

REPORT NUMBER TR-P30068-01-NC

**SIDE AIRBAG OCCUPANT RISK PROGRAM
OCCUPANT OUT-OF-POSITION TESTS**

**TOYOTA MOTOR CORPORATION
2010 LEXUS HS 250H
4-DOOR SEDAN**

NHTSA NUMBER: MA5119TWG2

**PREPARED BY:
KARCO ENGINEERING, LLC
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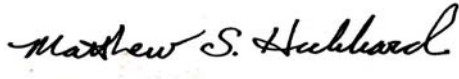
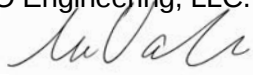
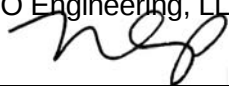
JULY 16, 2010

FINAL REPORT

**PREPARED FOR:
ALPHA TECHNOLOGY ASSOCIATE, INC.
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This final test report was prepared for the U.S. Department of Transportation, Alpha Technology Associate, Inc., in response to Contract Number DTNH22-03-D-32005.

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Approval Date:	08/02/10

FINAL REPORT ACCEPTED BY:

Manager, New Car Assessment Program

Date of Acceptance

COTR, NCAP Frontal Impact Program

Date of Acceptance

TABLE OF CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1	Purpose and Summary of Test MA5119TWG2	1
2	Occupant and Vehicle Information	3

<u>Data Sheet</u>	<u>Description</u>	<u>Page</u>
1	Test Summary	4
2	General Test and Vehicle Parameter Data	5
3	Test Vehicle Information	6
4	Dummy Positioning Information	7
5	Hybrid III ATD Injury Criteria and Sensor Data	8
6	Camera Locations	10

<u>Appendix</u>	<u>Description</u>	<u>Appendix</u>
A	Photographs	A
B	Data Plots	B
C	Instrumentation Data Channel Assignments	C

LIST OF PHOTOGRAPHS

<u>Figure</u>	<u>Description</u>	<u>Page</u>
A-1	Right Front $\frac{3}{4}$ View, As Received	A-1
A-2	Vehicle Certification Label	A-2
A-3	Post-Test Right Front $\frac{3}{4}$ View of Frontal NCAP Test	A-3
A-4	Post-Test Right Side View of Frontal NCAP Test	A-4
A-5	Pre-Test Dummy Position, Left Side View	A-5
A-6	Pre-Test Dummy Position, $\frac{3}{4}$ View	A-6
A-7	Pre-Test Dummy Position, Front View	A-7
A-8	Post-Test Dummy Position and Airbag, Left Side View	A-8
A-9	Post-Test Airbags, Left Side View	A-9
A-10	Post-Test Airbags, Left Front $\frac{3}{4}$ View	A-10

LIST OF DATA PLOTS

Data Plot		Page
B-1	Pass. (SID IIs) Head X	B-1
	Pass. (SID IIs) Head Y	B-1
	Pass. (SID IIs) Head Z	B-1
	Pass. (SID IIs) Head Resultant	B-1
B-2	Pass. (SID IIs) Upper Neck Force X	B-2
	Pass. (SID IIs) Upper Neck Force Y	B-2
	Pass. (SID IIs) Upper Neck Force Z	B-2
	Pass. (SID IIs) Upper Neck Force Resultant	B-2
B-3	Pass. (SID IIs) Upper Neck Moment X	B-3
	Pass. (SID IIs) Upper Neck Moment Y	B-3
	Pass. (SID IIs) Upper Neck Moment Z	B-3
	Pass. (SID IIs) Upper Neck Moment Resultant	B-3
B-4	Pass. (SID IIs) Lower Neck Force X	B-4
	Pass. (SID IIs) Lower Neck Force Y	B-4
	Pass. (SID IIs) Lower Neck Force Z	B-4
	Pass. (SID IIs) Lower Neck Force Resultant	B-4
B-5	Pass. (SID IIs) Lower Neck Moment X	B-5
	Pass. (SID IIs) Lower Neck Moment Y	B-5
	Pass. (SID IIs) Lower Neck Moment Z	B-5
	Pass. (SID IIs) Lower Neck Moment Resultant	B-5

SECTION 1

PURPOSE AND SUMMARY OF TEST MA5119TWG2

1.1 PURPOSE

This occupant out-of-position static side airbag deployment test is part of the Technical Working Group Occupant Injury Risk from Deploying Side Airbags Testing Program sponsored by Alpha Technology Associate, Inc. under Contract No. DTNH22-03-D-32005. The purpose of this test was to obtain occupant injury data for a side airbag deployment.

The occupant out-of-position side airbag test was conducted in accordance with the Technical Working Group Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

1.2 SUMMARY

The effects of a roof mounted curtain airbag and a torso airbag deployment in a 2010 Lexus HS 250h 4-Door Sedan with an out-of-position SID IIs 5th percentile adult female dummy were evaluated. The test was performed at Karco Engineering, LLC on July, 16th 2010. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Three high-speed digital cameras and one real time camera were used to document the curtain airbag deployment. Camera locations and other pertinent camera information can be found on Data Sheet No.1 and Data Sheet No.6.

SID IIs 5th percentile adult female anthropomorphic test device (ATD) was placed in the right front passenger seating position facing inboard according to the dummy placement instructions (3.3.3.6) in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The SID IIs 5th percentile adult female ATD was instrumented with head tri-axial accelerometers, and upper and lower neck transducers.

Fifteen (15) channels of data were recorded using an on-board data acquisition system. Appendix A contains Photographs. Appendix B contains dummy response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The front passenger side door remained closed during the deployment and was operable after the deployment.

The SID IIs 5th percentile adult female dummy's visible contact points were as follows: The curtain airbag contacted the ATD's head and the torso airbag contacted the ATD's back.

