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Testing. Advising. Assuring.

Physical Testing on Type I Office Chair Samples
Samples ID – Therapod Therapist HB Chair – AT Arms
ANSI/BIFMA X5.1-2011

A Report to:	**Allseating Corporation** 5800 Avebury Road Mississauga, Ontario L5R 3M3
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1.0 INTRODUCTION

At the request of Allseating Corporation (Allseating), Exova performed Physical Testing on Type I Office Chair samples, in accordance with ANSI/BIFMA X5.1-2011.

Allseating submitted three (3) type I office chair samples for testing. The as received samples were allocated with Exova Sample Numbers below:

Exova Sample #	Sample Description
12-15-C0226-1	Therapod Therapist HB Chair
12-15-C0226-2	Therapod Therapist HB Chair
12-15-C0226-3	Therapod Therapist HB Chair – AT Arms

2.0 OBJECTIVES

The objective of the proposed work was to provide information needed to evaluate the mechanical properties of the type I office chair samples 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
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 bed and the base was restrained from movement. The required load was applied to the backrest using a servo-hydraulic actuator, through a form fitting device and a calibrated load cell, at 16 in above the seat surface and 90 degrees with the backrest plane (tilt mechanism unlocked).

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 Backrest Strength – Static – Type III

The test was performed in accordance with Section 6 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test bed and restrained from movement. The required load was applied to the backrest using a servo-hydraulic actuator, through a form fitting device and a calibrated load cell, at 16 in above the seat surface and 90 degrees with the backrest plane (tilt mechanism locked).

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

A functional load of 150 lbs and a proof load of 250 lbs was applied to the backrest 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 inches diameter test bag was positioned at 6 inches above the uncompressed seat, centred sideways and with its edge at 0.5 inches 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 inches 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 inches 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 with tilt mechanism unlocked and at the least stable conditions was placed onto the test platform and the base was restrained from sliding in rearward direction, using 0.5 inches 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 procedure was repeated with tilt mechanism locked and backrest in upright position by placing 6 disks on the chair and applying a horizontal rearward force of 29.7 lbs corresponding to 20 in seat height.

The photos of the test set-up are presented in Figures 7 and 8.

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 inches high stops. A vertical downward load of 135 lbs was applied at 2.4 inches 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 9.

4.7 Arm Strength – Vertical

The test was performed in accordance with Section 13 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test fixture (aluminium plate raised 12 in from test bed) and restrained from movement. A servo-hydraulic actuator was configured to apply a vertical downward load to the arm, through a 5 inches long fixture positioned at worse case scenario location and a system of cable and pulley (40 in initial distance from arm to pulley centre axis).

The photo of the test set-up is presented in Figure 10.

A functional load of 169 lbs and a proof load of 253 lbs was applied to the arm and held for one minute.

4.8 Arm Strength - Horizontal

The test was performed in accordance with Section 14 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test bed and restrained from movement. The horizontal outward load to the arm was applied using a servo-hydraulic actuator and a calibrated load cell.

The photo of the test set-up is presented in Figure 11.

A functional load of 100 lbs and a proof load of 150 lbs were applied for one minute.

4.9 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 restraint 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 16 inches above the seat and 90 degrees with the backrest plane.

The photo of the test set-up is presented in Figure 12.

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.

4.10 Backrest Durability – Cyclic – Type III

The test was performed in accordance with Section 16 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test bed and the base was restraint from movement. A weight of 225 lbs was secured on the centre of the seat. The cyclic load of 0/75 lbs was applied using a pneumatic actuator and a dead weight, at 16 inches above the seat and 90 degrees with the backrest plane (tilt mechanism locked).

The photo of the test set-up is presented in Figure 13.

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

4.11 Arm Durability – Cyclic

The test was performed in accordance with Section 21 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test platform and the base was restrained from movement. A servo-hydraulic actuator was configured to apply the required cycling load of 90 lbs/arm (180 lbs total load), to both of the arms simultaneously, through a fixture containing two arms 23.6 in long and load application 10 degrees with the vertical direction.

The photo of the test set-up is presented in Figure 14.

The required cycling load was applied to failure or up to 60,000 cycles, whichever occurs first.

4.12 Out Stop Test

The test was performed in accordance with Section 22 from ANSI/BIFMA X5.1-2011.

The chair sample was seated on the test bed and the base was restraint from movement. A weight of 163 lbs was secured on the centre of the seat. A cable was attached to the centreline of the seat and then passed over a pulley with a weight of 55 lbs.

The photo of the test set-up is presented in Figure 15.

The seat with the hanging weight was released from its most rearward position allowing impacting the out stops for 25 cycles.

