



mga research corporation

**OFFICE OF INTERNATIONAL POLICY AND HARMONIZATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
KIA FRONT ROW SEATS
FMVSS 202A S4.2.5/5.2.5 - ENERGY ABSORPTION TEST SERIES
(PO #DTNH22-05-P-02098, REQ. #NVS-133-5-02098)**

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0850-01



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TEST REPORT

MGA REPORT NO.: G05Q7-003.1

TEST(S) PERFORMED ON: September 27 - October 20, 2005

TEST DESCRIPTION: FMVSS 202A S4.2.5/5.2.5 - Energy Absorption

ITEM DESCRIPTION: Kia Front Row Seats
(PO#DTNH22-05-P-02098, Req.#NVS-133-5-02098)

PROCEDURE NUMBER: MGATP202A_EA.0
1/17/2005

TEST REFERENCE NUMBER(S): DS5192-DS5197, DS5199-DS5204

TEST LABORATORY: MGA Research Corporation
446 Executive Drive
Troy, Michigan 48083

SUBMITTED TO: Susan Meyerson
Office of International Policy and Harmonization
National Highway Traffic Safety Administration
(NVS-133)
400 7th Street SW
Washington, DC 20590

MGA PERSONNEL:

Melanie Schick
Project Leader

Test Personnel:
David Maier

* The results presented in this report relate only to the specified test items.

** This report shall not be reproduced except in full, without the written approval of the laboratory.

Objective

This report contains results for FMVSS 202A S4.2.5/5.2.5 Energy Absorption testing requested by the Office of International Policy and Harmonization, National Highway Traffic Safety Administration (NHTSA). The test samples provided were tested to the requirements stated in the FMVSS 202A Final Rule dated December 7, 2004 and the OVSC Test Procedure 202aStatic dated December 22, 2004.

Purpose

1. This standard specifies requirements for head restraints to reduce the frequency and severity of neck injury in rear-end and other collisions.

FMVSS 202A S4.2.5 Energy Absorption

When the anterior surface of the head restraint is impacted in accordance with S5.2.5 of this section by the head form specified in that paragraph at any velocity up to and including 24.1 km/h, the deceleration of the head form must not exceed 785 m/s^2 (80g) continuously for more than 3 milliseconds.

Additional Customer-Specified Requirements

Per customer request, a total of twelve (12) samples were tested. Six (6) samples were tested with an inverted pendulum impactor and six (6) samples were tested with a linear impactor. A test matrix identifying the desired test set-up and impact device was provided by the NHTSA.

Equipment

MGA Research Corporation's Linear Impactor and Inverted Pendulum Test Systems, both manufactured by MGA, were used for this testing. The instrumentation included four (4) accelerometers (AMWC8, J43734, J22649, and G03-N16). Diagrams of each impactor test system can be found in Figure 1 and calibration information can be found in Appendix B.

Procedure/Method

The samples were tested in accordance with the FMVSS 202A S5.2.5 and OVSC 202aStatic Demonstration Procedures. All seat adjustments were placed in the position determined during the H-Point evaluation and the head restraint was placed in full down (lowest locking notch) position. The impact angle was $0^\circ \pm 2^\circ$ (from the front) and the impact location varied for each sample. The impact location was determined by the impact zone established during the H-Point evaluation. When applicable, the seat back bracing was placed at the approximate seat back CG and remained in place for the duration of the test.

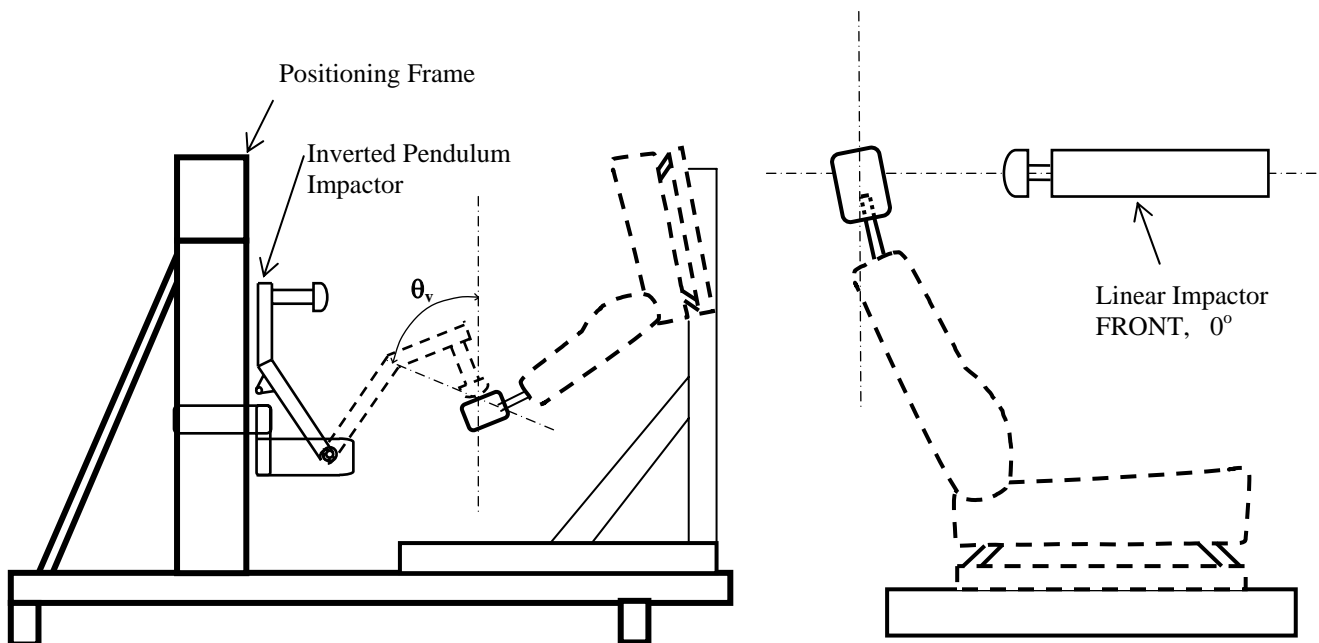


Figure 1 Inverted Pendulum Impactor System and Linear Impactor System

Test Results

Photographs as well as all data processing and graphs can be found in Appendix C. This data is raw data (SAE Class 600) and is not truncated timewise to any specific event. All data is traceable to the National Institute of Standards and Technology (NIST).

MGA Test #	Sample #	Seat Type	Impactor	Impact Angle (θ _h)	Impact Velocity (kph)	Accel 1 (g's)		Accel 2 (g's)		Post-Test Comments
						Peak	3 msec Clip Req't<80	Peak	3 msec Clip Req't<80	
DS5199	1	Front RH 2-Way Manual (w/o Brace)	Inverted Pendulum	1.0	23.7	22.5	20.4	22.5	20.4	• No sharp edges or damage evident.
DS5200	2			0.2	23.6	23.1	21.9	23.1	21.9	• No sharp edges or damage evident. • Recliner appears to have released on I/B side (see video).
DS5201	3	Front LH 4-Way Manual (w/o Brace)		0.0	23.4	21.6	19.8	21.5	19.8	• No sharp edges or damage evident.
DS5202	4	Front LH 4-Way Manual (w/Brace)		0.5	23.3	25.2	24.3	25.1	24.3	• No sharp edges or damage evident.
DS5203	5			0.2	23.4	28.4	27.8	28.1	27.5	• No sharp edges or damage evident.
DS5204	6			0.5	23.8	24.9	23.0	24.6	22.6	• No sharp edges or damage evident.
DS5192	7	Front RH 2-Way Manual (w/o Brace)	Linear	0.0	23.6	27.1	25.7	27.3	25.6	• No sharp edges or damage evident.
DS5193	8			0.1	23.6	30.1	25.6	30.3	25.3	• No sharp edges or damage evident.
DS5194	9			0.3	23.7	28.2	26.7	28.0	26.4	• No sharp edges or damage evident.
DS5195	10			0.1	23.7	30.4	29.7	30.5	30.0	• No sharp edges or damage evident.
DS5196	11			0.1	23.6	28.6	27.9	28.9	28.5	• No sharp edges or damage evident.
DS5197	12			0.1	23.7	27.5	26.5	27.8	26.7	• No sharp edges or damage evident.

Additional test documentation can be found in the following appendices.

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Appendix A
Customer Test Request and Related Documents

Test Procedure for Energy Absorption Test

1. Installation, Test Apparatus, Recording Instruments and Procedure

1.1 Setting Up

- 1.1.1 The seat, as mounted in the vehicle, shall be firmly secured to the test bench with the attachment parts provided by the manufacturer, so as to remain stationary when the impact is applied.
- 1.1.2 If the seat cushion adjusts independently of the seat back, adjust the seat cushion to the highest H-point position.
- 1.1.3 Adjust lumbar and side bolster support to the non-inflated or non-extended position.
- 1.1.4 The seat back, if adjustable, shall be set at the closest position to 25 degrees from vertical. If two positions of adjustments are equidistant from 25 degrees, adjust the seat back to the position rearward of 25 degrees.
 - 1.1.4.1 Position the SAE J826 three-dimensional manikin in the seat per the "SAE J826 three-dimensional manikin positioning procedure (ECE 17, Annex 3)." The head room probe shall be positioned laterally within 15 mm of the centerline of the head restraint. Verify the H-point. Measure the seat back angle using the back angle quadrant incorporated into the manikin. Adjust the seat as necessary to achieve the H-point and seat back angle.
 - 1.1.4.2 Extend the head room probe of the SAE J826 three-dimensional manikin along a line parallel to the torso reference line to a height of 635 mm. Project a plane perpendicular to the torso reference line. On the seat back, mark the line that represents the intersection of the projected plane and the seat back.
 - 1.1.4.3 Remove the SAE J826 three-dimensional manikin.
- 1.1.5 Locate the vertical centerline of the head restraint.
- 1.1.6 Measure 70 mm outboard from the head restraint vertical centerline and draw a line parallel to the head restraint centerline. Measure 70 mm inboard from the head restraint vertical centerline and draw a line parallel to the head restraint centerline.
- 1.1.7 Rigidly fix the seat back.
 - 1.1.7.1 Rigidly fixing the seat back may involve welding or blocking the hinge between the seat cushion and the seat back. Additionally an external brace may be welded to the seat frame and to the vehicle body.

1.2 Test Apparatus

- 1.2.1 Testing shall be conducted with either a pendulum impactor or a linear impactor
 - 1.2.1.1 Pendulum Impactor: This apparatus consists of a pendulum whose pivot is supported by ball bearings and whose reduced mass¹ at its center of percussion is 6.8 kg. The lower extremity of the pendulum consists of a rigid headform 165 mm in diameter whose center is identical with the center of percussion of the pendulum.
 - 1.2.1.1.1 The headform shall be fitted with two accelerometers and a speed measuring device, all capable of measuring values in the direction of impact.

¹ The relationship of the reduced mass "m_r" of the pendulum to the total mass "m" of the pendulum at a distance "a" between the center of percussion and the axis of rotation and at a distance "l" between the center of gravity and the axis of rotation is given by the formula:

$$m_r = m(l/a)$$

1.2.1.2 Linear Impactor: Use an impactor with a semispherical head form and a 165 ± 2 mm diameter and a surface roughness of less than $1.6 \mu\text{m}$, root mean square. The head form and associated base have a combined mass of 6.8 ± 0.05 kg.

1.2.1.2.1 The axis of the acceleration-sensing device coincides with the geometric center of the head form and the direction of impact.

1.3 Recording Instruments

The recording instruments used shall be such that measurements can be made with the following degree of accuracy:

1.3.1 Time recording:

1.3.1.1 The instrumentation shall enable the action to be recorded throughout its duration and readings to be made to within one one-thousandth of a second;

1.3.1.2 The beginning of the impact at the moment of first contact between the headform and the item being tested shall be detected on the recordings used for analyzing the test.

1.4 Test Variations

There will be a total of four test variations for conducting the energy absorption test. Two with the pendulum impactor and two with the linear impactor, and with the seat back rigidly fixed or the seat back not rigidly fixed.

1.4.1 Test 1, Pendulum test without fixing the seat back

1.4.1.1 Set up the vehicle seat as stated in sections 1.1 - 1.6.

1.4.1.2 Use the test fixture outlined in section 1.2.1.1.

1.4.1.3 Follow the test procedure as stated in section 1.5.1

1.4.2 Test 2, Pendulum test with a fixed seat back

1.4.2.1 Set up the vehicle seat as stated in Sections 1.1-1.7

1.4.2.2 Use the test fixture outlined in section 1.2.1.1

1.4.2.3 Follow the test procedure as stated in section 1.5.1

1.4.3 Test 3, Linear Impactor without fixing seat back

1.4.3.1 Set up the vehicle seat as stated in sections 1.1-1.6

1.4.3.2 Use the test fixture outlined in section 1.2.1.2.

1.4.3.3 Follow the test procedure as stated in section 1.5.2.

1.4.4 Test 4, Linear Impactor with fixed seat back

1.4.4.1 Set up the vehicle seat as stated in sections 1.1-1.7

1.4.4.2 Use the test fixture outline in section 1.2.1.2.

1.4.4.3 Follow the test procedure as stated in section 1.5.2

1.5 Test Procedure

The area bounded by the line at a height of 635 mm, the two lines parallel to the head restraint vertical centerline, and the top surface of the head restraint, is the area that must comply with the energy absorption requirements. Each head restraint shall only be tested once to the energy absorption requirements.

1.5.1 Pendulum Impactor

1.5.1.1 For the front face, the direction of impact from the front towards the rear shall be horizontal ($0^\circ \pm 2^\circ$) and parallel to the vehicle longitudinal centerline.