OUT OF POSITION OCCUPANT DATA SUMMARY

ATD Position	HIC ₁₅
Passenger	6.1

Orientation of the SID IIs 5th percentile adult female dummy was in the inboard facing position leaning against the front passenger door. The dummy's spine was aligned with the deploying trajectory of the curtain airbag. The lower legs were extended. This orientation complies with section 3.3.3.6 of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan NHTSA No.: MA5119TWG2
Test Program: TWG 3.3.3.6. Test Date: 07/16/10

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lb/in ²	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	$=(tf - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

* Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1

TEST SUMMARY

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan NHTSA No.: MA5119TWG2

Test Program: TWG 3.3.3.6. Test Date: 07/16/10

TEST DUMMY INFORMATION

Description	Passenger Seat Forward Facing
Dummy Type / Serial No.	SID IIs / 307
Head Contact	Yes
Chest Contact	None
Abdomen Contact	Yes
Pelvis	None
Left Knee Contact	None
Right Knee Contact	None

MOVIE COVERAGE

High Speed Digital	3
Real Time	1
Total	4

DATA CHANNELS

SID IIs ATD Sensors	15
Belt Assessment Sensors	0
Vehicle Structure Accelerometers	0
Total	15

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan NHTSA No.: MA5119TWG2
 Test Program: TWG 3.3.3.6. Test Date: 07/16/10

TEST VEHICLE INFORMATION

Make	Lexus
Model	HS 250h
Body Style	4-Door Sedan
NHTSA No.	MA5119TWG2
VIN	5THBB1B1A1A2002357
Color	Black Sapphire
Delivery Date	October 8, 2009
Odometer Reading (mile)	52
Dealer	Lexus of Las Vegas
Transmission	Automatic
Final Drive	Front
Type/Number Cylinders	Inline 4
Engine Displacement (L)	2.4
Engine Placement	Transverse

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Airbag	Yes
Driver Side Curtain Airbag	Yes
Pass. Front Airbag	Yes
Pass.Side Airbag	Yes
Pass. Curtain Airbag	Yes
Power Brakes	Yes
Power Steering	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	Yes
Anti-lock Brakes	Yes
Tilt Steering Wheel	Yes
Power Windows	Yes
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation	GVWR (kg)	2124
Date of Manufacture	July-09	GAWR Front (kg)	1160
		GAWR Rear (kg)	1000

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	230	230
Cold Pressure (kPa)	230	230
Recommend Tire Size	P215/55R17	P215/55R17
Tire Size on Vehicle	P215/55R17	P215/55R17
Tire Manufacturer	Michelin	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench	Bench	
Number of Occupants	2	3	0	5
Capacity Wt. (VCW) (kg)				375

* Vehicle had undergone New Car Assessment Program Frontal Impact Testing on October 24, 2009

DATA SHEET NO. 3

TEST VEHICLE INFORMATION

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan NHTSA No.: MA5119TWG2
Test Program: TWG 3.3.3.6. Test Date: 07/16/10

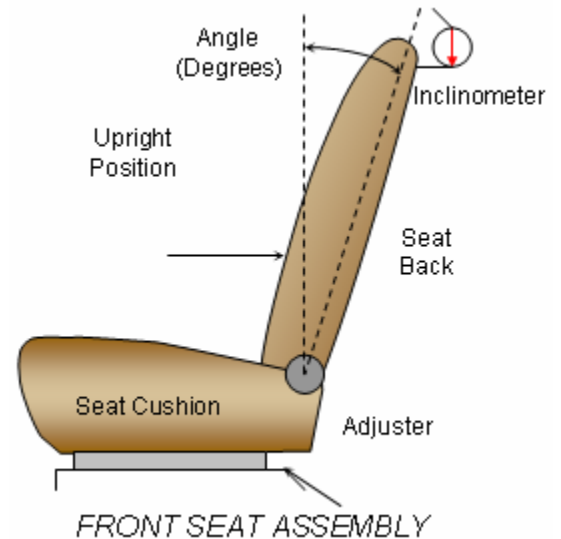
NOMINAL DESIGN RIDING POSITION

The passenger seat back is positioned to section 3.3.3.6. of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SEAT BACK ANGLES

Position	Deg.
Passenger w/ Dummy	2

Seat upright is 0 degrees.



SEAT FORE/AFT POSITIONS

The first or forward most position is counted as number one (1). The fore/aft position is set aft of the middle position for the passenger seat.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Passenger Seat	290mm	145mm

DATA SHEET NO. 4

DUMMY POSITIONING INFORMATION

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan NHTSA No. MA5119TWG2
 Test Program: TWG 3.3.3.6. Test Date: 07/16/10

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	SID IIs 5th percentile female	
		Length (mm)	Angle (°)
SA	Seat Back Angle		2
AMW	Side Airbag Module Width (Torso / Curtain)	30 / 28	
ABW	Side Airbag Width (Torso / Curtain)	420 / 400	
AML	Side Airbag Module Length (Torso / Curtain)	120 / 290	
ABL	Side Airbag Length (Torso / Curtain)	430 / 1725	
AN	Top of Airbag Module to Head/Neck Junction	240	
HD	Head CG to Door Panel/ Window	196	
HSC	Head to Seat Back Centerline	212	
HB	Head to B-Pillar (first contact)	164	
HZ	Head to Roof (Z)	130	
HHD	Head to Header	344	
ND	Nose to Dash	739	
NS	Nose to Seat Back	194	
NR	Nose to Header	415	
CD	Chest to Dash	598	
CS	Chest to Seat Back	239	
RACL	Right Arm to Seat Back Centerline	N/A	
LACL	Left Arm to Seat Back Centerline	171	
RA	Right Arm to Door Panel	N/A	
LA	Left Arm to Door Panel	135	
KK	Knee to Knee	133	
TT	Toe to Toe	111	
KSCR	Right Knee to Seat Cushion Centerline	218	
KSCL	Left Knee to Seat Cushion Centerline	225	
TSCR	Right Toe to Seat Cushion Centerline	617	
TSCL	Left Toe to Seat Cushion Centerline	620	

