FINAL REPORT NUMBER 201UI-MGA-10-07

SAFETY COMPLIANCE TESTING FOR FMVSS 201
Occupant Protection In Interior Impact
Upper Interior Head Impact Protection

VOLVO CAR CORPORATION
2010 Volvo XC60 MPV
NHTSA No. CA5902

MGA RESEARCH CORPORATION
446 Executive Drive
Troy, Michigan 48083

Test Dates: May 5-6, 2010
Report Date: July 27, 2010

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Approval Date: July 27, 2010

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Accepted By: _____

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12. Sponsoring Agency Name and Address U.S. Department Of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance 1200 New Jersey Avenue, SE West Building, 4th Floor Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report	
		14. Sponsoring Agency Code NVS-220	
15. Supplementary Notes			
16. Abstract A compliance test series was conducted on the subject 2010 Volvo XC60 MPV, NHTSA No. CA5902, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-201U-01 for the determination of FMVSS 201 compliance. The testing was conducted at MGA Research Corporation in Troy, Michigan on May 5-6, 2010. Test failures identified were as follows: None The data recorded indicates that the 2010 Volvo XC60 MPV tested appears to comply with the upper interior requirements of FMVSS 201.			
17. Key Words Compliance Testing Safety Engineering FMVSS 201UI 2010 Volvo XC60 MPV		18. Distribution Statement Copies of this report are available from: NHTSA Technical Reference Division, Mail Code: NPO-410 1200 New Jersey Avenue, SE West Building Washington, D.C. 20590	
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1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this head impact compliance test was to determine whether the subject vehicle, a 2010 Volvo XC60 MPV, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact - Upper Interior Head Impact Protection.

Tests were conducted on May 5-6, 2010 on a 2010 Volvo XC60 MPV, manufactured by Volvo Car Corporation.

All tests were conducted in accordance with the U. S. Department of Transportation, National Highway Traffic Safety Administration's Laboratory Test Procedure TP-201U-01 dated April 3, 1998 and the corresponding MGA Research Corporation's FMVSS 201U procedure number MGATP201U_FRAME#2 dated August 21, 2009.

All tests were conducted at MGA Research Corporation in Troy, Michigan and were performed by MGA engineers and technicians. The FMVSS 201U impactor test machine was used to conduct the testing. Target locations were determined by using a Coordinate Measurement Machine in conjunction with the MGA EZ-Target™ program and MGA procedure MGATP201U_Test Series dated November 9, 2009.

2.0 COMPLIANCE TEST DATA SUMMARY

The 2010 Volvo XC60 MPV was equipped with A, B, O (Other), and rear pillars, a fixed seat belt anchorage on each B-pillar, a grab handle located on the side rail above each front and rear door, a front overhead console and a dome light located on the front upper roof.

Upon completion of targeting the test vehicle, twelve (12) targets were chosen to be impacted based upon engineering judgment and certification test data provided by the manufacturer. The twelve (12) targets chosen were:

BP1	OP1	UR1@SR1	UR4@BP
BP2	OP2	UR2@Front of Sunroof	UR5@SR3-1
BP3	FH1	UR3@SR2A	UR6@OP

The 2010 Volvo XC60 MPV tested appears to comply with the upper interior performance criteria for FMVSS 201. The HIC(d) measured using the Part 572L (Free Motion Headform) was below 1000 for each tested component.