- 1.5.1.2 Initial test so that the headform strikes the test item at a speed of 23.6 km/h \pm 0.5 km/h; this speed shall be achieved either by the mere energy of propulsion or by using an additional impelling device.
- 1.5.1.3 Verify that the specified velocity is achieved by integrating the acceleration.
- 1.5.1.4 Process the acceleration versus time data recorded from the head form accelerometer by using a "3 ms clip" computer routine to establish the maximum (3 ms clip) value of head form acceleration data using SAE J211/1 (March 1995) recommended filter class 600 and cut-off frequency of 1000 Hz.
- 1.5.1.5 The deceleration of the head form shall not exceed 785 m/s² (80 g) continuously for 3 milliseconds.
- 1.5.1.6 Information for the algorithms used to calculate the "3 ms clip" and digitally filter the Class 600 data collected from the energy absorption test is available from the NHTSA website (<http://www-nrd.nhtsa.dot.gov/software/signal-analysis/index.htm>)
- 1.5.2 Linear Impactor
- 1.5.2.1 Ensure that the accelerometer output is properly connected to the data acquisition system
- 1.5.2.2 Install the 165 mm diameter semispherical head form on the actuator and align the head form such that the path of travel of the head form is horizontal ($0^\circ \pm 2^\circ$) and parallel to the vehicle longitudinal centerline.
- 1.5.2.3 Measure the distance between the head form and the impact zone. This distance must be greater than 25 mm.
- 1.5.2.4 Set the actuator to propel the head form such that an impact velocity of 23.6 km/h \pm 0.5 km/h is achieved.
- 1.5.2.5 Activate the timing device.
- 1.5.2.6 Fire the actuator and verify that the specified velocity is achieved by integrating the acceleration.
- 1.5.2.7 Process the acceleration versus time data recorded from the head form accelerometer by using a "3 ms clip" computer routine to establish the maximum (3 ms clip) value of head form acceleration data using SAE J211/1 (March 1995) recommended filter class 600 and cut-off frequency of 1000 Hz.
- 1.5.2.8 The deceleration of the head form shall not exceed 785 m/s² (80 g) continuously for 3 milliseconds.
- 1.5.2.8.1 Information for the algorithms used to calculate the "3 ms clip" and digitally filter the Class 600 data collected from the energy absorption test is available from the NHTSA website (<http://www-nrd.nhtsa.dot.gov/software/signal-analysis/index.htm>)
- 1.6 Documentation
- 1.6.1 All documentation will be provided on a CD. A test report must be provided for each seat tested. Data must be provided in a Microsoft Excel spreadsheet for each seat tested. A copy of the acceleration versus time plot shall be included in the final test report. All required photographs shall be included with the final test report. Photographs at a minimum shall include pretest photographs of the seat setup including the empty seat, seat with manikin in position, bracing (depending on test conducted), location of the impactor relative to the head restraint, target location for impact, area included in the required zone. Posttest photographs of the seat, target location, bracing (depending on test conducted), and any required close-ups or additional photographs to convey any

anomalous behavior or failure of the seat. Additionally, a high-speed digital video shall be recorded and provided, the video should be a side view that captures the entire seat, head restraint and the motion of the impactor.

1.6.2 Record all data on Data Sheet 6 of TP-202aS-00.

Appendix B
System Calibration Information



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CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J43734	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 10/13/2005	Calibration Date: <i>06/13/2005</i>
	Calibrated By: <i>Chuck DiMaggio/PCB Piezotronics, Inc.</i>

Test Reference Number: A0519

New DLR (100k , Units:G): 102.0

StdDeviation (%) 0.338

% Difference in DLR (New vs. Old): 0.325

Temperature (°F): 72

Humidity (%): 51

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 4.1\%$. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



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CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: AMWC8	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 10/13/2005	Calibration Date: <i>06/13/2005</i>
	Calibrated By: <i>Chuck DiMaggio/PCB Piezotronics, Inc.</i>

Test Reference Number: A0519

New DLR (100k , Units:G): 99.5

StdDeviation (%) 0.59

% Difference in DLR (New vs. Old): -1.106

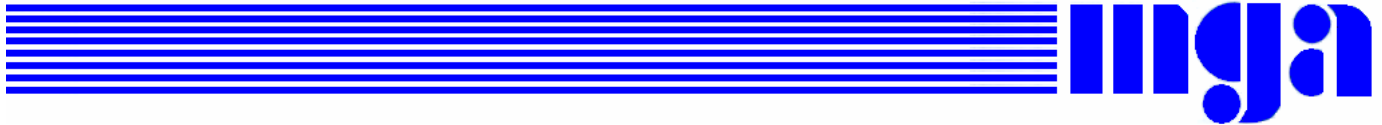
Temperature (°F): 72

Humidity (%): 51

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 4.1\%$. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



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CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: EGEBQE0-2000DIF	Model: <i>301M09/484B</i>
S/N: G03-N16	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 04/28/2005	Calibration Date: <i>05/11/2004</i>
	Calibrated By: <i>Chris Vega/PCB Piezotronics, Inc.</i>

Test Reference Number: A0510

New DLR (100k , Units:G): 113.0

StdDeviation (%) 0.234

% Difference in DLR (New vs. Old): -0.907

Temperature (°F): 68

Humidity (%): 26

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.4\%$. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



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CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J22649	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 04/14/2005	Calibration Date: <i>05/11/2004</i>
	Calibrated By: <i>Chris Vega/PCB Piezotronics, Inc.</i>

Test Reference Number: A0506

New DLR (100k , Units:G): 99.4

StdDeviation (%) 0.235

% Difference in DLR (New vs. Old): -0.648

Temperature (°F): 71

Humidity (%): 20

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 4.1\%$. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



4700 Barden Court S.E. • Kentwood, MI 49512 • Telephone: 616.698.3124 • Fax: 616.698.2364

Certificate of Calibration

MGA Research
 446 Executive Drive
 Troy, MI 48063

Order Number: 43372
 Report Number: 050208306
 Page: 1 of 1

Gauge Number: MGA00071
 Gauge Desc: Digital Protractor
 Manufacturer: Pro 360
 Model Number: N/A
 Serial Number: N/A

Customer PO: 07-05-0224
 Last Calibration: 1/29/04
 Calibration Date: 2/8/05
 Next Calibration: 2/8/06

As Found Condition: In Tolerance

As Left Condition: In Tolerance

MetroCal Inc. maintains reference standards of measurement which are traceable to the National Institute of Standards and Technology, or other authorized National Standards. Calibration was performed in accordance with MetroCal Proc. No. CP045 and complies with the ANSI/NCSL Z540-1 and ISO/IEC 17025 Standards. Results shall not be reproduced except in full without the written approval of MetroCal, Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired. Statements of compliance made using simple acceptance rule.

Standard Used	Cal Date	Due Date	Traceable No.	Calibration Procedure Uncertainty Expressed at 95% confidence (K=2)
Gage Blk Set S/N 941326	6/14/04	6/14/05	821/268344-03	+/- 0.0015 degrees
DoAll Sine Bar ID#1879	12/6/04	12/6/05	821/270003-04 & 3600042619	

Results:

Units	As Found Readings		
	Nominal	Actual	Deviation
Decimal Deg.	5.00	5.0	0.00
	10.00	10.1	0.10
	20.00	20.0	0.00
	30.00	30.1	0.10
	40.00	40.1	0.10

Reference Level Check: Within +/- 0.1 degrees

Nominal	As Left Readings	
	Actual	Deviation
5.00	5.0	0.00
10.00	10.1	0.10
20.00	20.1	0.10
30.00	30.0	0.00
40.00	40.0	0.00

Reference Level Check: Within +/- 0.1 degrees

Comments: Environmental conditions during calibration: 68 deg. F., 34 % RH.
 Deburred surface for more accurate readings.

issued: 2.8.05
 Jamie Nikolich/bjk
 Calibration Technician

Checked box indicate this calibration was performed at the customers facility.

MICHIGAN OPERATIONS
 DATE: 2/7/04
 SUPERCEDES: MGATPTMC.5

DOC. NO.: MGATPTMC
 REVISION NO.: 6
 PAGE 3 OF 3

Tape Measure Calibration Certificate

Reference Steel Rule

Brand: Johansson level and tool
 S/N: M6A 00122
 Calibration Date: 9/8/04

Subject Tape Measure

Brand: STANLEY
 S/N: TPM 569
 Calibration Date: 8/29/05

Reference <u>(in)</u> (mm)	Subject Tape Measure	Difference	Reference <u>(in)</u> (mm)	Subject Tape Measure	Difference
0 (0)	0	0	18 (450)	18	0
1 (25)	1	0	19 (475)	19	0
2 (50)	2	0	20 (500)	20	0
3 (75)	3	0	21 (525)	21	0
4 (100)	4	0	22 (550)	22	0
5 (125)	5	0	23 (575)	23	0
6 (150)	6	0	24 (600)	24	0
7 (175)	7	0	25 (625)	25	0
8 (200)	8	0	26 (650)	26	0
9 (225)	9	0	27 (675)	27	0
10 (250)	10	0	28 (700)	28	0
11 (275)	11	0	29 (725)	29	0
12 (300)	12	0	30 (750)	30	0
13 (325)	13	0	31 (775)	31	0
14 (350)	14	0	32 (800)	32	0
15 (375)	15	0	33 (825)	33	0
16 (400)	16	0	34 (850)	34	0
17 (425)	17	0	35 (875)	35	0

If all differences are $\pm 1/32$ of an inch (1 mm), then the tape measure is acceptable.

Pass Fail Maximum Difference = 0

Date: 8-29-05 Performed By: [Signature]

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 0.2\%$.
 All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor k=2.

JH 9/1/05

08/24/05 14:40 FAX 716 685 3886

PCB PIEZOTRONICS

002/00

~ Calibration Certificate ~

Per ISO 18063-21

Model Number: 301M09/484B (394M17 SYSTEM)

Serial Number: 862/2470

Description: ICP® Accelerometer

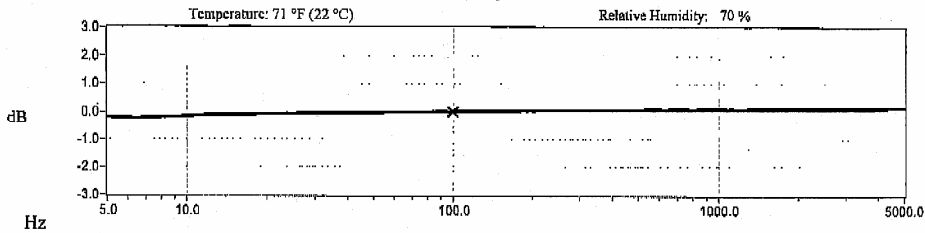
Method: Back-to-Back Comparison Calibration

Manufacturer: PCB

Calibration Data

Sensitivity @ 100.0 Hz	31.05 mV/g	Output Bias	8.6 VDC
	(3.17 mV/m/s ²)	Transverse Sensitivity	3.0 %

Sensitivity



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
5.0	-2.3	REF. FREQ.	0.0	5000.0	1.8
10.0	-1.9	300.0	0.6		
15.0	-1.4	500.0	0.8		
30.0	-0.7	1000.0	1.0		
50.0	-0.4	3000.0	1.4		

Mounting Surface: Stainless Steel w/Silicone Grease Coating Fastener: Std Mount Vertical
 Acceleration Level (msp): 100 g (981 m/s²)
 *The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude: Acceleration Level (g) = 0.010 * (freq)²
 *The gravitational constant used for calculations by the calibration system is: 1 g = 9.80665 m/s².

Condition of Unit

As Found: In Tolerance, No Adjustment Necessary

As Left: In Tolerance

Notes

1. Calibration is NIST Traceable thru Project 822/271196 and PTB Traceable thru Project 5399.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Due to state of the art limitations, the test accuracy ratio is 2:1. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 5-9 Hz; +/- 2.0%, 10-99 Hz; +/- 1.5%, 100-1999 Hz; +/- 1.0%, 2-10 kHz; +/- 2.5%.

Technician: Chuck DiMaggio Date: 06/13/05



3425 Walden Avenue Depew, NY 14043
 TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

~Certificate of Calibration~

Model Number: 484B	N.I.S.T. Project #: F2565002/5UU2VF-2-1/81000539626720012
Serial Number: 2470	Calibration Date: 6/15/2005
Description: Signal Conditioner	Recalibration Date:
Test Procedure: AT-106-1	Calibration Technician: James Higbee 2b <i>JH</i>
Temperature: 70° F	Relative Humidity: 54%

Volts	Current (mA)	Gain*
24.0	3.85	1.000

As Received: In tolerance, no adjustment required.

As Left: In tolerance.

Special Notes:

This document certifies that the equipment referenced above meets published specifications. The calibration procedure is in compliance with ISO 10012-1, and former MIL-STD-45662A and is traceable to NIST. *Measurement uncertainty (95% confidence level w/coverage factor of 2) for scale factors is +/- 0.2%.

This certificate may not be reproduced, except in full, without written approval of PCB Piezotronics, Inc.



3425 Walden Avenue Depew, New York, USA 14043-2495

For any questions concerning this certificate, please call PCB at (716) 684-0001 and ask for an application engineer.

~Certificate of Calibration~

Model Number: 484B	N.I.S.T. Project #: 6720012
Serial Number: 2470	Calibration Date: 05/11/2004
Description: Signal Conditioner	Recalibration Date:
Test Procedure: AT-106-1	Calibration Technician: Chris Vega <i>CV. #36</i>
Temperature: 74° F	Relative Humidity: 42%

<u>TESTS</u>	<u>BEFORE</u>	<u>AFTER</u>
INPUT VOLTAGE ($24 \pm 0.1V$)	24.02	24.02
ICP CURRENT ($4 \pm 0.6mA$)	3.97	3.97
DC OFFSET A.C. MODE (volts)	-.001	-.001
GAIN (REF 1 VRMS, 1kHz)	1.0000	NOT ADJUSTABLE
DRIFT (DC MODE)	< 2mV/min.	NOT ADJUSTABLE
FREQUENCY RESPONSE 10 Vp-p, 1 kHz REFERENCE	FLAT TO 200kHz	NOT ADJUSTABLE

As Received: In tolerance

As Left: In tolerance

Special Notes: MGA Research

This document certifies that the equipment referenced above meets published specifications. The calibration procedure is in compliance with ISO 10012-1, and former MIL-STD-45662A and is traceable to NIST. *Measurement uncertainty (95% confidence level w/coverage factor of 2) for scale factors is +/- 0.2%.