DATA SHEET NO. 5
HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan

NHTSA No.: MA5119TWG2

Test Program: TWG 3.3.3.6

Test Date: 7/16/10

HEAD PEAK ACCELERATIONS

Location	Axis	Units	Pass. SID-IIs			
			Max	Time	Min	Time
Head CG	X	G's	21.2	8.9	-3.0	106.2
Head CG	Y	G's	7.3	9.6	-6.5	17.8
Head CG	Z	G's	8.9	8.0	-7.4	14.5
Head CG Resultant	N/A	G's	23.0	8.9		

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Pass. SID-IIs			
			Max	Time	Min	Time
Neck Force	X	Newtons	66.6	15.0	-79.2	109.5
Neck Force	Y	Newtons	124.4	17.9	-69.2	100.1
Neck Force	Z	Newtons	63.6	64.0	-792.5	13.3
Neck Force Resultant	N/A	Newtons	799.9	13.3		
Neck Moment	X	Nm	10.1	25.0	-7.2	13.5
Neck Moment	Y	Nm	8.1	13.8	-13.3	27.7
Neck Moment	Z	Nm	4.6	24.0	-3.7	82.2
Neck Moment Resultant	N/A	Nm	16.8	25.0		

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Pass. SID-IIs			
			Max	Time	Min	Time
Neck Force	X	Newtons	145.2	11.8	-46.4	113.7
Neck Force	Y	Newtons	96.6	9.1	-26.1	97.1
Neck Force	Z	Newtons	28.7	63.8	-412.5	13.8
Neck Force Resultant	N/A	Newtons	423.8	13.8		
Neck Moment	X	Nm	18.9	32.8	-12.4	98.2
Neck Moment	Y	Nm	20.8	12.8	-7.4	42.9
Neck Moment	Z	Nm	11.4	14.8	-6.9	85.8
Neck Moment Resultant	N/A	Nm	24.9	14.1		

DATA SHEET NO. 5...(CONTINUED)Test Vehicle: 2010 Lexus HS 250h 4-Door SedanNHTSA No.: MA5119TWG2Test Program: TWG 3.3.3.6Test Date: 7/16/10**HEAD INJURY CRITERIA (HIC 15)**

Location	Pass. SID-IIs			
	HIC15	T ¹	T ²	Avg G
Head CG	6.1	7.8	20.8	11.6

UPPER NECK NIJ VALUES

Location	Pass. SID-IIs			
	Ntf	Nte	Ncf	Nce
Upper Neck	0.05	0.09	0.25	0.21

DATA SHEET NO. 6**CAMERA LOCATIONS**Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan NHTSA No.: MA5119TWG2Test Program: TWG 3.3.3.6. Test Date: 07/16/10

No.	Camera View	Location (mm)			Angle (Deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Real Time	0	-2400	-1060	0.0	N/A	30
2	High Speed Side View	0	-2400	-965	0.0	35	1000
3	High Speed 3/4 View	-1580	-1480	-1360	-8.0	35	1000
4	High Speed Front View	-2110	-60	-1365	-5.0	24	1000

* All measurements are taken relative to CG of dummy's head.

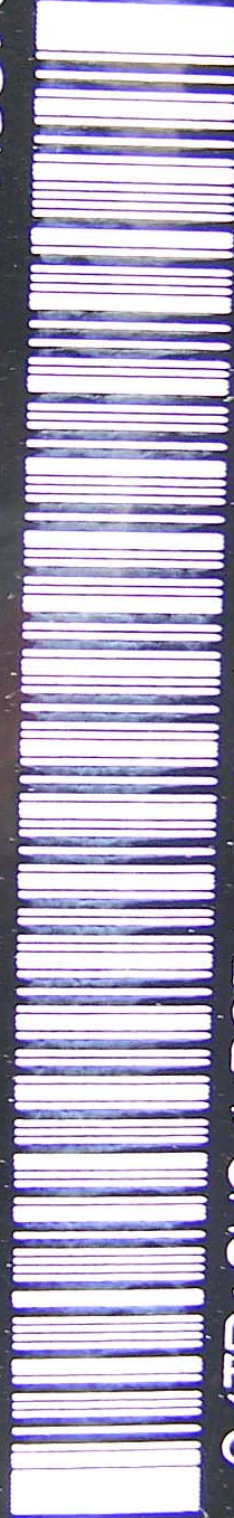
APPENDIX A

PHOTOGRAPHS



Figure A-1: Right Front $\frac{3}{4}$ View, As Received

MFD. BY: TOYOTA MOTOR CORPORATION 07/09
GVWR 4685LB GAWR FR 2560LB RR 2205LB
THIS VEHICLE CONFORMS TO ALL APPLICABLE
FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON
THEFT PREVENTION MANUFACTURE SHOWN ABOVE CAR
THE DATE OF JTHBB1BA1A2002357 PASS. CAR