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
Backrest Strength (Type II and III)	6	The backrest sustained the 150 lbs functional and 250 lbs proof loads without failure and passed the test requirements
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 rearward force and passed the test requirement
Arm Strength Vertical	13	The arm sustained the 169 lbs functional and 253 lbs proof loads without failure and passed the test requirements
Arm Strength Horizontal	14	The arm sustained the 100 lbs functional and 150 lbs proof loads without failure and passed the test requirements
Backrest Durability (Type I)	15	The chair sample completed 120,000 cycles without failure and passed the test requirement
Backrest Durability (Type II and III)	16	The chair sample completed 120,000 cycles without failure and passed the test requirement
Arm Durability	21	The arms completed 60,000 cycles of loading without failure and passed the test requirements
Out Stop	22	The seat slider completed 25 cycles of impact without failure and passed the test requirement

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

The tests were performed at Exova Mississauga facility between December 03 and December 27, 2012.

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FIGURES

(8 Pages)

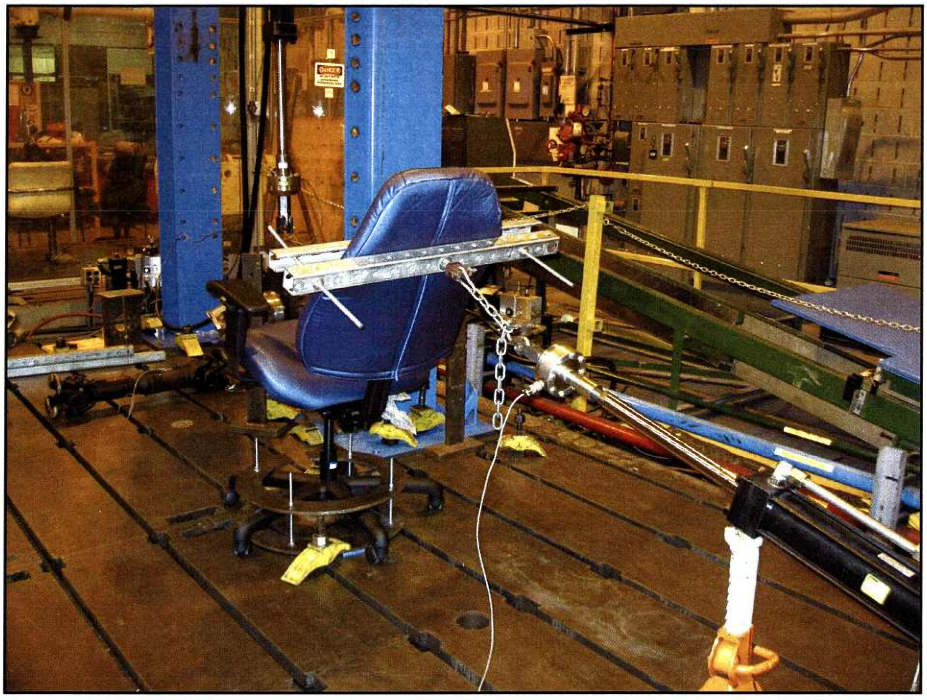

Figure 1 : Backrest strength test set-up (Type I)

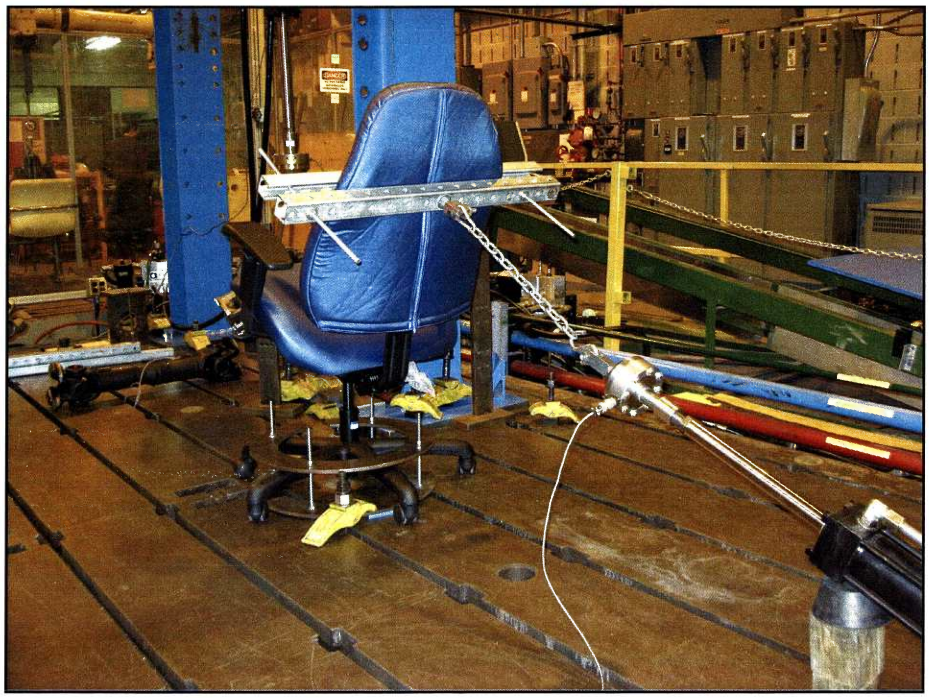

Figure 2 : Backrest strength test set-up (Type III)