This certificate may not be reproduced, except in full, without written approval of

~ Calibration Certificate ~

Per ISO 18063-21

Model Number: 301M09/484B (394M17 SYSTEM)

Serial Number: 862/2470

Description: ICP® Accelerometer

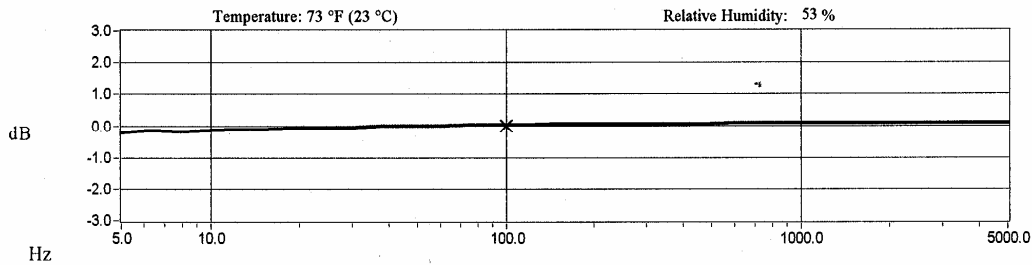
Method: Back-to-Back Comparison Calibration

Manufacturer: PCB

Calibration Data

Sensitivity @ 100.0 Hz **31.17 mV/g** Output Bias 8.6 VDC
 (3.179 mV/m/s²) Transverse Sensitivity 3.0 %

Sensitivity



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
5.0	-2.5	REF. FREQ.	0.0	5000.0	1.1
10.0	-1.9	300.0	0.7		
15.0	-1.4	500.0	0.8		
30.0	-0.6	1000.0	1.0		
50.0	-0.2	3000.0	1.1		

Mounting Surface: Stainless Steel w/Silicone Grease Coating Fastener: Stud Mount Vertical
 Acceleration Level (rms): 10.0 g (98.1 m/s²)
*The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude: Acceleration Level (g) = 0.010 x (Freq).
 *The gravitational constant used for calculations by the calibration system is: 1 g = 9.8066 m/s².

Condition of Unit

As Found: In Tolerance, No Adjustment Necessary

As Left: In Tolerance

Notes

1. Calibration is NIST Traceable thru Project 822/267400 and PTB Traceable thru Project 1055.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 5-9 Hz; +/- 2.0%, 10-99 Hz; +/- 1.5%, 100-1999 Hz; +/- 1.0%, 2-10 kHz; +/- 2.5%.

Technician: Chuck DiMaggio CD Date: 05/13/04



3425 Walden Avenue Depew, NY 14043
 TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

Appendix C
Test Data Plots and Photographs

MGA Test #: DS5199

Sample #: 1

Test Date: 10/18/2005

Seat Type: Front RH 2-Way Manual Seat (w/o Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	108 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	1.0 degrees measured between impact direction and vertical direction
Impactor Type	X	Inverted Pendulum
Head Restraint Type	X	2-Way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

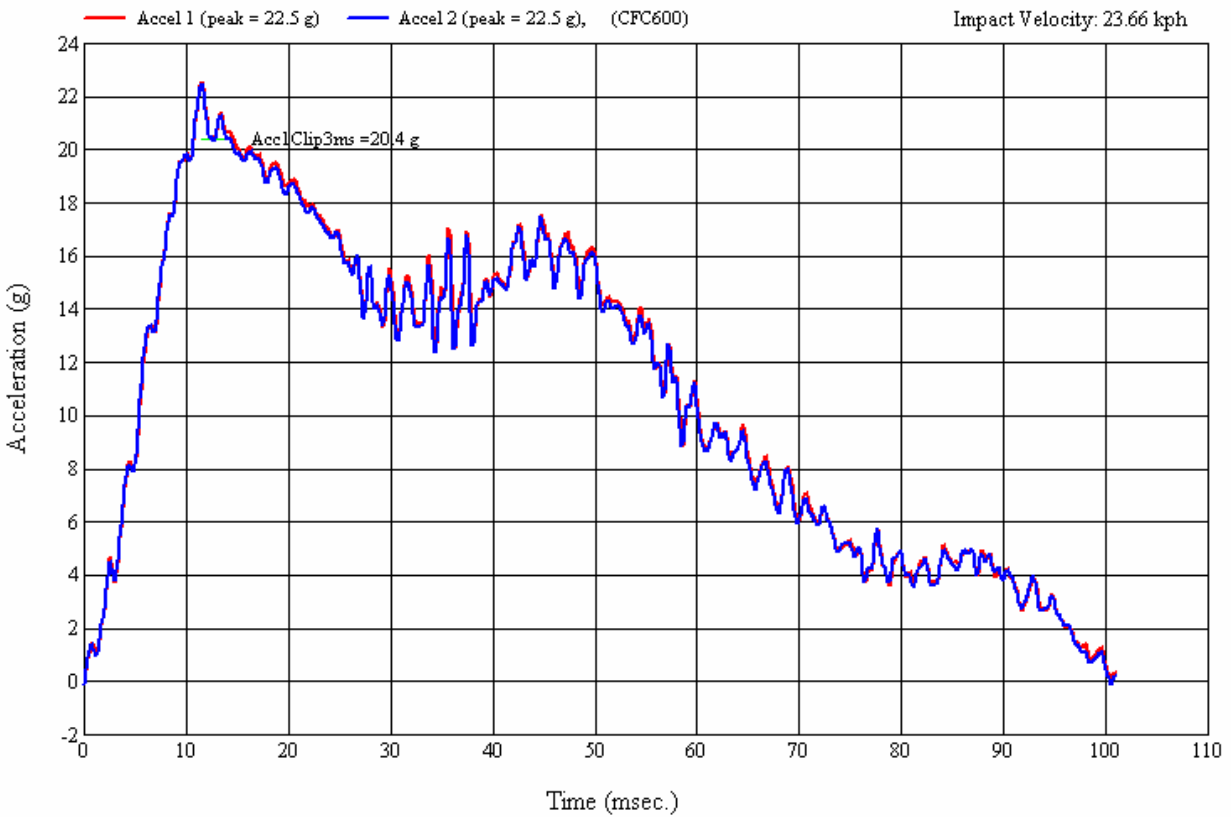


Figure 2 Acceleration History of Test #DS5199

DTNH22-05-P-02098

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA No.: DS5199 TEST DATE: 10/18/05

Seat Location: Front Row Passenger Type of head restraint: 2-way adjustable

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.9°
Seat Back Pivot
Striker to H-Point (mm): x = 162 mm
z = 58 mm Striker to H-Point angle:

Description of equipment or method used to rigidly fix the seat back: N/A for this test

Accelerometer identification: 1. AMWC8
2. J43734 Accelerometer type/brand: Endevco

Last calibration date: 1. 10/13/05
2. 10/13/05

Head form vertical angle (-2° - +2°): 1.0°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.66 kph

Impact location: 108 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 1, Pendulum Impactor
(No Brace)

Seat # 1

Clip 1 = 20.4 g Clip 2 = 20.4 g

Peak 1 = 22.5 g Peak 2 = 22.5 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 10/18/05

APPROVED BY: H. Kaloto



Pre-Test Photo #1 of Test #DS5199



Pre-Test Photo #2 of Test #DS5199



Pre-Test Photo #3 of Test #DS5199



Pre-Test Photo #4 of Test #DS5199



Pre-Test Photo #5 of Test #DS5199



Post-Test Photo #1 of Test #DS5199



Post-Test Photo #2 of Test #DS5199



Post-Test Photo #3 of Test #DS5199

MGA Test #: DS5200

Sample #: 2

Test Date: 10/19/2005

Seat Type: Front RH 2-Way Manual Seat (w/o Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	100 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.2 degrees measured between impact direction and vertical direction
Impactor Type	X	Inverted Pendulum
Head Restraint Type	X	2-Way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

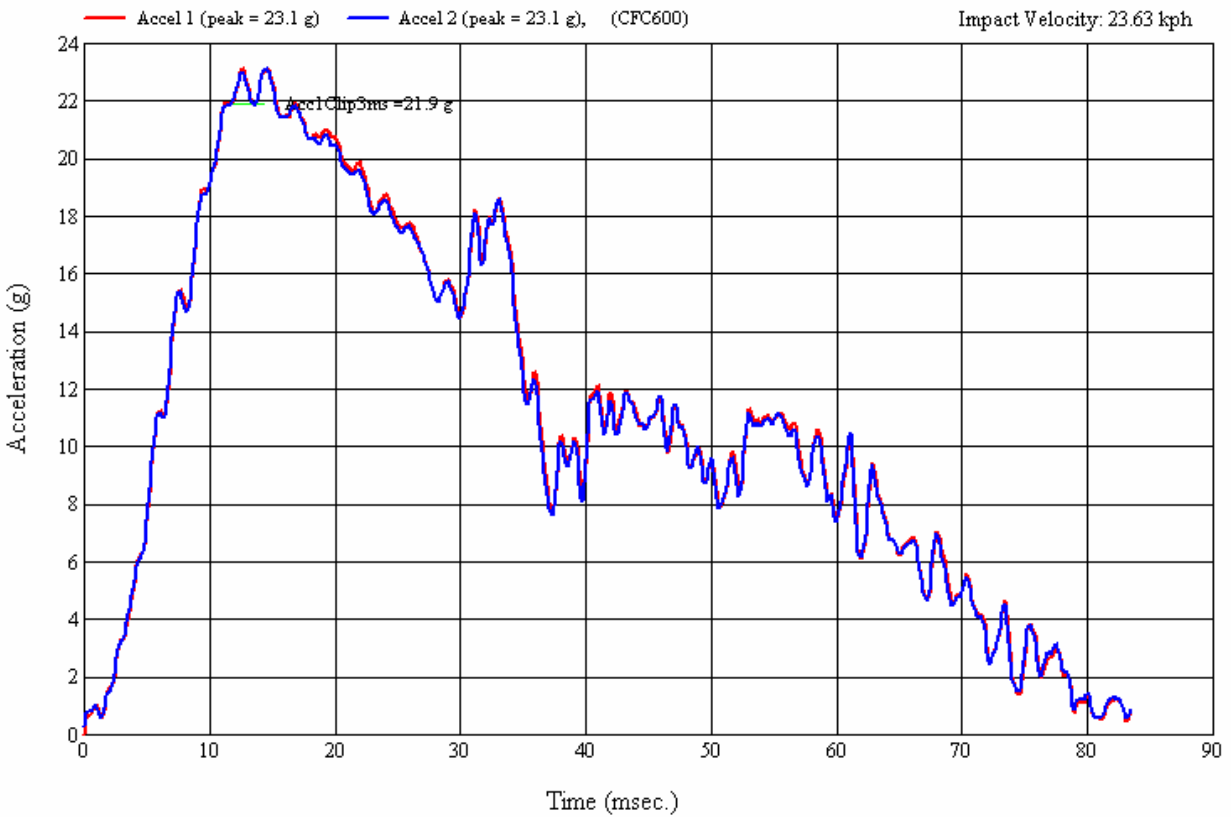


Figure 3 Acceleration History of Test #DS5200

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA NO.: DS5200 TEST DATE: 10/19/05

Seat Location: Front Row Type of head restraint: 2-way adjustable
Passenger

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.7°

Seat Back Pivot
Striker to H-Point (mm): x = 168 mm Striker to H-Point angle:
z = 56 mm

Description of equipment or method used to rigidly fix the seat back: N/A for this test

Accelerometer identification: 1. AMWC8
2. J43734 Accelerometer type/brand: Endevco

Last calibration date: 1. 10/13/05
2. 10/13/05

Head form vertical angle (-2° - +2°): 0.2°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.63 kph

Impact location: 100 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 1, Pendulum Impactor
(No Brace)

Seat #2

Clip 1 = 21.9 g Clip 2 = 21.9 g

Peak 1 = 23.1 g Peak 2 = 23.1 g

No sharp edges or damage evident.
* Recliner appears to have released on I/B side (see video).

RECORDED BY: M. Schick DATE: 10/19/05

APPROVED BY: H. Kalito



Pre-Test Photo #1 of Test #DS5200



Pre-Test Photo #2 of Test #DS5200



Pre-Test Photo #3 of Test #DS5200



Pre-Test Photo #4 of Test #DS5200



Post-Test Photo #1 of Test #DS5200



Post-Test Photo #2 of Test #DS5200



Post-Test Photo #3 of Test #DS5200

MGA Test #: DS5201

Sample #: 3

Test Date: 10/19/2005

Seat Type: Front LH 4-Way Manual Seat (w/o Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster	X	Full down
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar	X	Off
Impact Location	X	103 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.0 degrees measured between impact direction and vertical direction
Impactor Type	X	Inverted Pendulum
Head Restraint Type	X	2-Way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

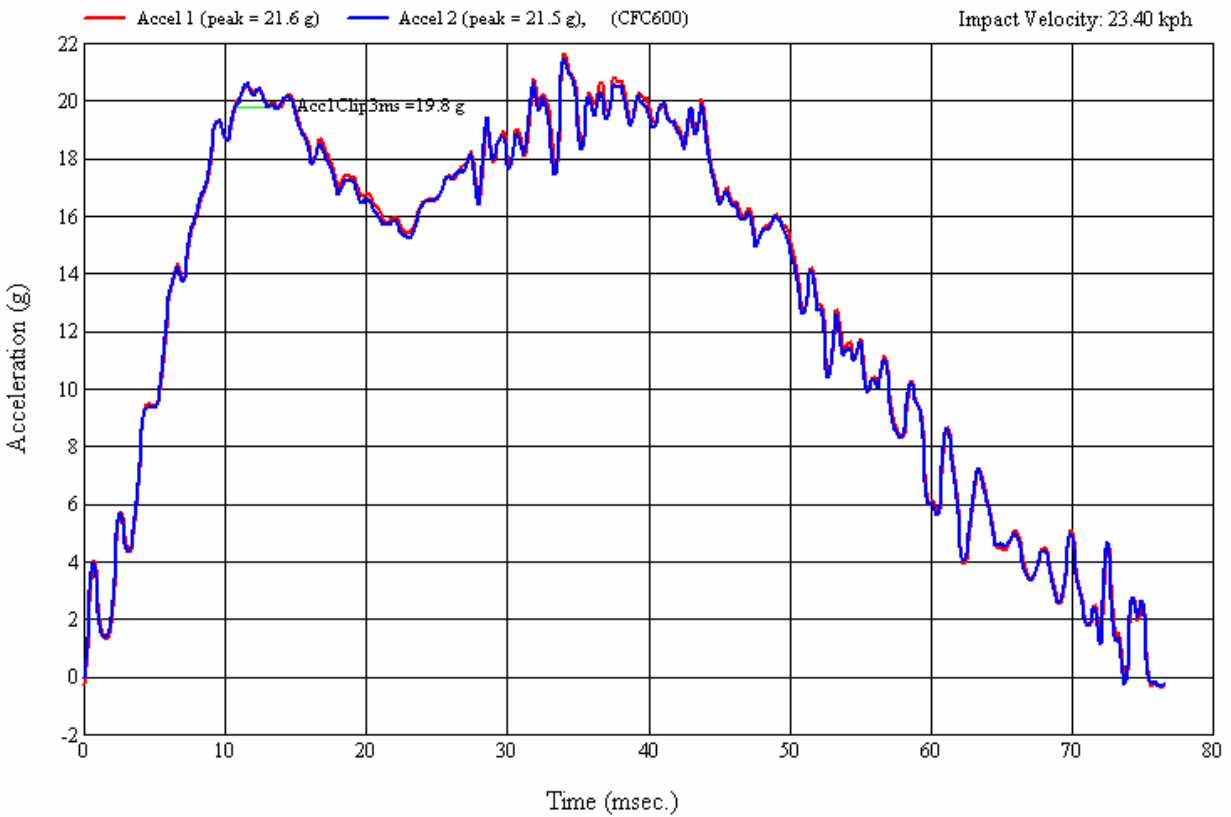


Figure 4 Acceleration History of Test #DS5201

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA NO.: DS5201 TEST DATE: 10/19/05