TABLE 2-1

SUMMARY TABLE OF TEST RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2010 Volvo XC60 MPV

VEH. NHTSA NO.: CA5902 VIN: YV4982DL2A2104332 COLOR: Grey

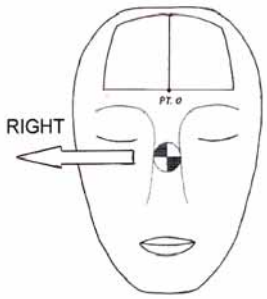
VEH. BUILD DATE: February, 2010 TEST DATES: May 5-6, 2010

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Nathaniel Newth, Donald J. Whiteside

TARGET	VEHICLE SIDE	HORIZONTAL ANGLE (deg)	VERTICAL ANGLE (deg)	VELOCITY (kph)	HIC(d)	FMH HIC	IMPACT ON FMH (mm)	
							Above	Left/Right
BP1	Right	90	8	18.8	451	377	75	3 Left
BP2	Right	90	-3	24.1	698	705	12	14 Left
BP3	Left	280	-6	23.8	589	560	9	2 Left
OP1	Left	270	22	18.7	462	392	36	1 Left
OP2	Right	90	-7	24.1	571	537	23	7 Right
FH1	Left	180	50	24.0	728	744	18	5 Right
UR1@SR1	Left	270	50	24.0	719	732	33	6 Left
UR2@Front of Sunroof	Right	180	45	24.1	398	308	7	1 Right
UR3@SR2A	Right	90	50	23.9	680	680	26	2 Left
UR4@BP	Left	270	50	24.1	625	608	25	7 Left
UR5@SR3-1	Left	270	50	23.8	571	536	19	1 Left
UR6@OP	Right	90	50	23.7	787	823	19	4 Left

Above and left/right refers to the position relative to reference pt. 0 where the target made contact with the Free Motion Headform. See the diagram below for details.



POST TEST COMMENTS:

The following description lists any post-test damage or other test observations for each target.

UR1 Left: Headliner deformation; grab handle compression.

UR2 Right: Headliner deformation.

UR3 Right: Headliner deformation; grab handle compression.

UR4 Left: Headliner deformation.

UR5 Left: Headliner deformation; grab handle compression.

REMARKS:

The targets listed were impacted in the following order:

Left: BP3, UR4@BP, UR1@SR1, FH1, UR5@SR3-1, OP1

Right: BP2, BP1, UR3@SR2A, UR2@Front of Sunroof, OP2, UR6@OP

The 150 mm rule was observed for targets horizontal to each other and the 200 mm rule was observed for vertical components.

RECORDED BY: Donald J. Whiteside DATE: May 6, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-2

GENERAL TEST AND VEHICLE PARAMETER DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2010 Volvo XC60 MPV

VEH. NHTSA NO.: CA5902 VIN: YV4982DL2A2104332 COLOR: Grey

VEH. BUILD DATE: February, 2010 TEST DATES: May 5-6, 2010

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Nathaniel Newth, Donald J. Whiteside

INTERIOR TRIM INFORMATION: A, B, O (Other), and rear pillars, a fixed seat belt anchorage on each B-pillar, a grab handle located on the side rail above each front and rear door, a front overhead console and a dome light located on the front upper roof.

SUNROOF INFORMATION:

Installed: _X_ Yes ____ No

Operation: _X_ Electric ____ Manual

SIDE RAIL CURTAIN AIRBAG INFORMATION:

Installed: _X_ Yes ___ No

ROLL-BAR INFORMATION:

Installed: _____ Yes _X_ No

Padded: _____ Yes _X_ No

Braces: _____ Yes _X_ No

GENERAL INFORMATION:

Date Received: 3/17/2010; Odometer Reading 8 miles

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: Volvo Car Corporation

Date of Manufacture: February, 2010; VIN: YV4982DL2A2104332

GVWR: 2358.7 kg; GAWR FRONT: 1242.8 kg;

GAWR REAR: 1154.4 kg;

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load:

FRONT: 240 kPa REAR: 240 kPa

Recommended Tire Size: 235/65R17

Recommended Cold Tire Pressure:

FRONT: 240 kPa REAR: 240 kPa

Size of Tire on Test Vehicle: 235/65R17

Type of Spare Tire: T125/80R17; Space Saver: X; Standard__

VEHICLE CAPACITY DATA:

Type of Front Seats: Bench__; Bucket X; Split Bench __

Number of Occupants: Front 2; Rear 3; TOTAL 5

VEHICLE CAPACITY WEIGHT:

Vehicle Capacity Weight (VCW) = 430 kg

No. of Occupants x 68 kg = 340 kg

Rated Cargo/Luggage Weight (RCLW) = 90 kg (difference)

WEIGHT OF TEST VEHICLE AS DELIVERED AT LABORATORY: (with maximum fluids)

Right Front =	529.5 kg	Right Rear =	361.5 kg
Left Front =	546.0 kg	Left Rear =	377.0 kg
TOTAL FRONT =	1075.5 kg	TOTAL REAR =	738.5 kg
% Total Weight =	59.3 %	% Total Weight =	40.7 %

TOTAL DELIVERED WEIGHT = 1814.0 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight = 1814.0 kg

Max. Test Cargo/Luggage Weight = 90.0 kg

Target Test Weight = 1904.0 kg

WEIGHT OF TEST VEHICLE FULLY LOADED:

Right Front =	524.5 kg	Right Rear =	411.5 kg
Left Front =	541.5 kg	Left Rear =	423.5 kg
TOTAL FRONT =	1066.0 kg	TOTAL REAR =	835.0 kg
% Total Weight =	56.1 %	% Total Weight =	43.9 %

TOTAL TEST WEIGHT = 1901.0 kg

Weight of ballast secured in vehicle's cargo area = 87.0 kg

TEST VEHICLE ATTITUDE:

AS DELIVERED: Right Front 797 mm; Left Front 793 mm;
Right Rear 823 mm; Left Rear 825 mm;
Pitch Angle at Right Door Sill = 1.5 Rear is higher
Pitch Angle at Left Door Sill = 1.2 Rear is higher
Roll Angle at Front Bumper = 0.2 Right is higher
Roll Angle at Rear Bumper = 0.2 Left is higher

FULLY LOADED: Right Front 798 mm; Left Front 795 mm;
Right Rear 807 mm; Left Rear 809 mm;
Pitch Angle at Right Door Sill = 1.2 Rear is higher
Pitch Angle at Left Door Sill = 0.9 Rear is higher
Roll Angle at Front Bumper = 0.1 Right is higher
Roll Angle at Rear Bumper = 0.0

AS TARGETED: Right Front 950 mm; Left Front 941 mm;
Right Rear 975 mm; Left Rear 970 mm;
Pitch Angle at Right Door Sill = 1.4 Rear is higher
Pitch Angle at Left Door Sill = 1.0 Rear is higher
Roll Angle at Front Bumper = 0.1 Right is higher
Roll Angle at Rear Bumper = 0.0

AS TESTED ON RIGHT SIDE:

Pitch Angle at Right Door Sill =	1.5 Rear is higher
Pitch Angle at Left Door Sill =	0.9 Rear is higher
Roll Angle at Front Bumper =	0.2 Right is higher
Roll Angle at Rear Bumper =	0.2 Left is higher

AS TESTED ON LEFT SIDE:

Pitch Angle at Right Door Sill =	1.5 Rear is higher
Pitch Angle at Left Door Sill =	1.1 Rear is higher
Roll Angle at Front Bumper =	0.2 Right is higher
Roll Angle at Rear Bumper =	0.0

VEHICLE WHEELBASE = 2780 mm

REMARKS: The seat travel distance was measured to be 252 mm for the driver front seat and 252 mm for the passenger front seat.