Figure 3 : Dynamic drop test set-up

Figure 4 : Swivel test set-up

Figure 5 : Seating durability – Impact test set-up

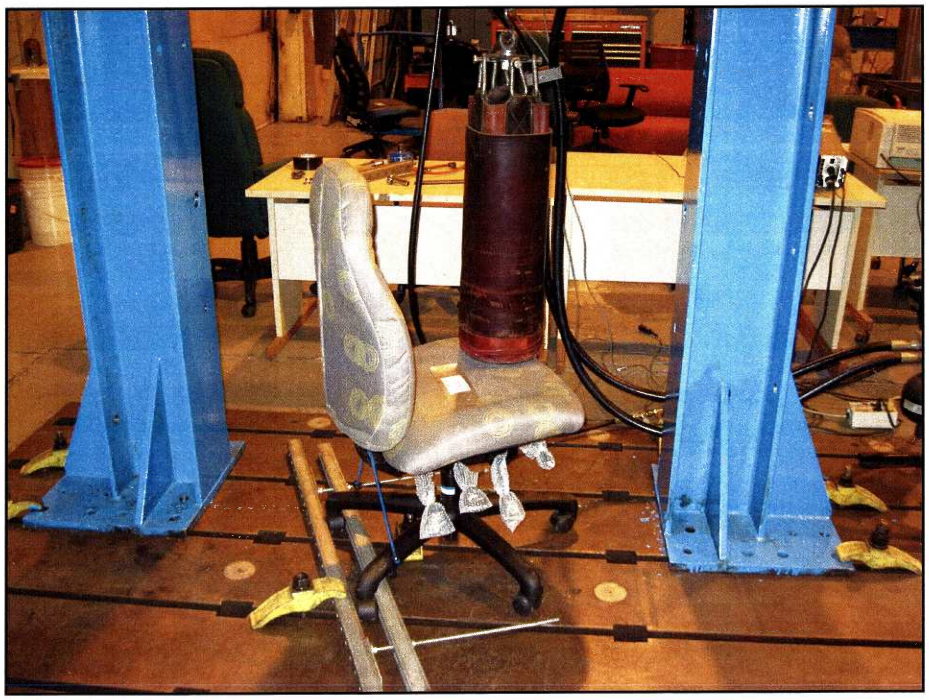

Figure 6 : Seating durability – Front load-ease test set-up

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

Figure 8 : Rear stability test set-up (Type III)

Figure 9 : Front stability test set-up

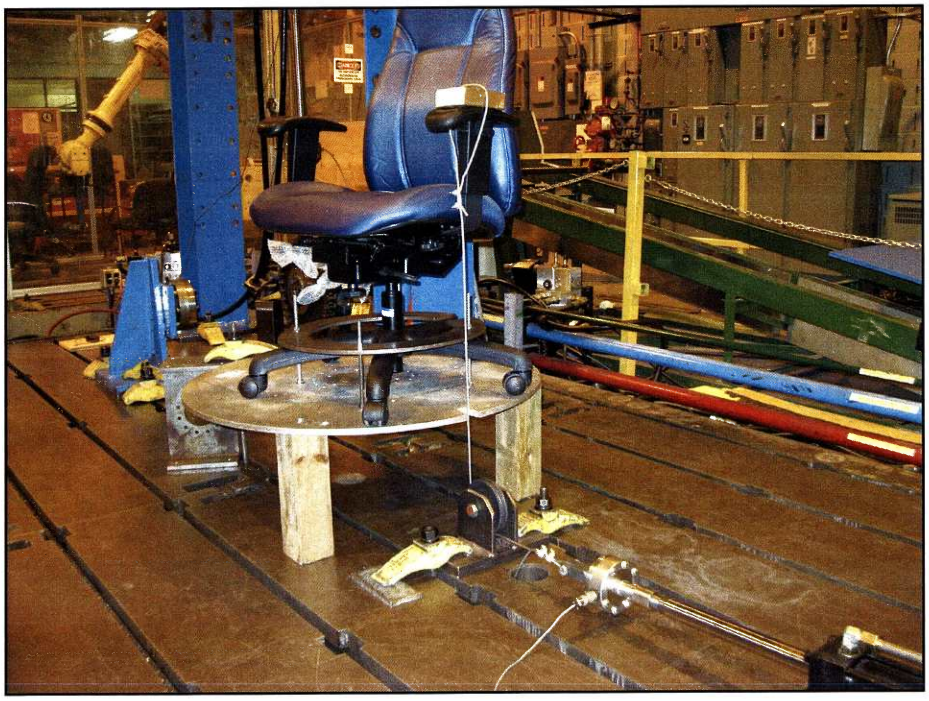

Figure 10 : Vertical arm strength test set-up

Figure 11 : Horizontal arm strength test set-up

Figure 12 : Backrest durability test set-up (Type I)

Figure 13 : Backrest durability test set-up (Type III)

Figure 14 : Arm durability test set-up

Figure 15 : Out stop test set-up