Seat Location: Front Row Type of head restraint: 2-way adjustable

Driver
635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.7°

Seat Back Pivot
Striker to H-Point (mm): x = 164 mm
z = 69 mm Striker to H-Point angle: _____

Description of equipment or method used to rigidly fix the seat back: N/A for this test

Accelerometer identification: 1. AMW08
2. J43734 Accelerometer type/brand: Endevco

Last calibration date: 1. 10/13/05
2. 10/13/05

Head form vertical angle (-2° - +2°): 0.0°

Distance between head form and target location (> or = 25 mm): _____

Impact velocity (23.6 kph ± 0.5 kph): 23.40 kph

Impact location: 103 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): _____

REMARKS: Test Variation # 1, PASS FAIL
(No Brace)

Seat # 3

Clip 1 = 19.8 g Clip 2 = 19.8 g

Peak 1 = 21.6 g Peak 2 = 21.5 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 10/19/05

APPROVED BY: H. Kalato



Pre-Test Photo #1 of Test #DS5201



Pre-Test Photo #2 of Test #DS5201



Pre-Test Photo #3 of Test #DS5201



Pre-Test Photo #4 of Test #DS5201



Post-Test Photo #1 of Test #DS5201



Post-Test Photo #2 of Test #DS5201



Post-Test Photo #3 of Test #DS5201

MGA Test #: DS5202

Sample #: 4

Test Date: 10/19/2005

Seat Type: Front LH 4-Way Manual Seat (w/Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster	X	Full down
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar	X	Off
Impact Location	X	99 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.5 degrees measured between impact direction and vertical direction
Impactor Type	X	Inverted Pendulum
Head Restraint Type	X	2-Way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

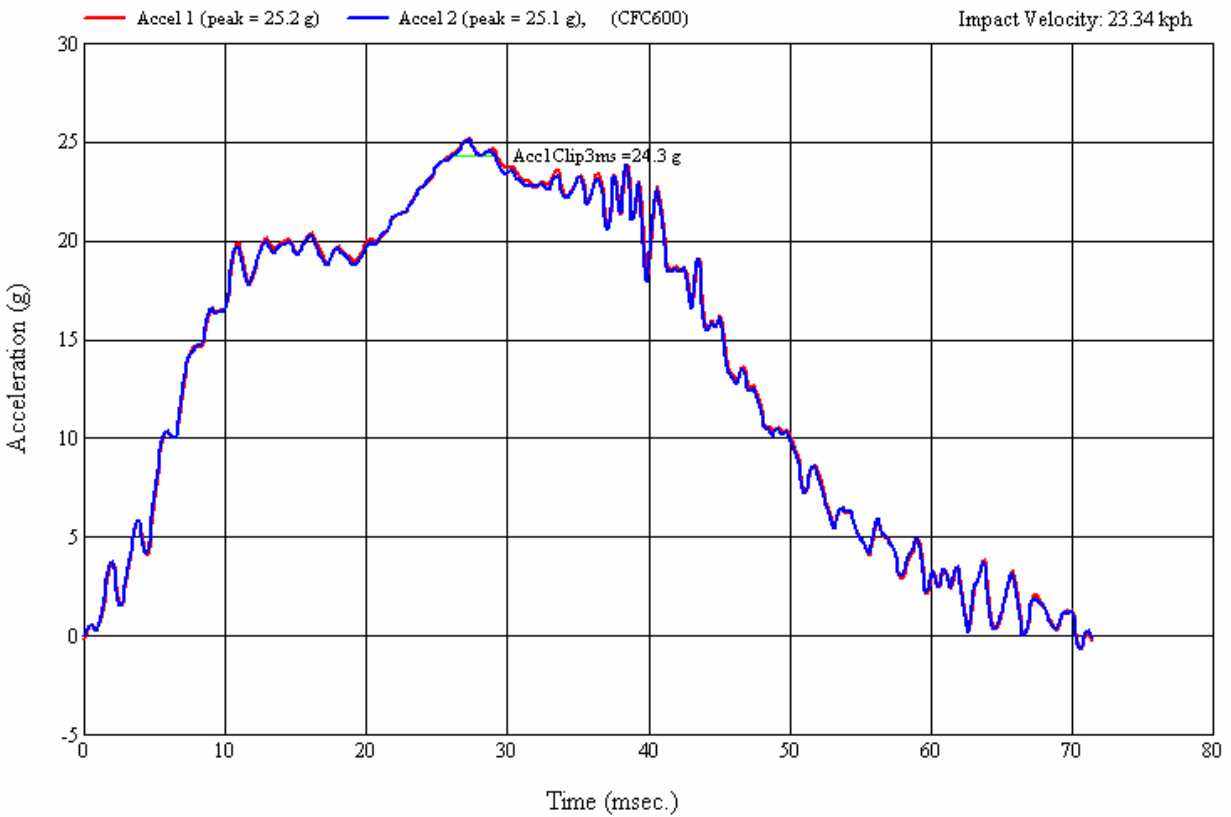


Figure 5 Acceleration History of Test #DS5202

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA NO.: DS5202 TEST DATE: 10/19/05

Seat Location: Front Row Driver Type of head restraint: 2-way adjustable

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 25.7°

Seat Back Pivot
Striker to H-Point (mm): x = 185 mm
z = 70 mm Striker to H-Point angle: _____

Description of equipment or method used to rigidly fix the seat back:

rigid seat back brace (see photos)

Accelerometer identification: 1. AMWC8
2. J43T34 Accelerometer type/brand: Endevco

Last calibration date: 1. 10/13/05
2. 10/13/05

Head form vertical angle (-2° - +2°): 0.5°

Distance between head form and target location (> or = 25 mm): _____

Impact velocity (23.6 kph ± 0.5 kph): 23.34 kph

Impact location: 99 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): _____

REMARKS: Test Variation # 2, PASS FAIL
(w/Brace)

Seat #4

Clip 1 = 24.3 g Clip 2 = 24.3 g

Peak 1 = 25.2 g Peak 2 = 25.1 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 10/19/05

APPROVED BY: H. Kalito



Pre-Test Photo #1 of Test #DS5202



Pre-Test Photo #2 of Test #DS5202



Pre-Test Photo #3 of Test #DS5202



Pre-Test Photo #4 of Test #DS5202



Post-Test Photo #1 of Test #DS5202



Post-Test Photo #2 of Test #DS5202



Post-Test Photo #3 of Test #DS5202



Post-Test Photo #4 of Test #DS5202

MGA Test #: DS5203

Sample #: 5

Test Date: 10/19/2005

Seat Type: Front LH 4-Way Manual Seat (w/Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster	X	Full down
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar	X	Off
Impact Location	X	108 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.2 degrees measured between impact direction and vertical direction
Impactor Type	X	Inverted Pendulum
Head Restraint Type	X	2-Way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

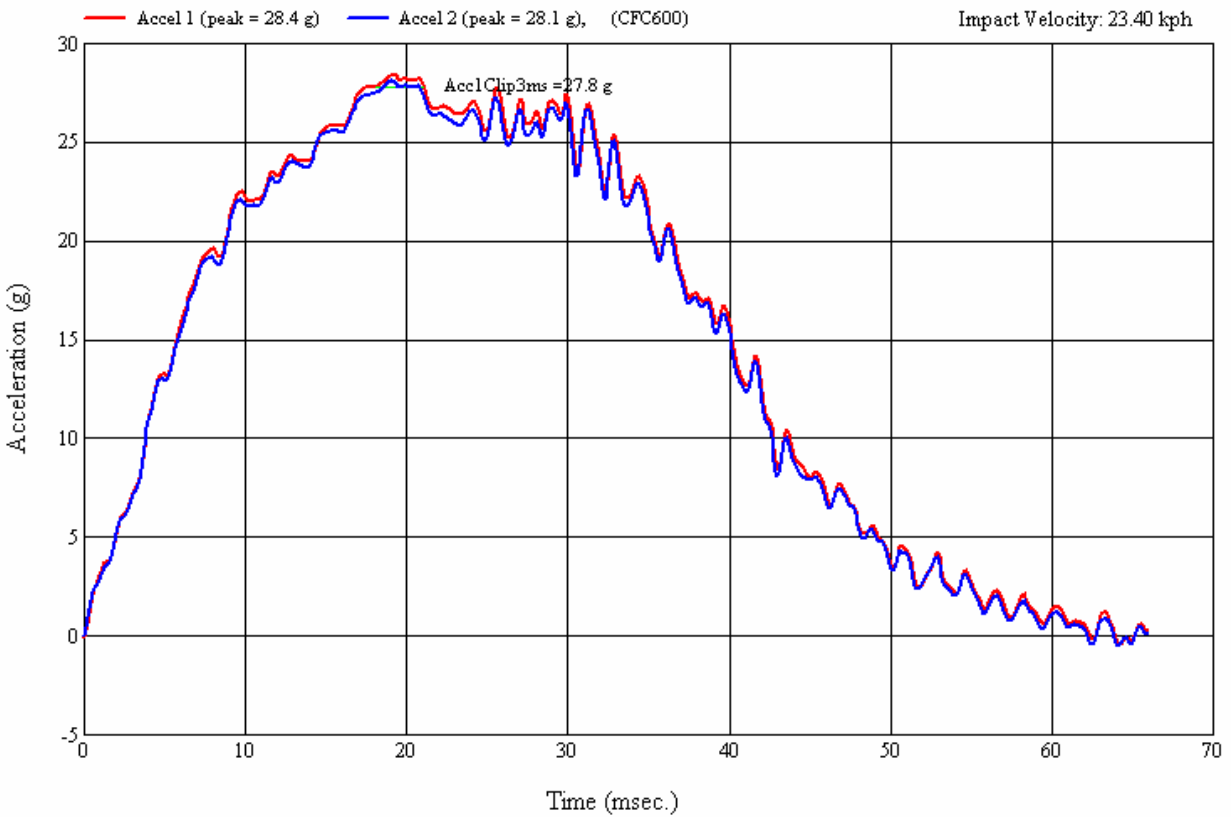


Figure 6 Acceleration History of Test #DS5203

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA No.: DS5203 TEST DATE: 10/19/05

Seat Location: Front Row Type of head restraint: 2-way adjustable
Driver

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 25.0°

Seat Back Pivot
Striker to H-Point (mm): x = 182 mm Striker to H-Point angle:
z = 71 mm

Description of equipment or method used to rigidly fix the seat back:
rigid seat back brace (see photos)

Accelerometer identification: 1. AMWC8 Accelerometer type/brand: Endevco
2. 343734

Last calibration date: 1. 10/13/05
2. 10/13/05

Head form vertical angle (-2° - +2°): 0.2°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.40 kph

Impact location: 108 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)):

PASS FAIL

REMARKS: Test Variation # 2, Pendulum Impactor
(w/ Brace)

Seat # 5

Clip 1 = 27.8 g Clip 2 = 27.5 g

Peak 1 = 28.4 g Peak 2 = 28.1 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 10/19/05

APPROVED BY: H. Kalisto



Pre-Test Photo #1 of Test #DS5203



Pre-Test Photo #2 of Test #DS5203



Pre-Test Photo #3 of Test #DS5203



Pre-Test Photo #4 of Test #DS5203



Post-Test Photo #1 of Test #DS5203



Post-Test Photo #2 of Test #DS5203



Post-Test Photo #3 of Test #DS5203

MGA Test #: DS5204

Sample #: 6

Test Date: 10/20/2005

Seat Type: Front LH 4-Way Manual Seat (w/Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster	X	Full down
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar	X	Off
Impact Location	X	94 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.5 degrees measured between impact direction and vertical direction
Impactor Type	X	Inverted Pendulum
Head Restraint Type	X	2-Way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