RECORDED BY: Donald J. Whiteside DATE: May 6, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-3

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

VEH. MOD YR/MAKE/MODEL/BODY: 2010 Volvo XC60 MPV

VEH. NHTSA NO.: CA5902 VIN: YV4982DL2A2104332 COLOR: Grey

VEH. BUILD DATE: February, 2010 TEST DATES: May 5-6, 2010

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Nathaniel Newth, Donald J. Whiteside

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

	HORIZONTAL ANGLE SPECIFIED RANGE	MINIMUM HORIZONTAL ANGLE	MAXIMUM HORIZONTAL ANGLE
A-PILLAR	L 195º-255º	L 203.7º	L 252.8º
	R 105º-165º	R 107.7º	R 156.2º
B-PILLAR	L 195º-345º	L 199.9º	L 287.7º
	R 15º-165º	R 71.1º	R 165.0º

AS DETERMINED USING THE PROCEDURES SPECIFIED IN S8.13.4.1

REMARKS:

RECORDED BY: Donald J. Whiteside DATE: May 6, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-4

VERTICAL IMPACT ANGLE RANGES

VEH. MOD YR/MAKE/MODEL/BODY: 2010 Volvo XC60 MPV

VEH. NHTSA NO.: CA5902 VIN: YV4982DL2A2104332 COLOR: Grey

VEH. BUILD DATE: February, 2010 TEST DATES: May 5-6, 2010

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Nathaniel Newth, Donald J. Whiteside

VERTICAL IMPACT ANGLE RANGES

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
FRONT HEADER	FH1	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	FH2	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
SIDE RAIL	SR1	L 0º-50º	L 0º	L 39º
		R 0º-50º	R 0º	R 39º
	SR2A	L 0º-50º	L 0º	L 46º
		R 0º-50º	R 0º	R 46º
	SR2B	L 0º-50º	L 0º	L 39º
		R 0º-50º	R 0º	R 39º
	SR3-1	L 0º-50º	L 0º	L 43º
		R 0º-50º	R 0º	R 43º
	SR3-2	L 0º-50º	L 0º	L 44º
		R 0º-50º	R 0º	R 44º
	SR3-3	L 0º-50º	L 0º	L 39º
		R 0º-50º	R 0º	R 39º

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
A-PILLAR	AP1	L -5º-50º	L -5º	L 23º
		R -5º-50º	R -5º	R 23º
	AP2	L -5º-50º	L -5º	L 50º
		R -5º-50º	R -5º	R 50º
	AP3	L -5º-50º	L -5º	L 48º
		R -5º-50º	R -5º	R 48º
B-PILLAR	BP1	L -10º-50º	L -10º	L 8º
		R -10º-50º	R -10º	R 8º
	BP2	L -10º-50º	L -10º	L -3º
		R -10º-50º	R -10º	R -3º
	BP3	L -10º-50º	L -10º	L -6º
		R -10º-50º	R -10º	R -6º
	BP4	L -10º-50º	L -10º	L -5º
		R -10º-50º	R -10º	R -5º
OTHER-PILLAR	OP1	L -10º-50º	L -10º	L 22º
		R -10º-50º	R -10º	R 22º
	OP2	L -10º-50º	L -10º	L -7º
		R -10º-50º	R -10º	R -7º
UPPER ROOF 1		0º-50º	0º	50º
UPPER ROOF 2		0º-50º	0º	45º
UPPER ROOF 3		0º-50º	0º	50º
UPPER ROOF 4		0º-50º	0º	50º
UPPER ROOF 5		0º-50º	0º	50º
UPPER ROOF 6		0º-50º	0º	50º

As determined using the Procedures specified in S8.13.4.2.

RECORDED BY: Donald J. Whiteside DATE: May 6, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-5

TARGET MEASUREMENTS

VEH. MOD YR/MAKE/MODEL/BODY: 2010 Volvo XC60 MPV

VEH. NHTSA NO.: CA5902 VIN: YV4982DL2A2104332 COLOR: Grey

VEH. BUILD DATE: February, 2010 TEST DATES: May 5-6, 2010

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Nathaniel Newth, Donald J. Whiteside