C/TR: 8U0/LB05 ANF10L-AEXVBA 091 A
A/TM: -01A/P311 MADE IN JAPAN

Figure A-2: Vehicle Certification Label



Figure A-3: Post-Test Right Front $\frac{3}{4}$ View of Frontal NCAP Test



Figure A-4: Post-Test Right Side View of Frontal NCAP Test



Figure A-5: Pre-Test Dummy Position, Left Side View



Figure A-6: Pre-Test Dummy Position, $\frac{3}{4}$ View



Figure A-7: Pre-Test Dummy Position, Front View



Figure A-8: Post-Test Dummy Position and Airbags, Left Side View

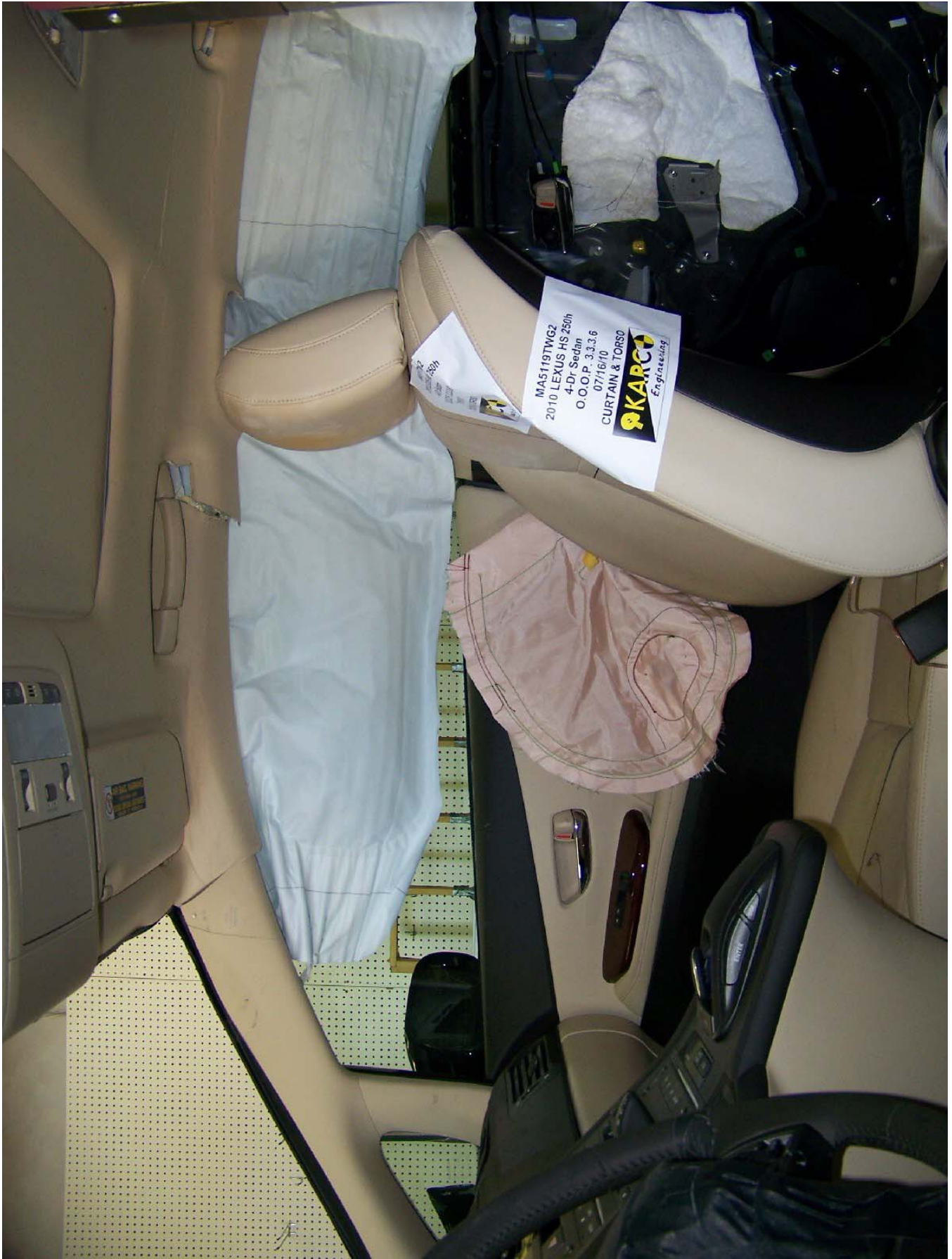


Figure A-9: Post-Test Airbags, Left Side View



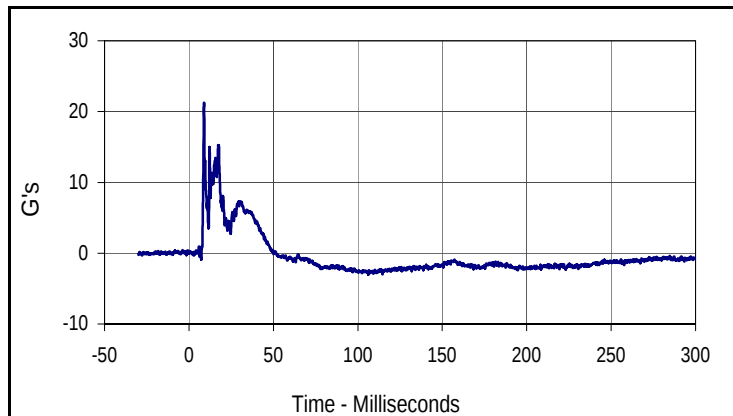
Figure A-10: Post-Test Airbags, Left Front ¾ View

APPENDIX B

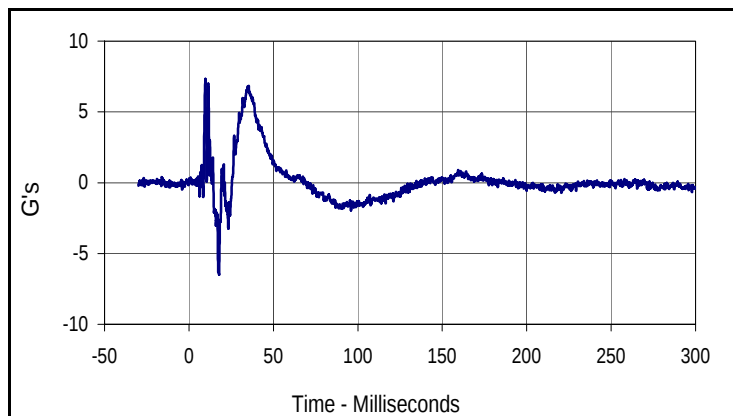
DATA PLOTS

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan
 Test Program: TWG 3.3.3.6

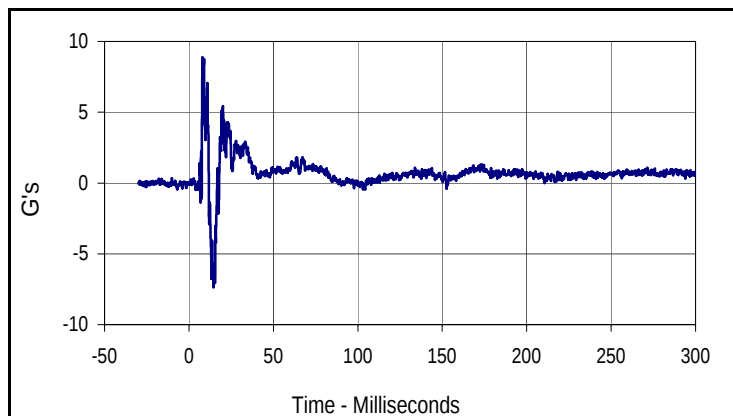
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 NHTSA No.: MA5119TWG2