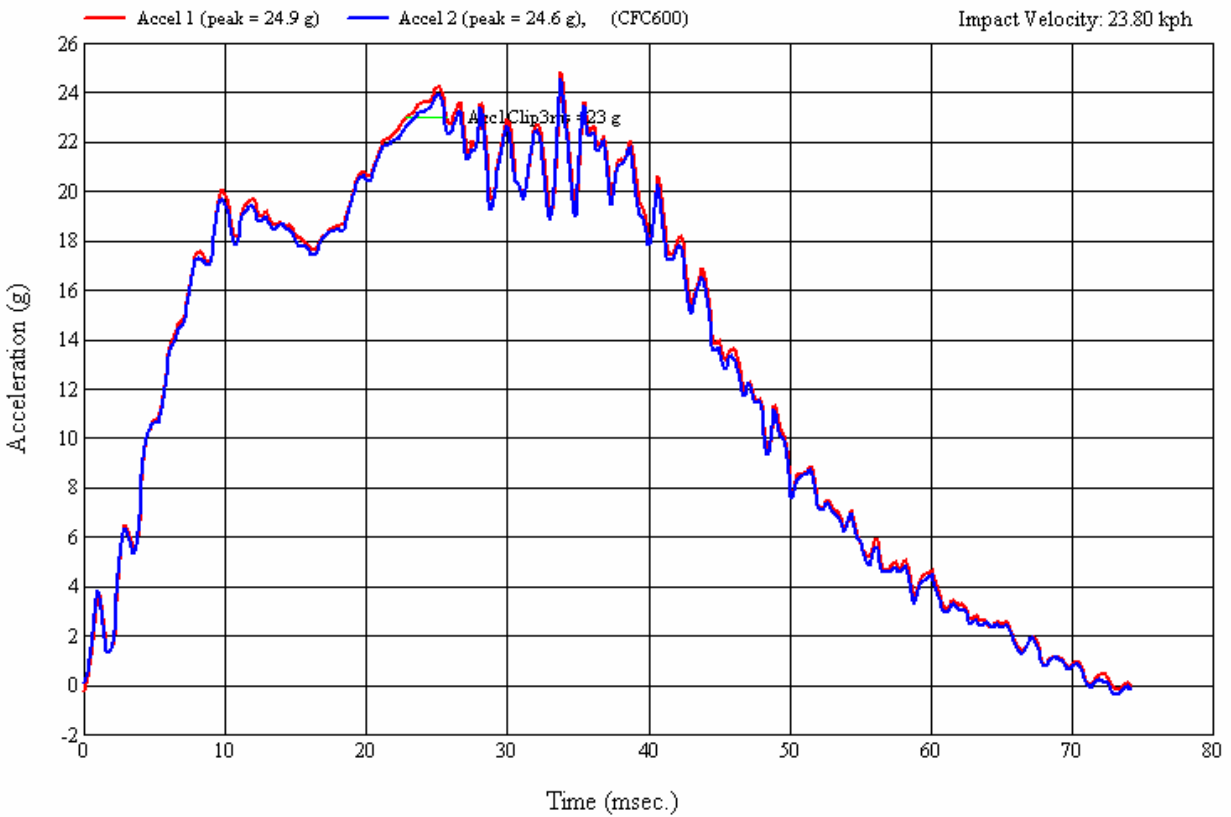


Figure 7 Acceleration History of Test #DS5204

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test #
VEH. NHTSA NO.: DS5204 TEST DATE: 10/20/05

Seat Location: Front Row Type of head restraint: 2-way adjustable
Driver

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 25.2°
Seat Back Pivot
Striker to H-Point (mm): x = 178 mm Striker to H-Point angle:
z = 50 mm

Description of equipment or method used to rigidly fix the seat back:

rigid seat back brace (see photos)

Accelerometer identification: 1. AMW08
2. J43734 Accelerometer type/brand: Endevco

Last calibration date: 1. 10/13/05
2. 10/13/05

Head form vertical angle (-2° - +2°): 0.9°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.80 kph

Impact location: 94 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)):

PASS FAIL

REMARKS: Test Variation # 2, Pendulum Impactor
(w/ Brace)

Seat # 6

Clip 1 = 23.0 g Clip 2 = 22.6 g

Peak 1 = 24.9 g Peak 2 = 24.6 g

No sharp edges or damage evident.

RECORDED BY: M. Schick

DATE: 10/20/05

APPROVED BY: H. Kalito



Pre-Test Photo #1 of Test #DS5204



Pre-Test Photo #2 of Test #DS5204



Pre-Test Photo #3 of Test #DS5204



Pre-Test Photo #4 of Test #DS5204



Post-Test Photo #1 of Test #DS5204



Post-Test Photo #2 of Test #DS5204



Post-Test Photo #3 of Test #DS5204

MGA Test #: DS5192

Sample #: 7

Test Date: 9/27/2005

Seat Type: Front RH 2-Way Manual Seat (w/o Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	108 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.0 degrees measured between impact direction and horizontal direction
Impactor Type	X	Linear
Head Restraint Type	X	2-way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

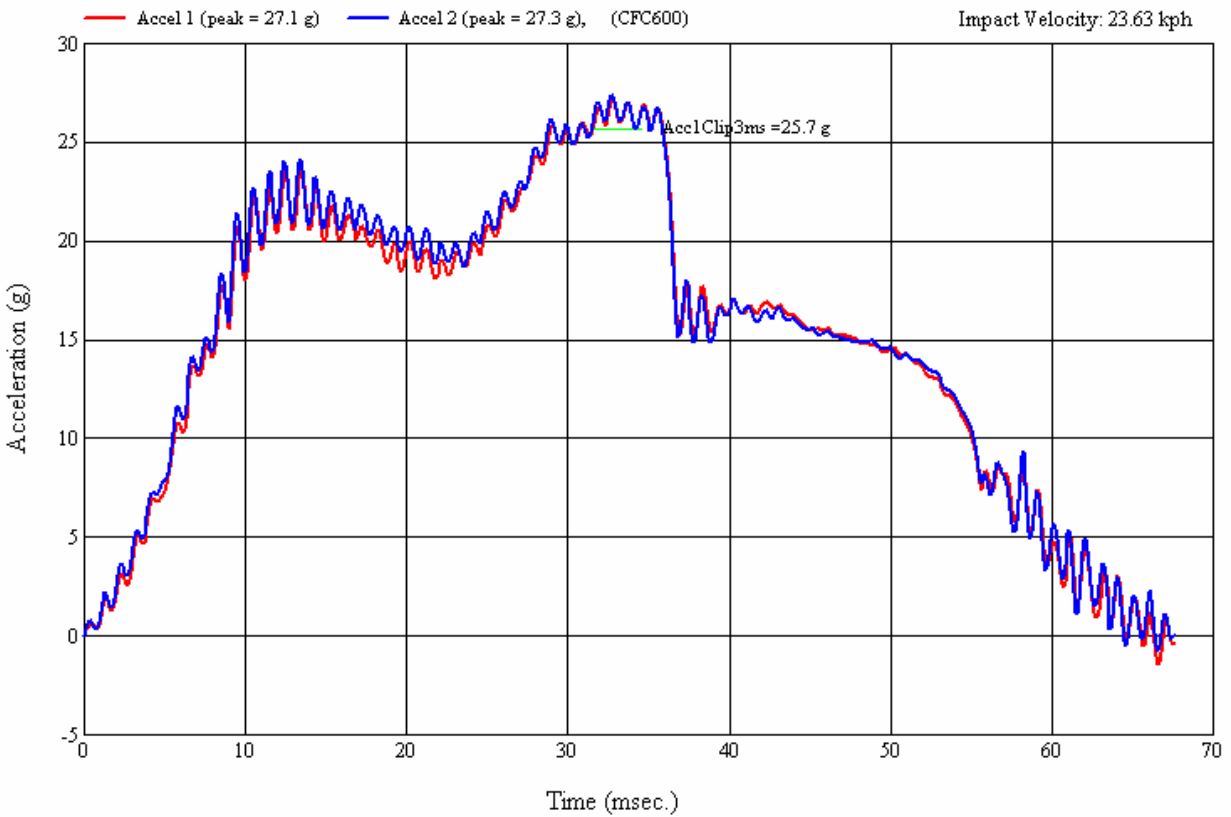


Figure 8 Acceleration History of Test #DS5192

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test #
VEH. NHTSA NO.: DS5192 TEST DATE: 9/27/05

Seat Location: Front Row Passenger Type of head restraint: 2-way adjustable

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.5°
Seat Back Pivot
Striker to H-Point (mm): x = 166 mm
z = 49 mm Striker to H-Point angle:

Description of equipment or method used to rigidly fix the seat back: N/A for this test

Accelerometer identification: 1. J22649
2. G03-N16 Accelerometer type/brand: Endevco

Last calibration date: 1. 4/14/05
2. 4/28/05 Entran

Head form vertical angle (-2° - +2°): 0.0°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.63 kph

Impact location: 108 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)):

PASS FAIL

REMARKS: Test Variation # 3, Linear Impactor
(No Brace)

Seat # 7

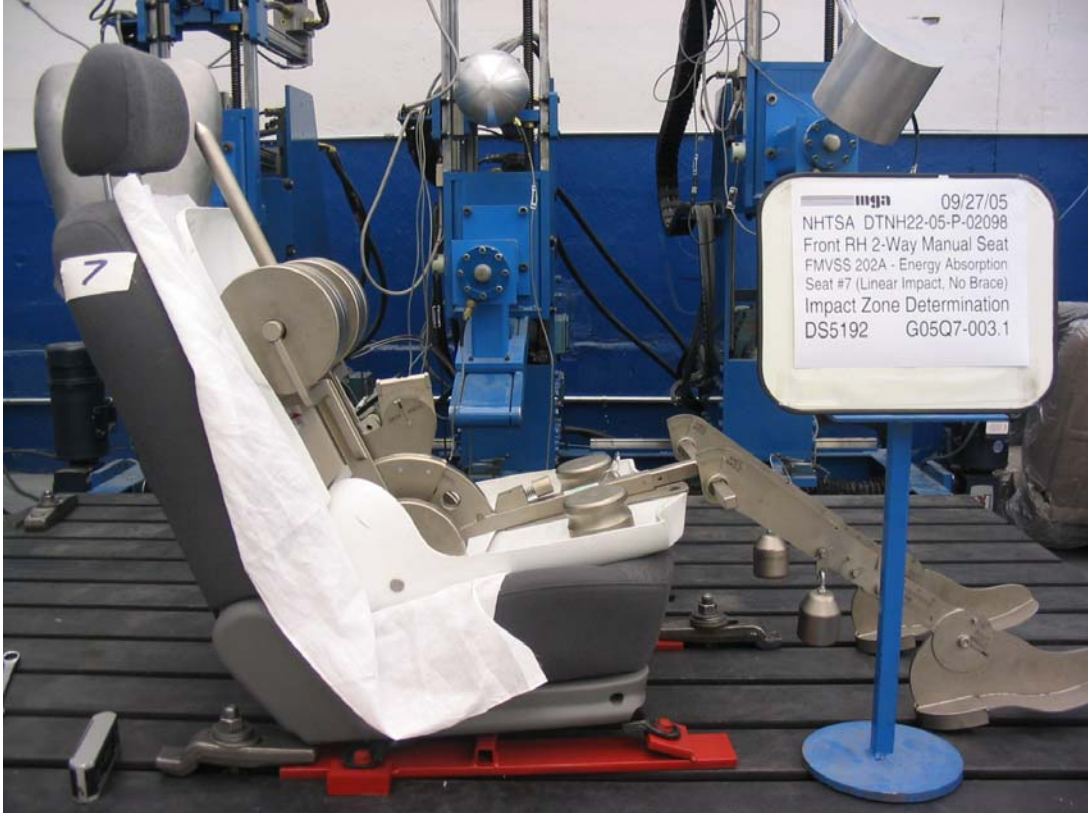
Clip 1 = 25.7 g Clip 2 = 25.6 g

Peak 1 = 27.1 g Peak 2 = 27.3 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 9/27/05

APPROVED BY: H. Keleto



Pre-Test Photo #1 of Test #DS5192



Pre-Test Photo #2 of Test #DS5192



Pre-Test Photo #3 of Test #DS5192



Pre-Test Photo #4 of Test #DS5192



Post-Test Photo #1 of Test #DS5192



Post-Test Photo #2 of Test #DS5192



Post-Test Photo #3 of Test #DS5192

MGA Test #: DS5193

Sample #: 8

Test Date: 9/27/2005

Seat Type: Front RH 2-Way Manual Seat (w/o Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	109 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.1 degrees measured between impact direction and horizontal direction
Impactor Type	X	Linear
Head Restraint Type	X	2-way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

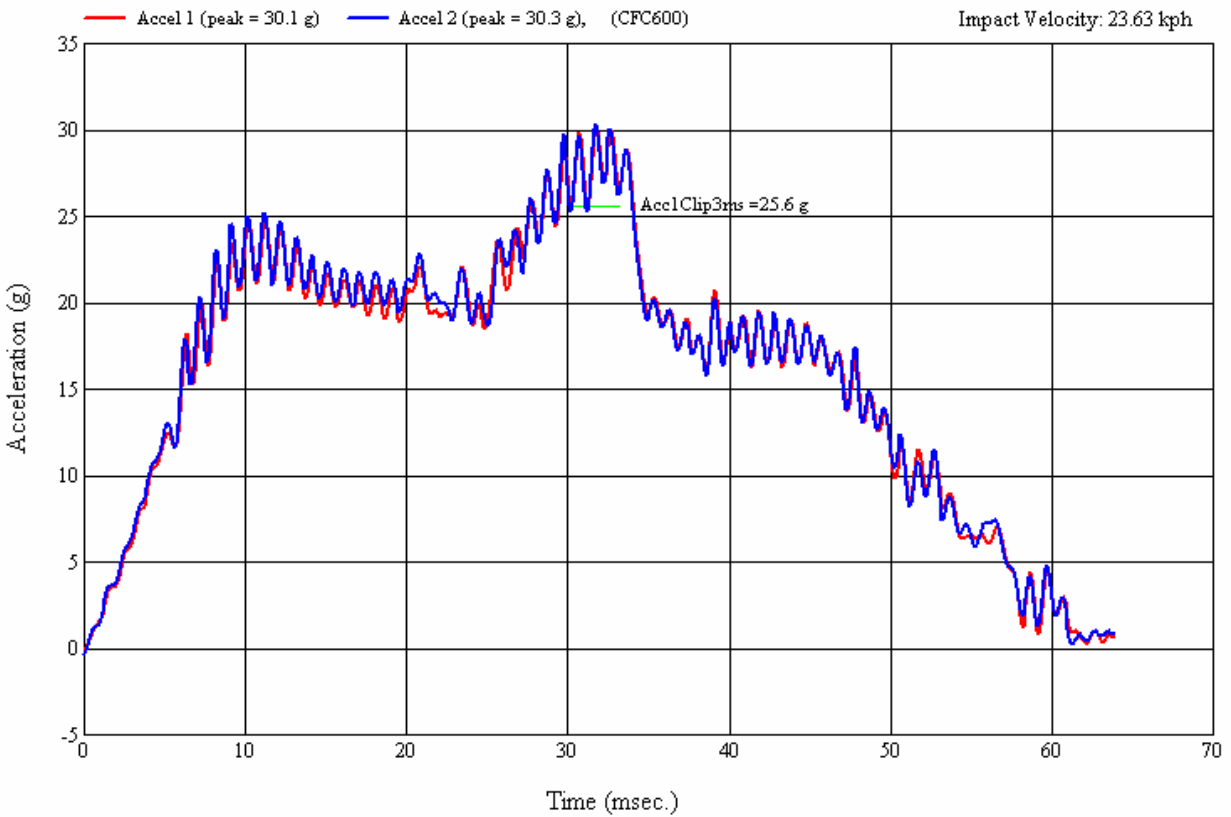


Figure 9 Acceleration History of Test #DS5193

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA NO.: DS5193 TEST DATE: 9/27/05