Measurement	Description	Left Side	Right Side
M	Seat Fore/Aft Travel (Front seats)	252 mm	252 mm
Tº	Horizontal < {CG-F1 (Left Seat) to (Right A-Pillar)}	107.2º	--
A1º	360º - Tº	252.8º	--
Wº	Horizontal < {CG-2 (Left Seat) to (Left A-Pillar)}	203.7º	--
A2º	A2º = Wº	203.7º	--
Uº	Horizontal < {CG-2 (Left Seat) to (Left B-Pillar)}	287.7º	--
B1º	B1º = Uº	287.7º	--
Vº	Horizontal < {CG-R (Left Seat) to (Left B-Pillar)}	199.9º	--
B2º	B2º = Vº	199.9º	--
Wº (right)	Horizontal < {CG-F2 (Right Seat) to (Right A-Pillar)}	--	156.2º
A1º (right)	A1º (right) = Wº (right)	--	156.2º
T º (right)	Horizontal < {CG-F1 (Right Seat) to (Left A-Pillar)}	--	252.3º
A2º (right)	360º-Tº (right)	--	107.7º
V º (right)	Horizontal < {CG-R (Right Seat) to (Right B-Pillar)}	--	174.9º
B1º (right)	B1º (right) = Vº (right) (cutoff due to limit is 165.0 º)	--	165.0º
U º (right)	Horizontal < {CG-F2 (Right Seat) to (Right B-Pillar)}	--	71.1º
B2º (right)	B2º (right) = Uº (right)	--	71.1º
J	A-Pillar {(Plane 3) – (Plane 5)}	350.6 mm	347.4 mm
J/2	J ÷ 2	175.3 mm	173.7 mm
D1	Upper Roof {(Plane A) – (Plane B)}	2065.0 mm	
D1/2	D1 ÷ 2	1032.5 mm	

Measurement	Description	Left Side	Right Side
D2	Upper Roof {(Plane C) – (Plane D)}	1219.6 mm	
D2/2	D2 ÷ 2	609.8 mm	
.35D1	.35 x D1	722.8 mm	
.35D2	.35 x D2	426.9 mm	
N	B-Pillar {(BPR) – (lowest point on daylight opening forward of B-Pillar)}	428.3 mm	429.9 mm
N/2	B-Pillar {(BP3) – (lowest point on daylight opening forward of B-Pillar)}	214.2 mm	215.0 mm
N/4	B-Pillar {(BP4) – (lowest point on daylight opening forward of B-Pillar)}	107.1 mm	107.5 mm
Q	O-Pillar (Plane 13 – Plane 14)	380.3 mm	381.1 mm
Q/2	Q / 2	190.2 mm	190.6 mm
D	R-Pillar (Point 7 – Point M)	883.0 mm	883.0 mm
3D/7	3*D / 7	378.4 mm	378.4 mm

As determined using the Procedures specified in S10.1-10.13.

SgRP Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	3105.3	-367.0	737.5	3105.3	367.0	737.5
Rear	3935.9	-367.0	847.2	3935.9	367.0	847.2

SgRP Locations (vehicle coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	3105.3	-367.0	737.5	3105.3	367.0	737.5
Rear	3935.9	-367.0	847.2	3935.9	367.0	847.2

CG Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
CGF1	3013.3	-367.0	1397.5	3013.3	367.0	1397.5
CGF2	3265.3	-367.0	1397.5	3265.3	367.0	1397.5
CGR	4095.9	-367.0	1507.2	4095.9	367.0	1507.2

REFERENCE FOR VEHICLE COORDINATE SYSTEM (measured in millimeters):

Passenger side door stop (x, y, z) = 2300.6, 785.9, 830.1

Driver side door stop (x, y, z) = 2300.6, -785.9, 830.1

Front driver seat rear inboard seat anchor (x, y, z) = 3219.3, -164.0, 432.9

REMARKS:

RECORDED BY: Donald J. Whiteside DATE: April 26, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-6

SUMMARY OF TARGETING RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2010 Volvo XC60 MPV

VEH. NHTSA NO.: CA5902 VIN: YV4982DL2A2104332 COLOR: Grey

VEH. BUILD DATE: February, 2010 TEST DATES: May 5-6, 2010

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Nathaniel Newth, Donald J. Whiteside

SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**Z**					
A-Pillar Left Side								
AP1	2938.1	-530.4	1523.9	251	23	No	--	No
AP2	2808.7	-592.4	1436.9	205	50	No	--	No
AP3	2613.8	-635.0	1349.6	205	48	No	--	No
A-Pillar Right Side								
AP1	2939.7	528.8	1520.9	109	23	No	--	No
AP2	2809.2	586.6	1433.8	155	50	No	--	No
AP3	2615.0	629.1	1347.5	155	48	No	--	No
B-Pillar Left Side								
BP1	3398.4	-508.3	1577.8	--	--	Yes	--	--
REL	3397.6	-483.2	1591.2	270	8	--	1	No
BP2	3372.8	-608.8	1336.8	270	-3	No	--	No
BP3	3334.7	-607.7	1364.3	280	-6	No	--	Yes
BP4	3430.4	-658.1	1258.4	201	-5	No	--	No
B-Pillar Right Side								
BP1	3397.5	507.3	1577.0	--	--	Yes	--	--
REL	3393.4	485.1	1588.4	90	8	--	1	Yes
BP2	3373.0	608.6	1332.9	90	-3	No	--	Yes

SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**Z**					
BP3	3334.4	604.5	1362.9	80	-6	No	--	No
BP4	3431.5	658.0	1256.6	164	-5	No	--	No
Other Pillar Left Side								
OP1	4134.8	-498.5	1600.0	270	22	No	--	Yes
OP2	4192.1	-636.6	1410.4	270	-7	No	--	No
Other Pillar Right Side								
OP1	4134.5	497.1	1600.7	90	22	No	--	No
OP2	4193.4	630.4	1409.9	90	-7	No	--	Yes
Rear Pillar Left Side								
RP1	4618.6	-507.3	1525.5	Target exempt from testing per S6.3(b).				No
RP2	4720.6	-657.0	1375.6	Target exempt from testing per S6.3(b).				No
Rear Pillar Right Side								
RP1	4614.8	505.5	1525.0	Target exempt from testing per S6.3(b).				No
RP2	4721.5	653.6	1375.2	Target exempt from testing per S6.3(b).				No
Front Header Left Side								
FH1	2836.7	-413.4	1535.1	180	50	No	--	Yes
FH2	2808.3	-266.9	1539.8	180	50	No	--	No
Front Header Right Side								
FH1	2833.6	415.8	1533.9	180	50	No	--	No
FH2	2804.8	269.2	1538.4	180	50	No	--	No
Side Rail Left Side								
SR1	3087.3	-511.4	1575.1	--	--	Yes	--	--
REL	3085.3	-483.7	1570.2	270	39	--	1	No
SR2A	3238.2	-510.2	1590.6	--	--	Yes	--	--
REL	3222.2	-492.8	1571.9	270	46	--	1	No
SR2B	3097.6	-512.0	1577.1	--	--	Yes	--	--
REL	3097.6	-483.8	1572.4	270	39	--	1	No
SR3-1	3743.8	-500.7	1574.1	270	43	No	--	No
SR3-2	3914.8	-500.0	1575.8	270	44	No	--	No