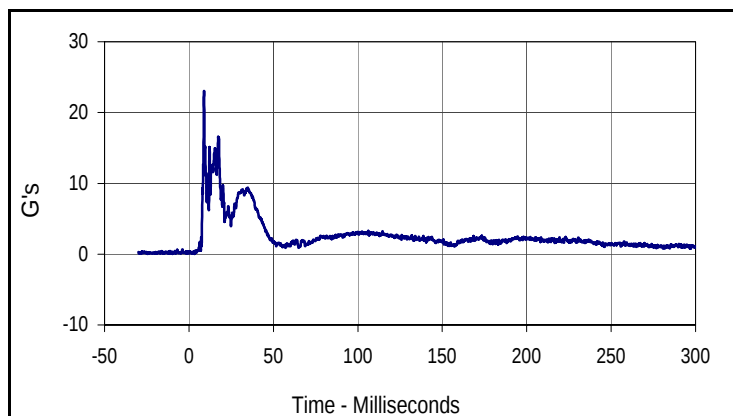
Curve Description			
Pass. SID-IIs Head X			
CURNO	Type	SAE Class	Units
001	FIL	1000	G's
Max	Time	Min	Time
21.2	8.9	-3.0	106.2



Curve Description			
Pass. SID-IIs Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
7.3	9.6	-6.5	17.8



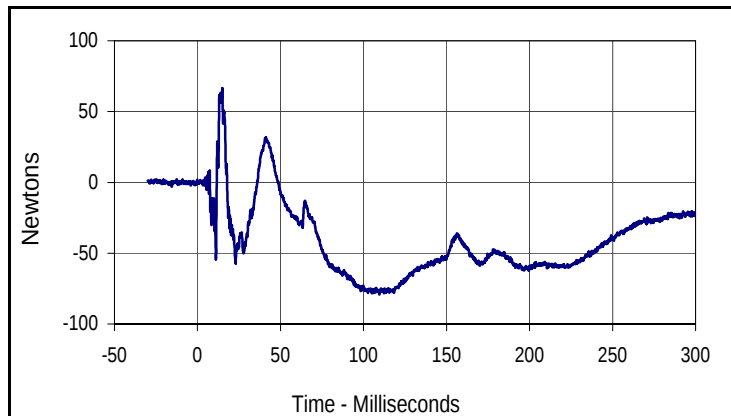
Curve Description			
Pass. SID-IIs Head Z			
CURNO	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
8.9	8.0	-7.4	14.5



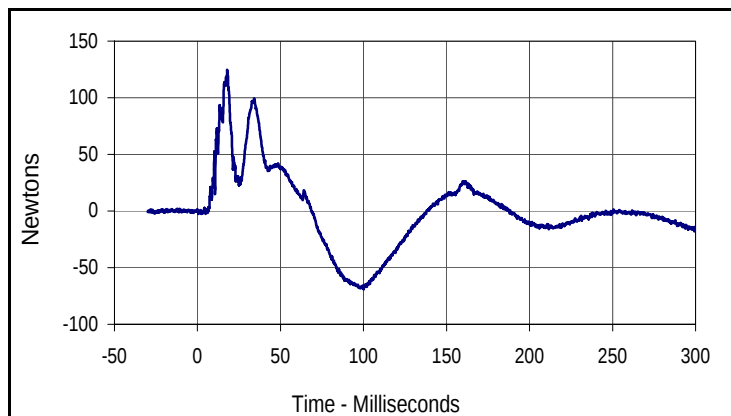
Curve Description			
Pass. SID-IIs Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
23.0	8.9	0.0	3.3

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan
 Test Program: TWG 3.3.3.6

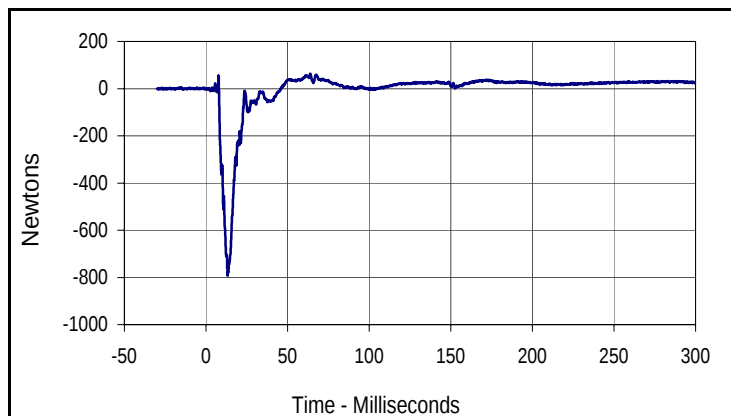
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 NHTSA No.: MA5119TWG2



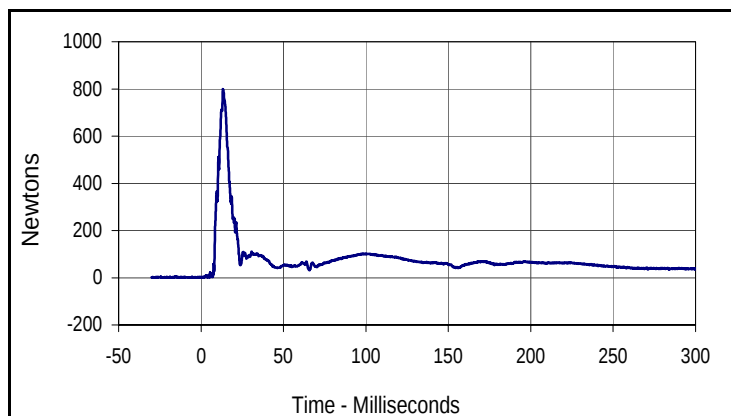
Curve Description			
Pass. SID-IIs Upper Neck Force X			
CURNO	Type	SAE Class	Units
004	FIL	1000	Newtons
Max	Time	Min	Time
66.6	15.0	-79.2	109.5