Seat Location: Front Row Type of head restraint: 2-way adjustable
Passenger

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.9°

Seat Back Pivot
Striker to H-Point (mm): x = 168 mm Striker to H-Point angle:
z = 51 mm

Description of equipment or method used to rigidly fix the seat back: N/A for this test

Accelerometer identification: 1. J22649 Accelerometer type/brand: Endevco
2. 403-N16 Entran

Last calibration date: 1. 4/14/05
2. 4/28/05

Head form vertical angle (-2° - +2°): 0.1°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.63 kph

Impact location: 109 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 3, Linear Impactor
(No Brace)

Seat # 8

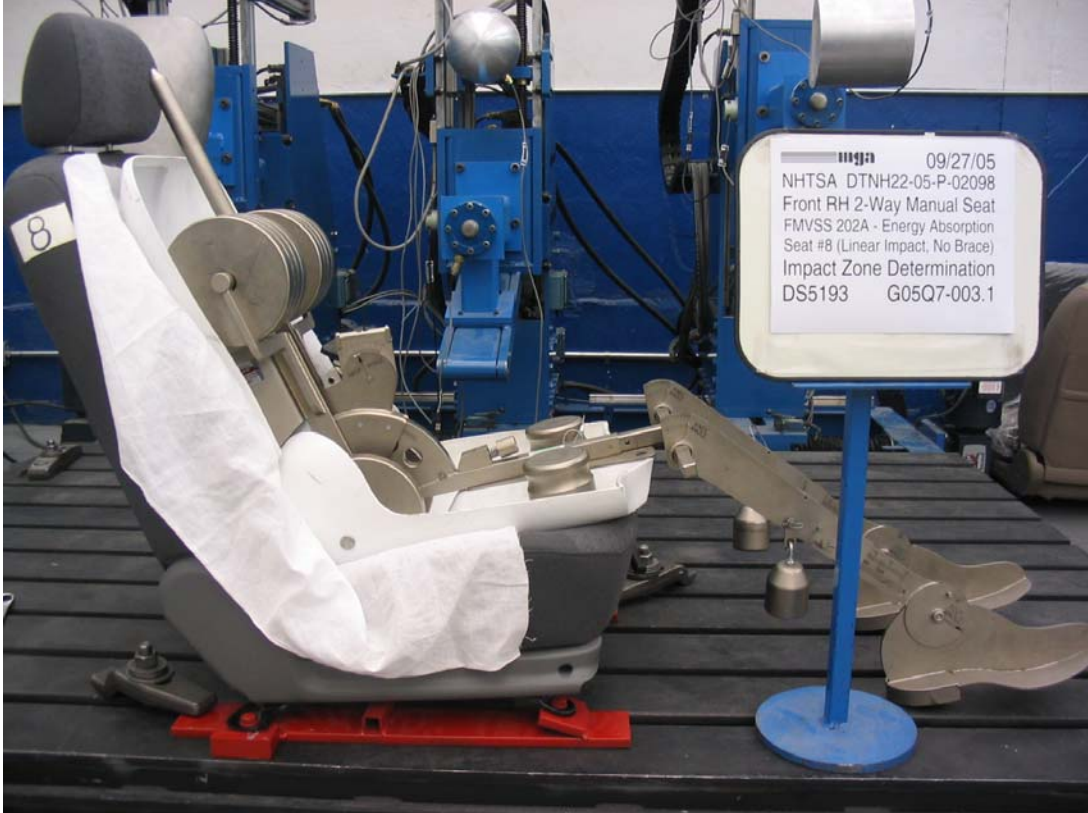
Clip 1 = 25.6 g Clip 2 = 25.4 g

Peak 1 = 30.1 g Peak 2 = 30.3 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 9/27/05

APPROVED BY: H. Keeto



Pre-Test Photo #1 of Test #DS5193



Pre-Test Photo #2 of Test #DS5193



Pre-Test Photo #3 of Test #DS5193



Pre-Test Photo #4 of Test #DS5193



Post-Test Photo #1 of Test #DS5193



Post-Test Photo #2 of Test #DS5193



Post-Test Photo #3 of Test #DS5193



Post-Test Photo #4 of Test #DS5193

MGA Test #: DS5194

Sample #: 9

Test Date: 9/28/2005

Seat Type: Front RH 2-Way Manual Seat (w/o Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	103 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.3 degrees measured between impact direction and horizontal direction
Impactor Type	X	Linear
Head Restraint Type	X	2-way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

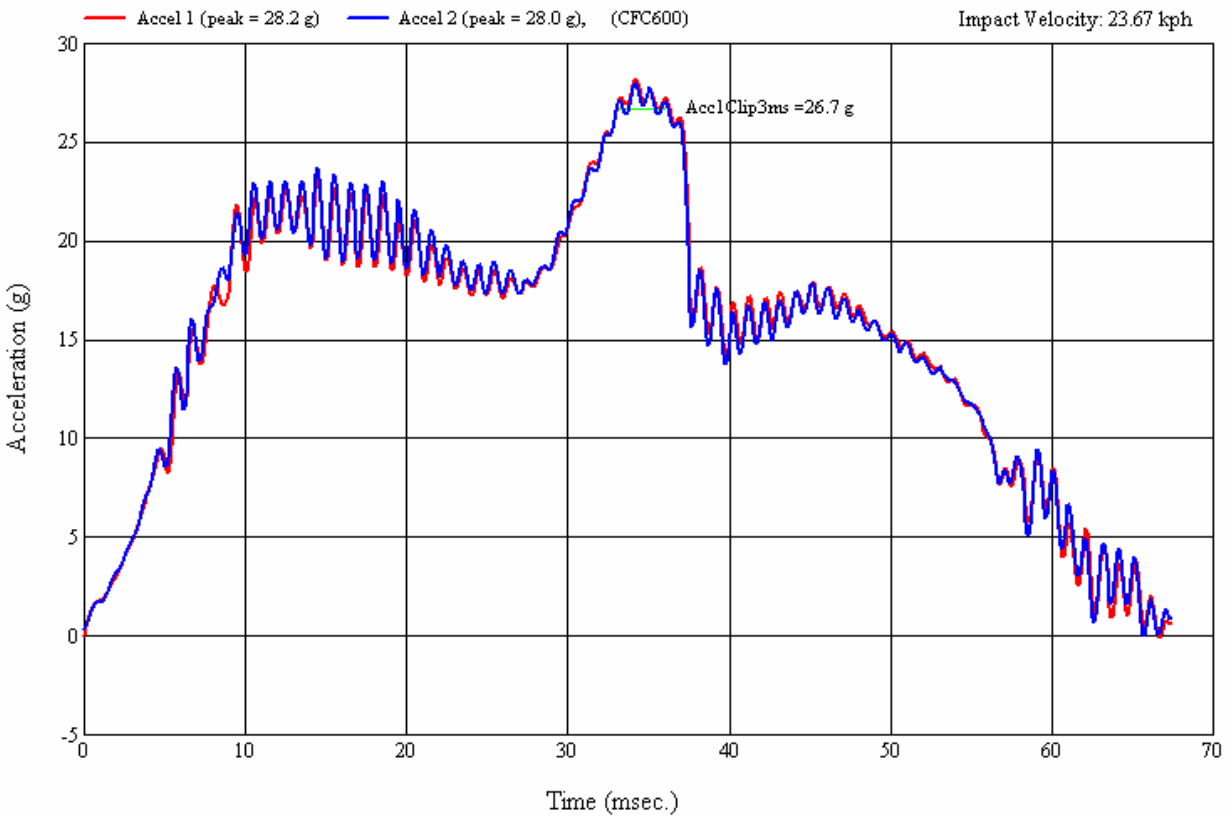


Figure 10 Acceleration History of Test #DS5194

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA NO.: DS5194 TEST DATE: 9/27/05

Seat Location: Front Row Passenger Type of head restraint: 2-way adjustable

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 25.8°

Seat Back Pivot Striker to H-Point (mm): x = 165 mm Striker to H-Point angle: _____
z = 58 mm

Description of equipment or method used to rigidly fix the seat back: N/A for this test

Accelerometer identification: 1. J22649 Accelerometer type/brand: Endevco
2. G03-N16 Entran

Last calibration date: 1. 4/14/05
2. 4/28/05

Head form vertical angle (-2° - +2°): 0.3°

Distance between head form and target location (> or = 25 mm): _____

Impact velocity (23.6 kph ± 0.5 kph): 23.67 kph

Impact location: 103 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 3, Linear Impactor (No Brace)

Seat # 9

Clip 1 = 26.7 g Clip 2 = 26.4 g

Peak 1 = 28.2 g Peak 2 = 28.0 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 9/28/05

APPROVED BY: H. Kaloto



Pre-Test Photo #1 of Test #DS5194



Pre-Test Photo #2 of Test #DS5194



Pre-Test Photo #3 of Test #DS5194



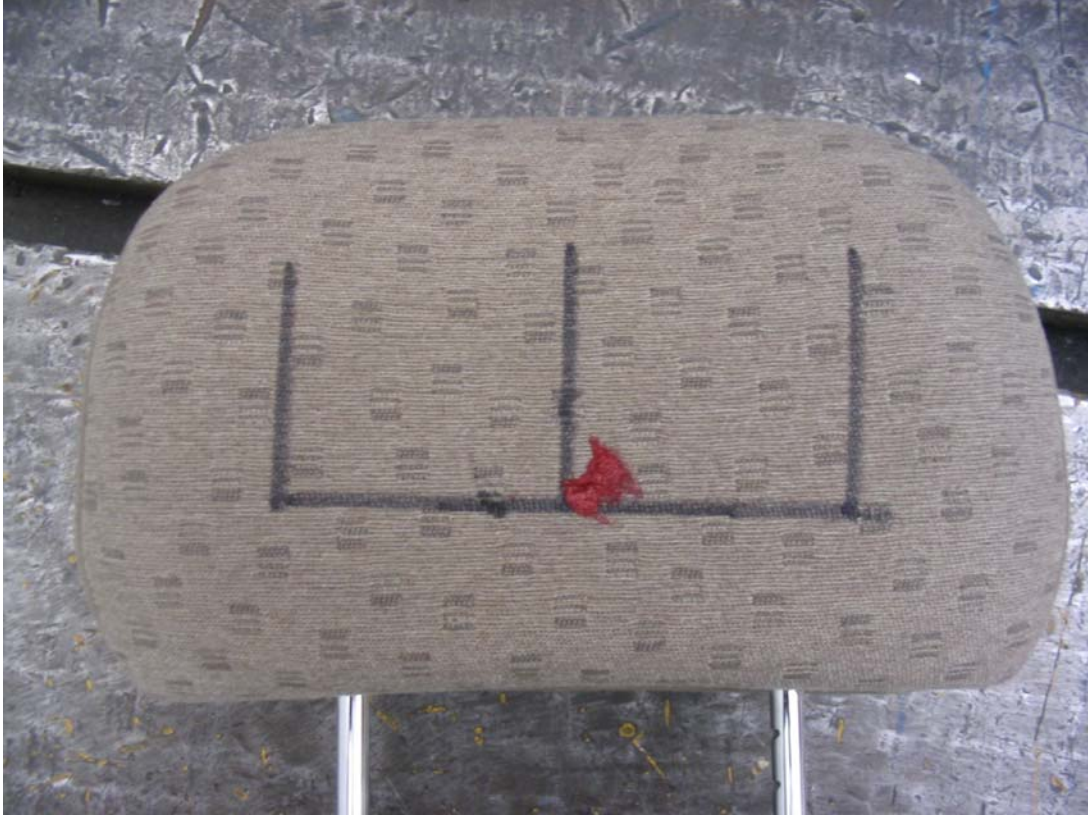
Pre-Test Photo #4 of Test #DS5194



Post-Test Photo #1 of Test #DS5194



Post-Test Photo #2 of Test #DS5194



Post-Test Photo #3 of Test #DS5194



Post-Test Photo #4 of Test #DS5194

MGA Test #: DS5195

Sample #: 10

Test Date: 9/28/2005

Seat Type: Front RH 2-Way Manual Seat (w/Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	101 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.1 degrees measured between impact direction and horizontal direction
Impactor Type	X	Linear
Head Restraint Type	X	2-way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

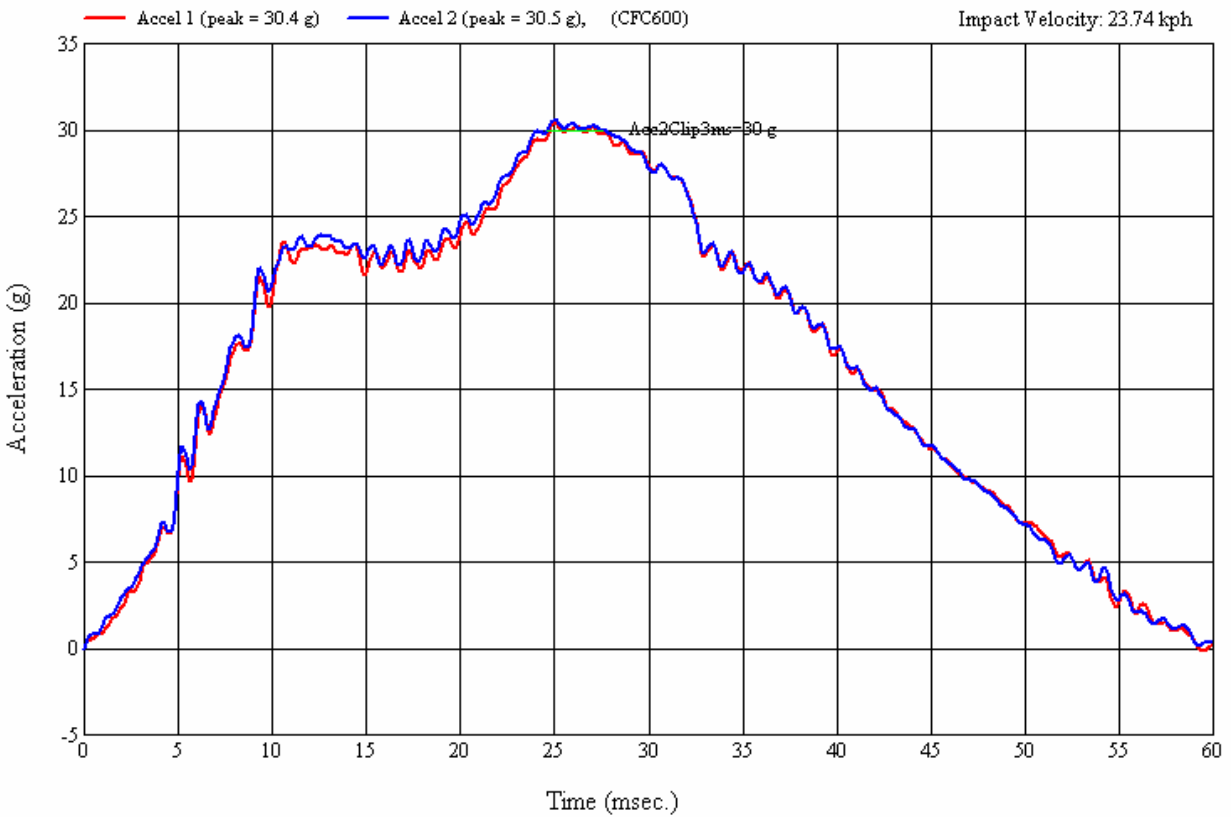


Figure 11 Acceleration History of Test #DS5195

DTNH22-05-P-02098

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test #
VEH. NHTSA NO.: DS5195 TEST DATE: 9/28/05