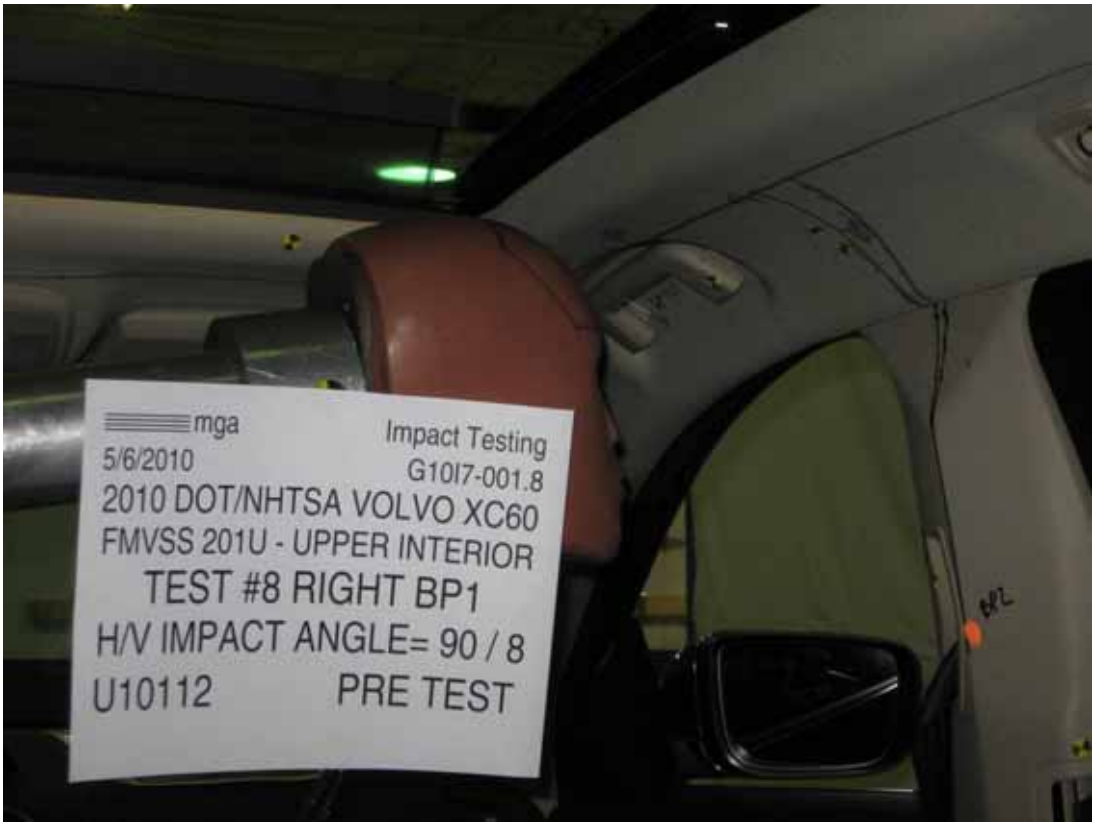
SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**Z**					
SR3-3	4284.9	-530.4	1567.4	270	39	No	--	No
Side Rail Right Side								
SR1	3089.6	510.9	1575.6	--	--	Yes	--	--
REL	3085.7	482.0	1568.5	90	39	--	1	No
SR2A	3239.2	509.1	1590.6	--	--	Yes	--	--
REL	3225.3	491.8	1571.7	90	46	--	1	No
SR2B	3097.0	509.9	1576.1	--	--	Yes	--	--
REL	3098.7	481.2	1570.3	90	39	--	1	No
SR3-1	3744.6	496.9	1575.6	90	43	No	--	No
SR3-2	3916.0	495.4	1577.2	90	44	No	--	No
SR3-3	4284.7	526.9	1568.8	90	39	No	--	No
Rear Header Left Side								
RH	4677.7	-367.5	1548.8	Target exempt from testing per S6.3(b).				No
Rear Header Right Side								
RH	4677.4	367.8	1546.8	Target exempt from testing per S6.3(b).				No
Upper Roof Left Side								
UR1@SR1	3062.1	-418.6	1575.5	270	50	No	--	Yes
UR4@BP	3394.4	-418.8	1604.9	270	50	No	--	Yes
UR5@SR3-1	3753.7	-381.7	1622.4	270	50	No	--	Yes
Upper Roof Right Side								
UR2@Front of Sunroof	3091.9	223.9	1601.7	180	45	Yes	--	Yes
UR3@SR2A	3223.3	421.8	1594.3	90	50	Yes	--	Yes
UR6@OP	4097.4	407.8	1620.7	90	50	Yes	--	Yes

As determined using the Procedures specified in S10.1-10.13.