Curve Description			
Pass. SID-IIs Upper Neck Force Y			
CURNO	Type	SAE Class	Units
005	FIL	1000	Newtons
Max	Time	Min	Time
124.4	17.9	-69.2	100.1



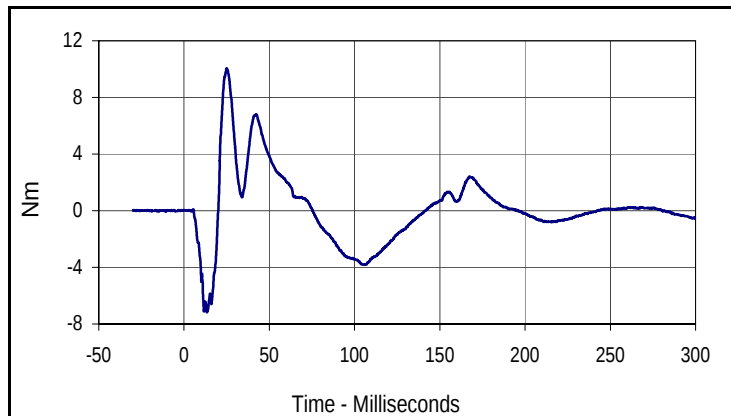
Curve Description			
Pass. SID-IIs Upper Neck Force Z			
CURNO	Type	SAE Class	Units
006	FIL	1000	Newtons
Max	Time	Min	Time
63.6	64.0	-792.5	13.3



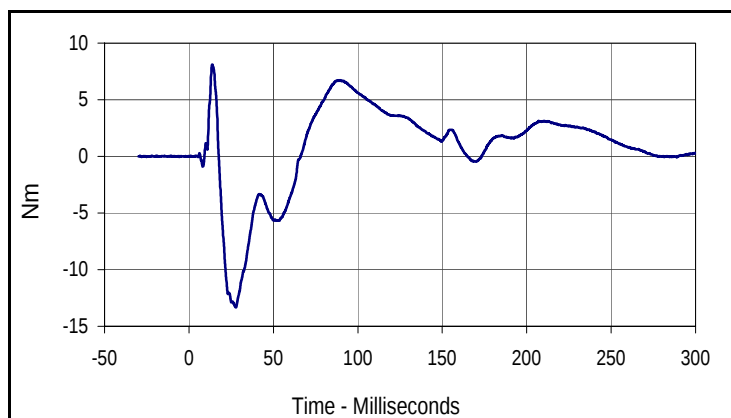
Curve Description			
Pass. SID-IIs Upper Neck Force Resultant			
CURNO	Type	SAE Class	Units
004	RES	1000	Newtons
Max	Time	Min	Time
799.9	13.3	0.6	1.4

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan
 Test Program: TWG 3.3.3.6

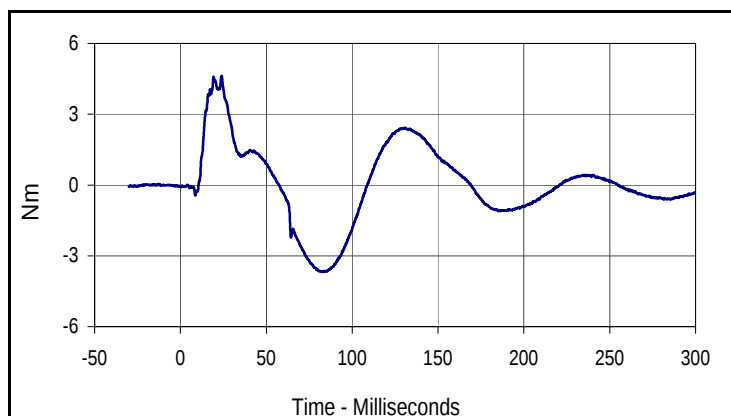
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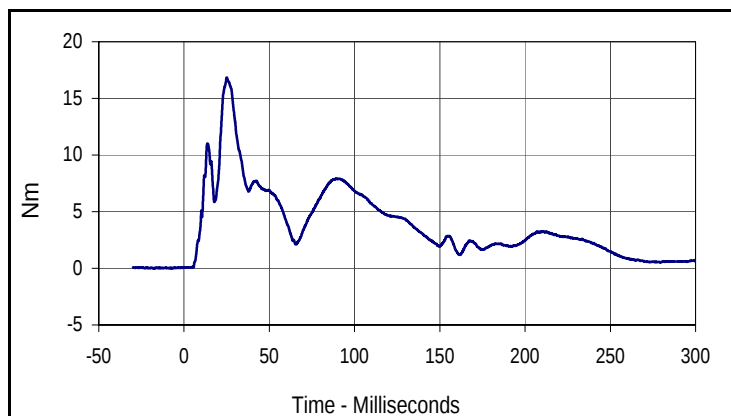
Curve Description			
Pass. SID-IIs Upper Neck Moment X			
CURNO	Type	SAE Class	Units
007	FIL	600	Nm
Max	Time	Min	Time
10.1	25.0	-7.2	13.5



Curve Description			
Pass. SID-IIs Upper Neck Moment Y			
CURNO	Type	SAE Class	Units
008	FIL	600	Nm
Max	Time	Min	Time
8.1	13.8	-13.3	27.7