Seat Location: Front Row Type of head-restraint: 2-way adjustable
Passenger

635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.8°

Seat Back Pivot
Striker to H-Point (mm): x = 168 mm Striker to H-Point angle:
z = 55 mm

Description of equipment or method used to rigidly fix the seat back:

Seat back brace (see photos)

Accelerometer identification: 1. J22649 Accelerometer type/brand: Endevco
2. G03-N16 Entran

Last calibration date: 1. 4/14/05
2. 4/28/05

Head form vertical angle (-2° - +2°): 0.1°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.74 kph

Impact location: 101 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 4, Linear Impactor
(w/Brace)

Seat # 10

Clip 1 = 29.7 g Clip 2 = 30.0 g

Peak 1 = 30.4 g Peak 2 = 30.5 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 9/28/05

APPROVED BY: H. Kalto



Pre-Test Photo #1 of Test #DS5195



Pre-Test Photo #2 of Test #DS5195



Pre-Test Photo #3 of Test #DS5195



Pre-Test Photo #4 of Test #DS5195



Post-Test Photo #1 of Test #DS5195



Post-Test Photo #2 of Test #DS5195



Post-Test Photo #3 of Test #DS5195

MGA Test #: DS5196

Sample #: 11

Test Date: 9/28/2005

Seat Type: Front RH 2-Way Manual Seat (w/Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	103 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.1 degrees measured between impact direction and horizontal direction
Impactor Type	X	Linear
Head Restraint Type	X	2-way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

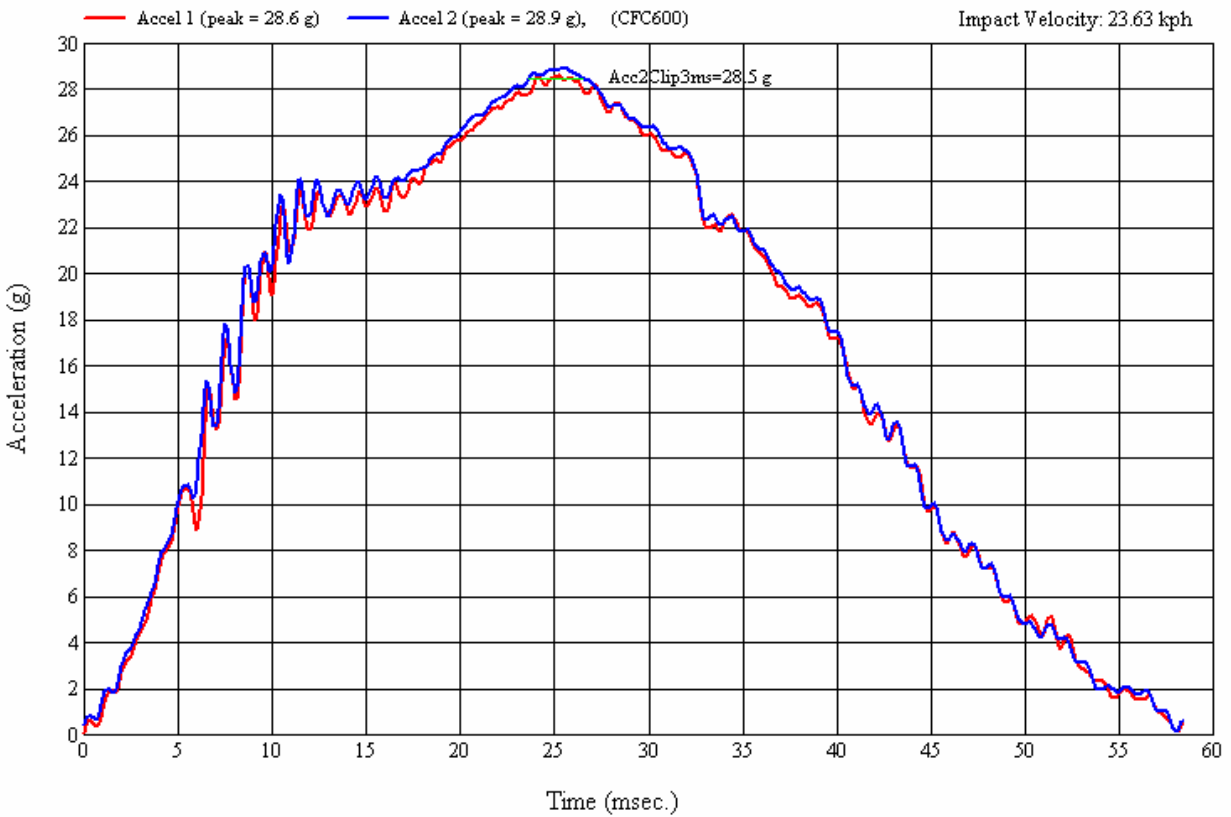


Figure 12 Acceleration History of Test #DS5196

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test # _____
VEH. NHTSA NO.: DS5196 TEST DATE: 9/28/05

Seat Location: Front Row Passenger Type of head restraint: 2-way adjustable
635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 24.3°
Seat Back Pivot Striker to H-Point (mm): X = 162 mm
Z = 60 mm Striker to H-Point angle: _____

Description of equipment or method used to rigidly fix the seat back:
Seat back brace (see photos)

Accelerometer identification: 1. J22649
2. G03-N16 Accelerometer type/brand: Endevco

Last calibration date: 1. 4/14/05
2. 4/28/05 Entran

Head form vertical angle (-2° - +2°): 0.1°

Distance between head form and target location (> or = 25 mm): _____

Impact velocity (23.6 kph ± 0.5 kph): 23.63 kph

Impact location: 103 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 4, Linear Impactor (w/Brace)

Seat # 11

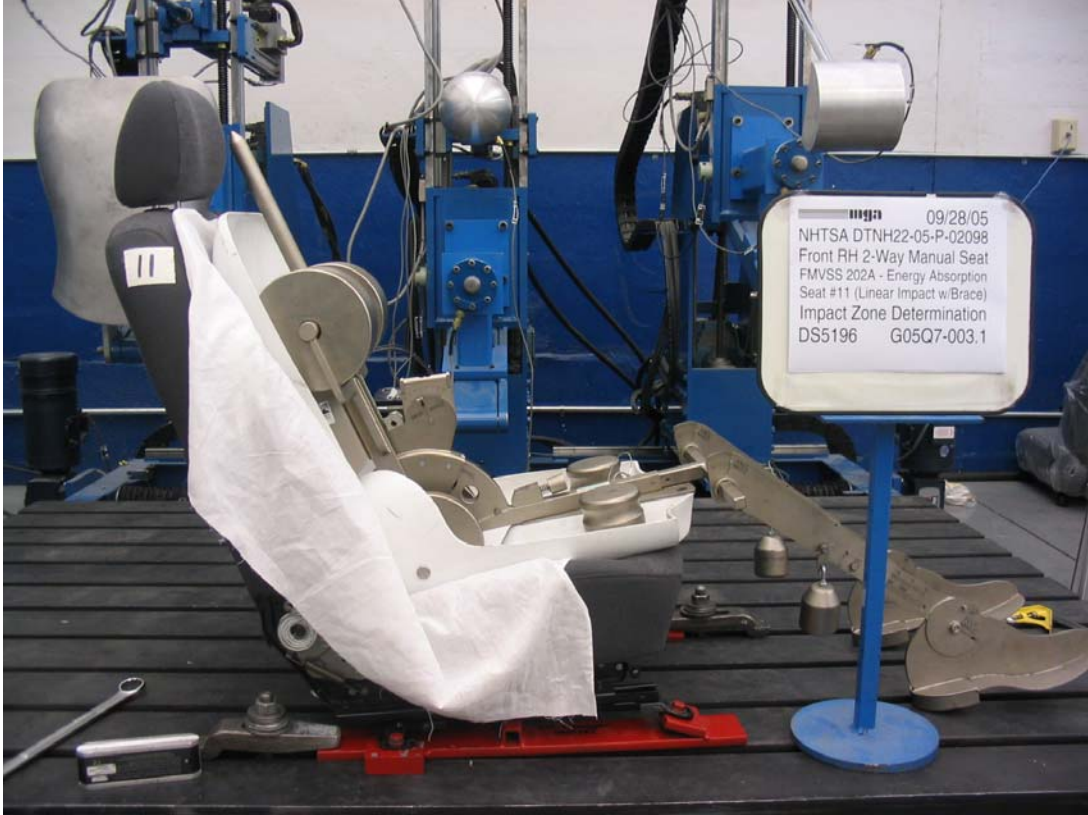
Clip 1 = 27.9 g Clip 2 = 28.5 g

Peak 1 = 28.6 g Peak 2 = 28.9 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 9/28/05

APPROVED BY: H. Kaloto



Pre-Test Photo #1 of Test #DS5196



Pre-Test Photo #2 of Test #DS5196



Pre-Test Photo #3 of Test #DS5196



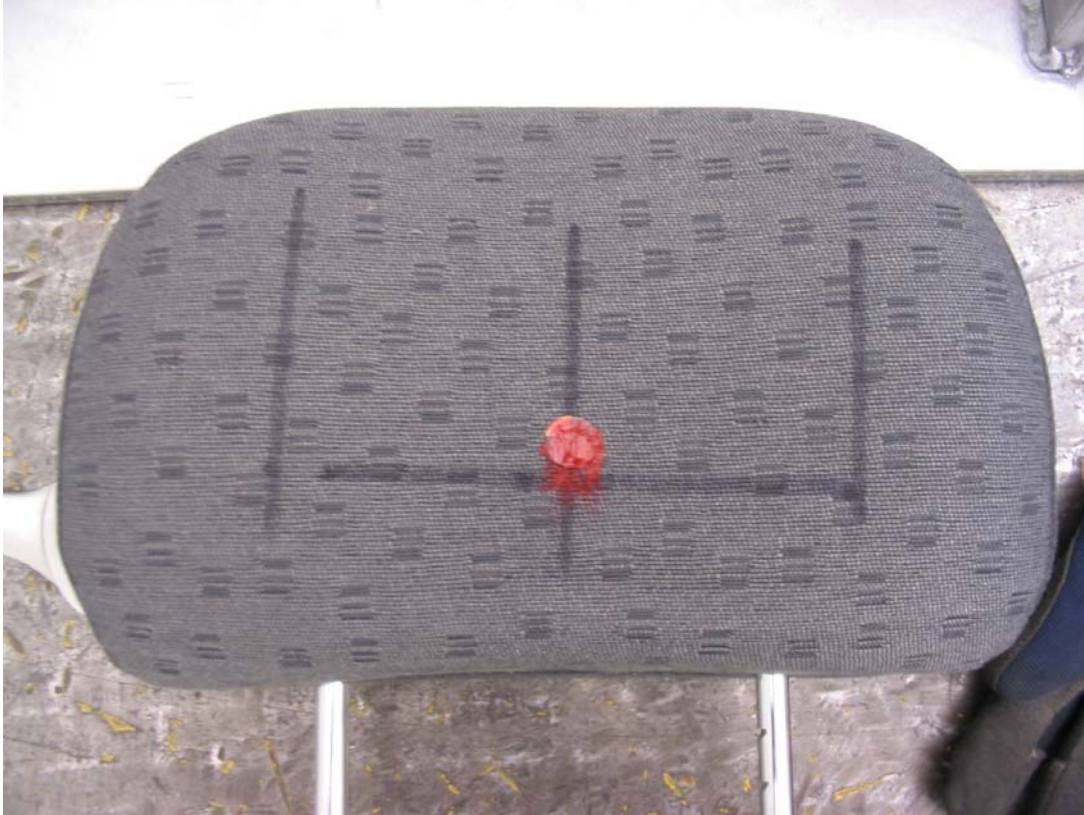
Pre-Test Photo #4 of Test #DS5196



Post-Test Photo #1 of Test #DS5196



Post-Test Photo #2 of Test #DS5196



Post-Test Photo #3 of Test #DS5196

MGA Test #: DS5197

Sample #: 12

Test Date: 9/28/2005

Seat Type: Front RH 2-Way Manual Seat (w/Brace)		
Seat Function		Test Position
Fore/Aft Tracks	X	Full rearward
Vertical Adjuster		
Seat Back Recliner	X	5.5° measured on H/R posts
Lumbar		
Impact Location	X	103 mm vertically below the top of the H/R on the vertical centerline
Impact Angle	X	0.1 degrees measured between impact direction and horizontal direction
Impactor Type	X	Linear
Head Restraint Type	X	2-way adjustable
Head Restraint Position	X	Full down (lowest locking notch)

