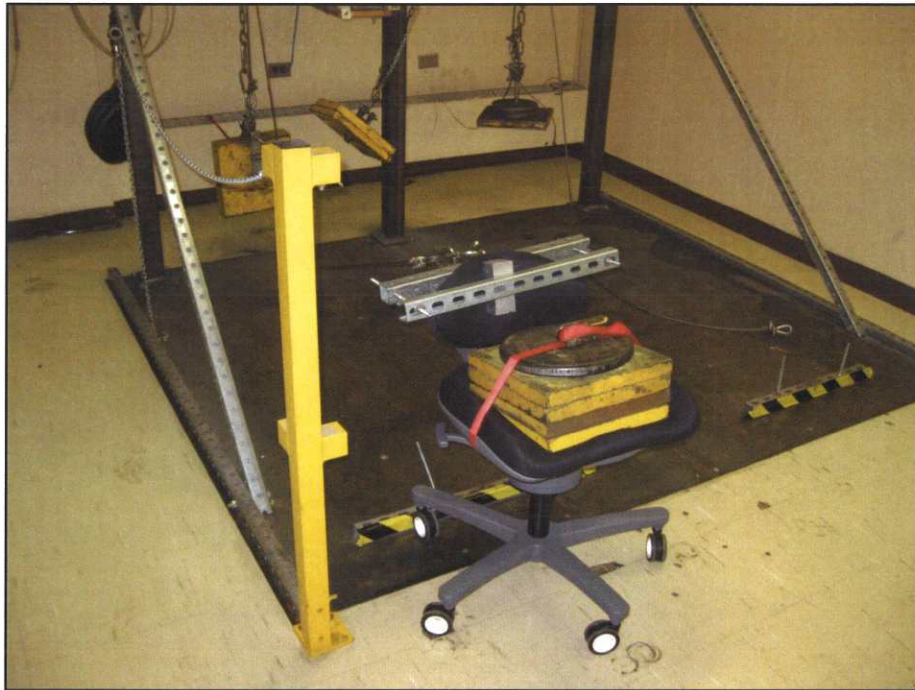


Figure 9 : Backrest durability test set-up (Type I)



Figure 10 : Caster/base durability test set-up without obstacles

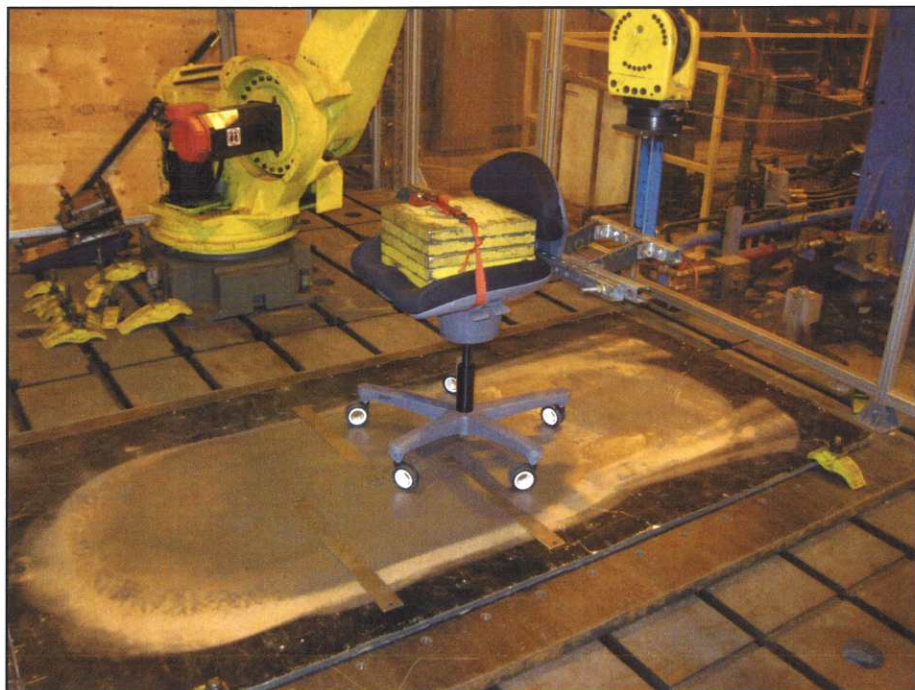


Figure 11 : Caster/base durability test set-up with obstacles