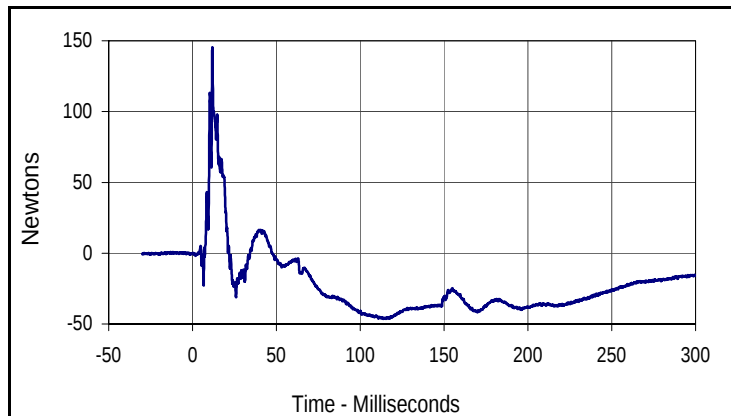
Curve Description			
Pass. SID-IIs Upper Neck Moment Z			
CURNO	Type	SAE Class	Units
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Max	Time	Min	Time
4.6	24.0	-3.7	82.2



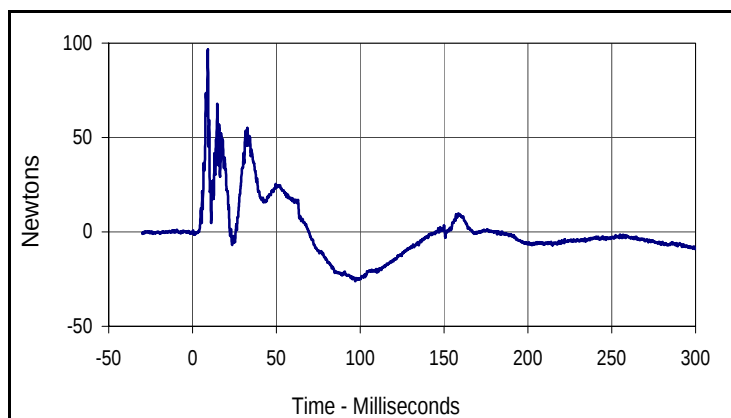
Curve Description			
Pass. SID-IIs Upper Neck Moment Resultant			
CURNO	Type	SAE Class	Units
007	RES	600	Nm
Max	Time	Min	Time
16.8	25.0	0.0	3.6

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan
 Test Program: TWG 3.3.3.6

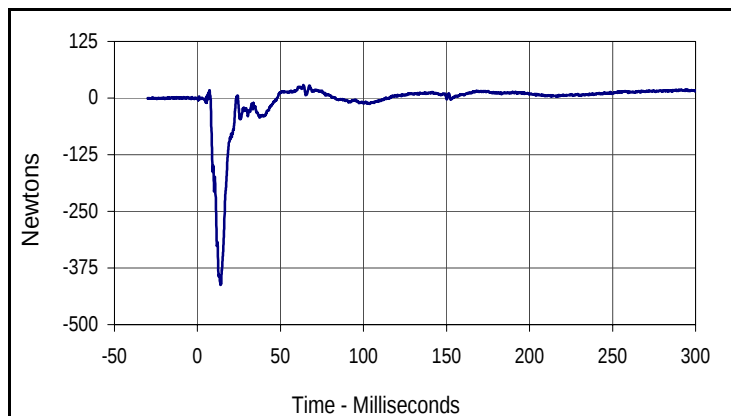
Test Date: 7/16/10
 NHTSA No.: MA5119TWG2



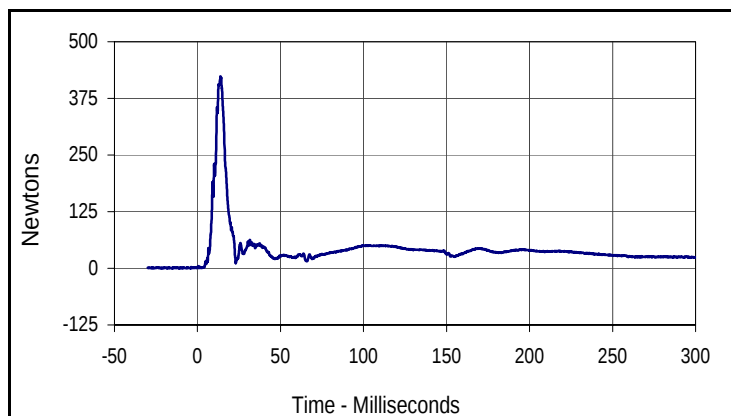
Curve Description			
Pass. SID-IIs Lower Neck Force X			
CURNO	Type	SAE Class	Units
010	FIL	1000	Newtons
Max	Time	Min	Time
145.2	11.8	-46.4	113.7



Curve Description			
Pass. SID-IIs Lower Neck Force Y			
CURNO	Type	SAE Class	Units
011	FIL	1000	Newtons
Max	Time	Min	Time
96.6	9.1	-26.1	97.1



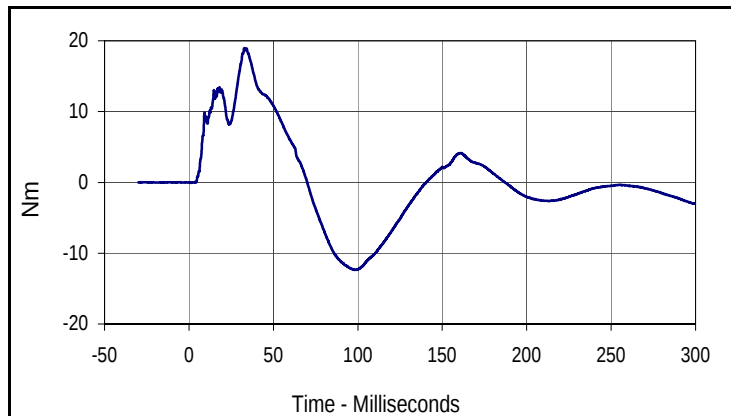
Curve Description			
Pass. SID-IIs Lower Neck Force Z			
CURNO	Type	SAE Class	Units
012	FIL	1000	Newtons
Max	Time	Min	Time
28.7	63.8	-412.5	13.8