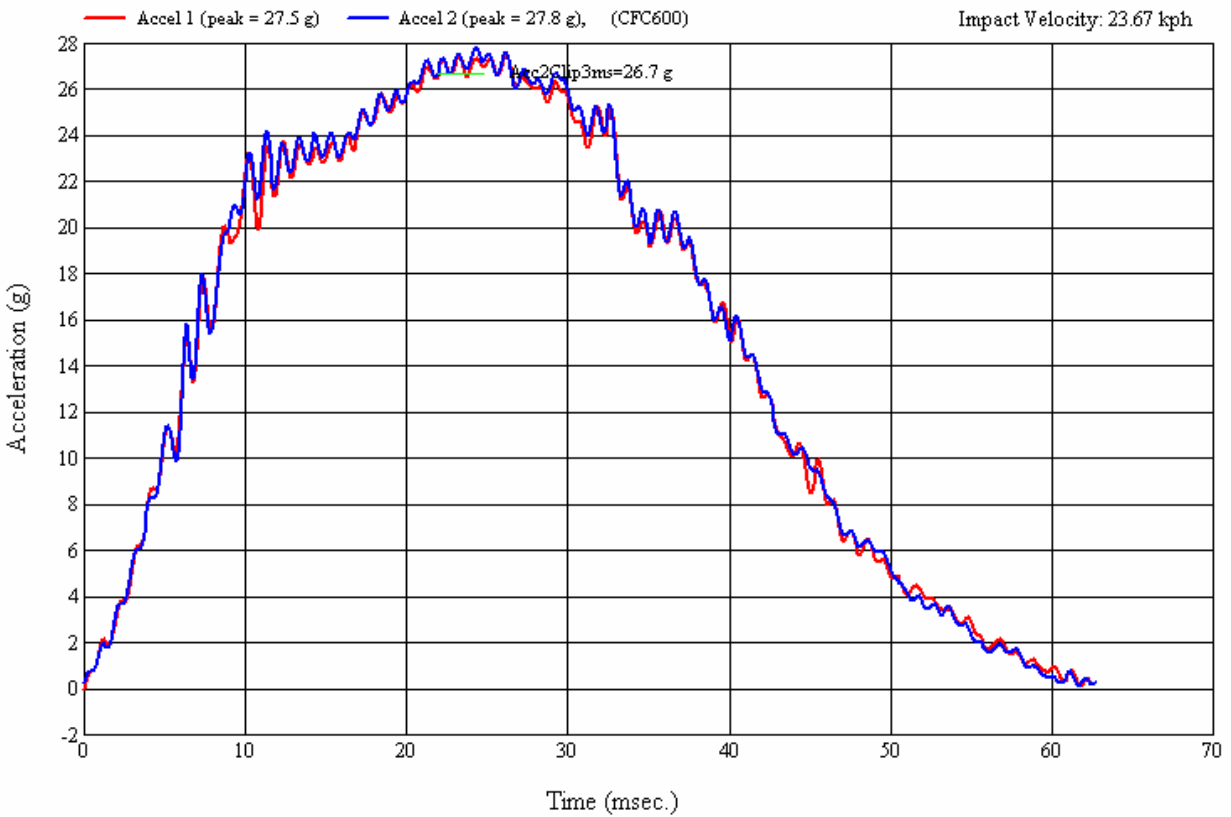


Figure 13 Acceleration History of Test #DS5197

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DATA SHEET 6

ENERGY ABSORPTION TEST

MGA Test #
VEH. NHTSA NO.: DS5197 TEST DATE: 9/28/05

Seat Location: Front Row Passenger Type of head restraint: 2-way adjustable
635 mm Height Measurement for lower boundary of the impact zone

SAE J826 three-dimensional manikin torso angle: 25.0°

Seat Back Pivot
Striker to H-Point (mm): x=164 mm Striker to H-Point angle:
z=59 mm

Description of equipment or method used to rigidly fix the seat back:
Seat back brace (see photos)

Accelerometer identification: 1. J22649 Accelerometer type/brand: Endevco
2. G03-N16 Entran

Last calibration date: 1. 4/14/05
2. 4/28/05
Head form vertical angle (-2° - +2°): 0.1°

Distance between head form and target location (> or = 25 mm):

Impact velocity (23.6 kph ± 0.5 kph): 23.67 kph

Impact location: 103 mm vertically below the top of the H/R on vertical centerline

Maximum deceleration (< or = 785 m/s² (80 g)): PASS FAIL

REMARKS: Test Variation # 4, Linear Impactor
(w/Brace)

Seat # 12

Clip 1 = 26.5 g Clip 2 = 26.7 g

Peak 1 = 27.5 g Peak 2 = 27.8 g

No sharp edges or damage evident.

RECORDED BY: M. Schick DATE: 9/28/05

APPROVED BY: H. Kaloto



Pre-Test Photo #1 of Test #DS5197



Pre-Test Photo #2 of Test #DS5197



Pre-Test Photo #3 of Test #DS5197



Pre-Test Photo #4 of Test #DS5197



Post-Test Photo #1 of Test #DS5197



Post-Test Photo #2 of Test #DS5197

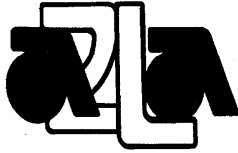


Post-Test Photo #3 of Test #DS5197



Post-Test Photo #4 of Test #DS5197

Appendix D
A2LA Laboratory Accreditation Certificate



**THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION**

ACCREDITED LABORATORY

A2LA has accredited

MGA RESEARCH CORPORATION
Troy, MI

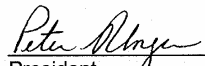
for technical competence in the field of

Mechanical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 4th day of April 2005.





President
For the Accreditation Council
Certificate Number 850.01
Valid to May 31, 2007

For tests or types of tests to which this accreditation applies,
please refer to the laboratory's Mechanical Scope of Accreditation.



American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

MGA RESEARCH CORPORATION
446 Executive Drive
Troy, MI 48083
P. Michael Miller II Phone: 248 577 5001

MECHANICAL

Valid Until: May 31, 2007

Certificate Number: 0850.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Load Fatigue Testing
0-10,000 lbs

Multiple Axis Vibration Testing
60 in x 84 in Table Size

Static Crush Testing
0-100,000 lbs

0-5 g's
0-100 Hz
10 in. Vertical, 6 in. Horizontal

Impact Testing
0-1,000 lbs
0-30 mph

Vibration Testing
Sine, Random, Shock, and Time-History
8.2 g's (peak-to-peak)
4.8 g RMS (maximum)

Extreme Temperature Testing
-40°C to + 100°C

2 in displacement (peak-to-peak)
0-1,000 Hz
Universal Fixture/Support for Various Components

Semi-Anechoic Sound Chamber
Size: 9'4" W x 9'4" L x 10' H
Ambient noise level 29 dBA
30 dBA (1.0-1.2 Sones) Vibration System in Chamber

Sound Pressure Measurement
Frequency Range of Microphone (20 Hz-20 kHz)
Sampling Rate (44.1 kHz & 48 kHz)
Sound Data Analysis using Head Acoustics Artemis Analyzer

Test Name	Test Description	Test Procedure
FMVSS 201 Compliance FMVSS 201 - Seats	Occupant Protection in Interior Impact Occupant Impact on Seat Backs and Head Restraints	NHTSA 201 MGATP 201S
FMVSS 201 - IP	Occupant Impact on Instrument Panels	MGATP 201IP
FMVSS 201U Compliance	Upper Interior Head Impact Protection	NHTSA 201U
FMVSS 201U	Occupant Impact With Upper Interior Components	MGATP 201U
FMVSS 201U Head Drop	FMVSS 201U Head Form Drop Calibration Procedure	MGATP 201UHD
FMVSS 201U Targeting	Utilizing EZ-Target Software	MGATP201U-EZ-Target

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Test Name	Test Description	Test Procedure
FMVSS 202 Compliance	Head Restraints	NHTSA 202
FMVSS 202	Head Restraints	MGATP 202
FMVSS 202a Compliance	Head Restraints	NHTSA 202a
FMVSS 202a	Head Restraints	MGATP 202a
FMVSS 203 Compliance	Steering Wheel Impact	NHTSA 203
FMVSS 203	Steering Wheel Impact	MGATP203
FMVSS 206 Compliance	Door Lock and Retention Components	NHTSA 206
FMVSS 206	Door Lock and Retention Component Static Loading	MGATP 206
FMVSS 207	Seating Systems	MGATP 207FRA, UB, FL
FMVSS 207 Compliance	Seating Systems	NHTSA 207
FMVSS 210 Compliance	Seat Belt Assembly Anchorages	NHTSA 210
FMVSS 207/210	Seat Belt Anchorage Quasi-Static	MGATP 207210
FMVSS 208	Suppression	MGATP208SUP
FMVSS 208	Low Risk Deployment	MGATP208LRAD
FMVSS 214 Compliance	Side Impact Protection	NHTSA 214S
FMVSS 214	Static Side Door Intrusion	MGATP 214
FMVSS 216 Compliance	Roof Crush Resistance	NHTSA 216
FMVSS 216	Static Roof Crush Strength Test	MGATP 216
FMVSS 225	Child Tether Anchorage	MGATP 225
FMVSS 225 Compliance	Child Restraint Anchorage System Tether and Lower	TP-225L & TP225T
FMVSS 302	Flammability	NHTSA 302, MGATP 302 GM 9070P, SAE J369
ECE-12.03 Compliance	Protection of the Driver Against the Steering Mechanism	ECETP 1203
ECE-17.07 Compliance	Strength of Seats and Their Anchorages and Head Restraint Characteristics	ECETP 1707
ECE-21.01 Compliance	Interior Fittings	ECETP 2101
ECE-25.04 Compliance	Head Restraints, Whether or Not Incorporated in Vehicle Seats	ECETP 2504
TRIAS 32/36 Compliance	Head Restraints	TRIAS 3236
ECE-17/25 Pre- Homologation	Head Restraints and Seat Back Energy Dissipation, Displacement and Strength	MGATP ECE-17
ECE-14.02 Compliance	Safety Belt Anchorages	ECETP 1402
Custom Quasi-Static Loading	Quasi-static Force vs. Deflection Characteristics	MGATP_CQSL
Custom Dynamic Impact	Dynamic Force vs. Deflection Characteristics	MGATP_CDI
H-Point	Occupant Seating Location (and ICBC)	MGATP_HPT
Airbag Deployment	Airbag Static Deployment or Dynamic Impact	MGATP_SAD
Dynamic Sled Testing	Simulation of Specific Dynamic Environments (i.e. Frontal Crash, Side Impact)	MGATP_DST MGATP_SIS
Jounce and Squirm	Durability Cycling of Seat Backs and Cushions	MGATP_JS
Ingress/Egress	Durability Cycling of Seat Backs, Cushions, Bolsters	MGATP_IE
Durability	Cycling of Various Types of Vehicle Components (i.e., Seats, Doors, IPs)	MGATP_DUR

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Test Name	Test Description	Test Procedure
Multi-Axis Simulation Table Vibration Salt Fog	Vibration Testing of Various Interior and Exterior Components ASTM B117	MGATP_MAST MGATP_SALTFOG
<u>Material Test Procedures:</u>		
AATCC TM8 SAE J861	Crocking - Wet and Dry Evaluation	MGATP_CRO
ASTM D1238 ISO 1133	Melt Flow of Plastic Materials	MGATP_MFR
ASTM D4157 SAE J1530 SAE J948	Wyzenbeek Abrasion - Oscillatory Cylinder Abrasion	MGATP_WYZ
ASTM D4966 ISO 5470-2	Martindale Abrasion - Textile Abrasion-Lissajous Form	MGATP_MAB
ASTM D3884 SAE J1530 SAE J948 ISO 5470-1	Taber Abrasion - Rotary Platform Abrasion	MGATP_TAB
ASTM D737	Air Permeability - Airflow through Fabrics	MGATP_AP
ASTM D5420	Gardner Impact - 2, 4, 8 lb. Free Falling Mass Impact	MGATP_GAR
ASTM D256 ISO 180 ASTM D4812	Izod Impact - Impact Testing on Notched and Un-notched Specimens	MGATP_NIZO MGATP_UNIZO
ASTM D5034 ASTM D638 ASTM D2261 ASTM D1056 ISO 3386-1 ISO 3386-2	Materials Characteristics (Plastics, Foams, Fabrics) - Tension, Compression, Seam Strength, Stitch Strength, Tear Strength	MGATP_TNSL
ASTM D792 ISO 845	Specific Gravity and Density	MGATP_DENS
ASTM D3776 SAE J860	Mass Determination	MGATP_MPUA
SAE J365	Scuffing Determination	MGATP_SCUF
ASTM D570	Immersion - Determine Water Absorption	MGATP_WAT
SAE J1885, J1960	Interior/Exterior Xenon	MGATP_1885, 1960
SAE J1545 AATCC TM 173	Color Eye Evaluation	MGATP_COLOR
ASTM D1308	60° Gloss Evaluation	MGATP_GLOSS
ASTM D1308 GM 9900P	Chemical Resistance	MGATP_CR

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ASTM D6413 TB 117 (Section A, Part 1) FAR 25.853	Vertical Flammability	MGATP_VFLAM
SAE J1351	Odor	MGATP_ODOR

In addition, customer-supplied test methods and industry-accepted methods may be used in conjunction with all of the above procedures. These Methods include:

AATCC, ASTM, ISO, MIC-STD, SAE
 Chrysler PF-10254, PF-9334 and LP requirements (Materials)
 GM GMN/GMW/CPC/MTL/P/M
 Ford DVM for IP (Interiors), ST (Seats), MA (Materials) and FLTM (Materials)
 Other OEM methods from Nissan, Honda, Toyota, VW and Audi

Acoustics Testing:

Test Name	Test Description	Test Procedure
GMW 7293, GMW 14011, GMN 5160	Squeak and Rattle Evaluation	MGATP_VESR
Sound Evaluation	Sound Quality/Intensity/Pressure/Power Analysis	MGATP_VESR
Sound Measurement	Zwicker Loudness (Sones) DB (SPL/A/B/C/D)	MGATP_VESR

Dimensional Testing:

Parameter	Technique	Range	Best Uncertainty* (±)
Length	CMM – Faro	2 ft measuring zone	0.125 mm (0.0049 in)
		8 ft measuring zone	0.5 mm (0.0197 in)
	Calipers	0-305 mm (0-12")	0.035 mm (0.0014 in)

*“Best Uncertainty” is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine inspections of nearly ideal measurement standards with nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific test performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer’s test piece, to the environment (if the dimensional inspection is performed in the field) and to influences from the circumstances of the specific test.