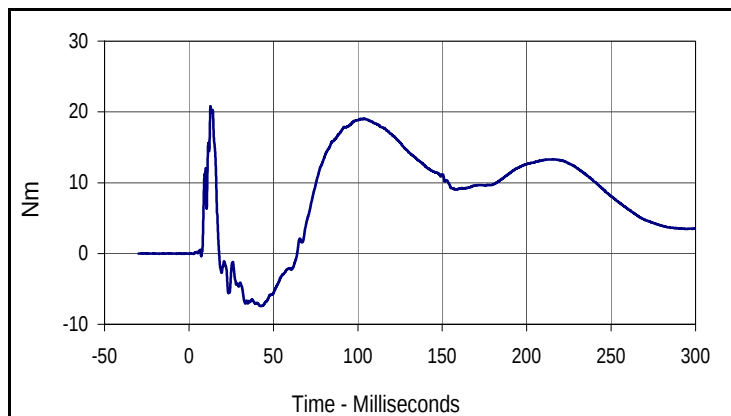
Curve Description			
Pass. SID-IIs Lower Neck Force Resultant			
CURNO	Type	SAE Class	Units
010	RES	1000	Newtons
Max	Time	Min	Time
423.8	13.8	0.8	2.9

Test Vehicle: 2010 Lexus HS 250h 4-Door Sedan
 Test Program: TWG 3.3.3.6

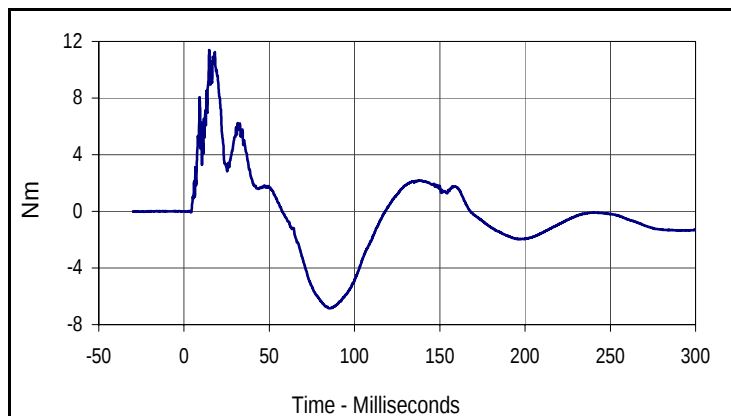
Test Date: 7/16/10
 NHTSA No.: MA5119TWG2



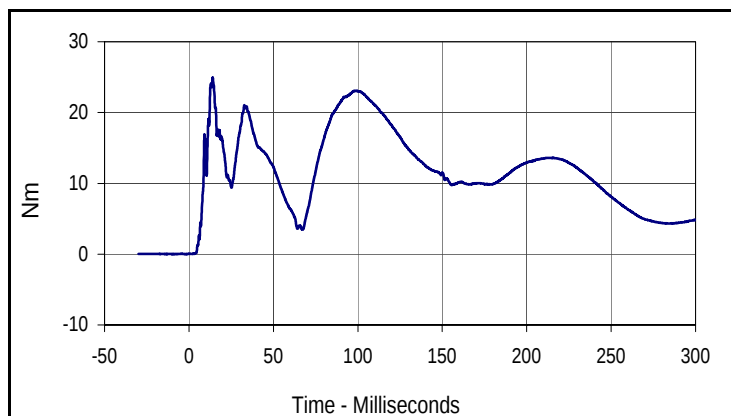
Curve Description			
Pass. SID-IIs Lower Neck Moment X			
CURNO	Type	SAE Class	Units
013	FIL	600	Nm
Max	Time	Min	Time
18.9	32.8	-12.4	98.2



Curve Description			
Pass. SID-IIs Lower Neck Moment Y			
CURNO	Type	SAE Class	Units
014	FIL	600	Nm
Max	Time	Min	Time
20.8	12.8	-7.4	42.9



Curve Description			
Pass. SID-IIs Lower Neck Moment Z			
CURNO	Type	SAE Class	Units
015	FIL	600	Nm
Max	Time	Min	Time
11.4	14.8	-6.9	85.8



Curve Description			
Pass. SID-IIs Lower Neck Moment Resultant			
CURNO	Type	SAE Class	Units
013	RES	600	Nm
Max	Time	Min	Time
24.9	14.1	0.0	1.2

APPENDIX C

INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

TWG 3.3.3.6
Instrumentation Data Channel Assignments
A.T.D. Serial Number 307
7/16/10
2010 Lexus HS 250h 4-Door Sedan

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	HEAD	X	P58900	Accel.,full bridge	ENDEVCO	7264C-2000	G
2	HEAD	Y	P58902	Accel.,full bridge	ENDEVCO	7264C-2000	G
3	HEAD	Z	P58983	Accel.,full bridge	ENDEVCO	7264C-2000	G
4	UPPER NECK FORCE	X	287	Load cell, six axis neck	R. A. Denton	IF-205	N
5	UPPER NECK FORCE	Y	287	Load cell, six axis neck	R. A. Denton	IF-205	N
6	UPPER NECK FORCE	Z	287	Load cell, six axis neck	R. A. Denton	IF-205	N
7	UPPER NECK MOMENT	X	287	Load cell, six axis neck	R. A. Denton	IF-205	Nm
8	UPPER NECK MOMENT	Y	287	Load cell, six axis neck	R. A. Denton	IF-205	Nm
9	UPPER NECK MOMENT	Z	287	Load cell, six axis neck	R. A. Denton	IF-205	Nm
10	LOWER NECK FORCE	X	294	Load cell, six axis neck	R. A. Denton	2430	N
11	LOWER NECK FORCE	Y	294	Load cell, six axis neck	R. A. Denton	2430	N
12	LOWER NECK FORCE	Z	294	Load cell, six axis neck	R. A. Denton	2430	N
13	LOWER NECK MOMENT	X	294	Load cell, six axis neck	R. A. Denton	2430	Nm
14	LOWER NECK MOMENT	Y	294	Load cell, six axis neck	R. A. Denton	2430	Nm
15	LOWER NECK MOMENT	Z	294	Load cell, six axis neck	R. A. Denton	2430	Nm