RECORDED BY: Donald J. Whiteside DATE: May 6, 2010

APPROVED BY: Helen A. Kaleto

3.0 TEST DATA (Including Acceleration and Velocity Plots)




mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT BP1
H/V IMPACT ANGLE= 90 / 8
U10112
POST TEST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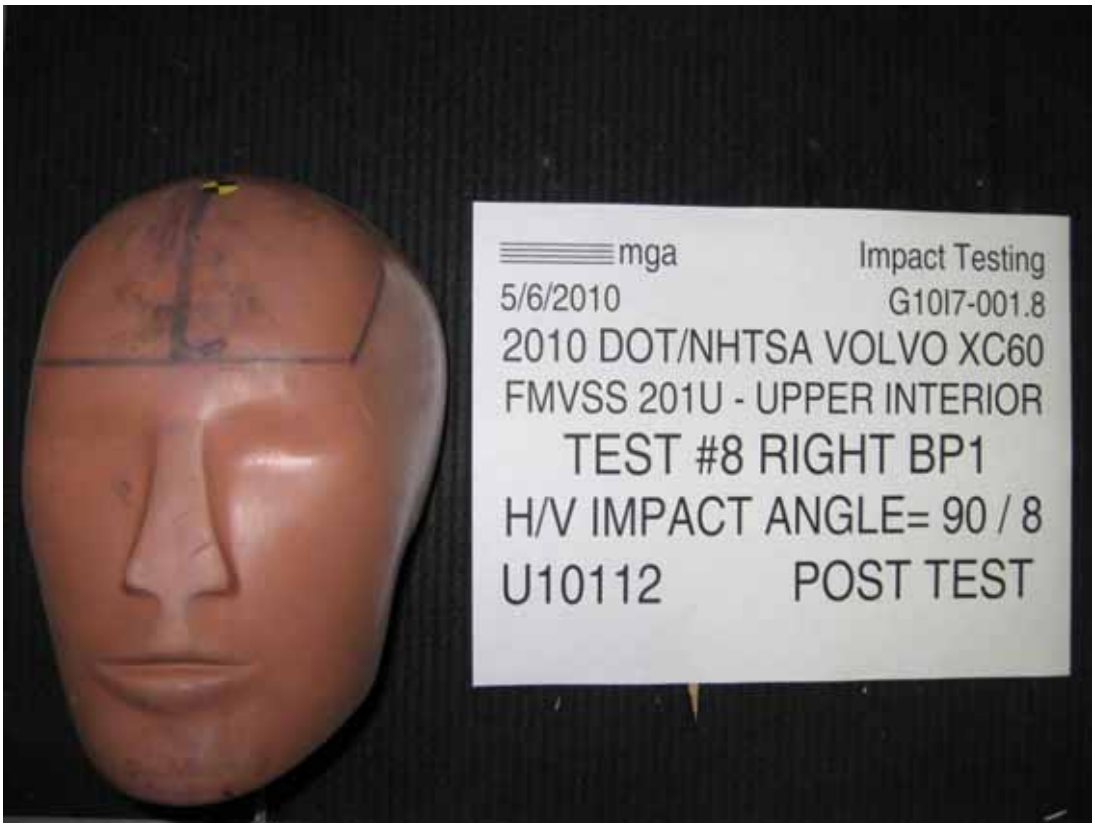
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT BP1
H/V IMPACT ANGLE= 90 / 8
U10112
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT BP1
H/V IMPACT ANGLE= 90 / 8
U10112
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#8

Target (Vehicle Side): BP1Right

Temperature:22.1C

MGA Test Reference No.:U10112

Humidity:38.5%

Approach Horizontal Angles:90º

Time of Test:9:24:48 AM

Approach Vertical Angles:8º

FMH Serial No:[037]

Additional Description: One relocation

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
451	377	9.8	18.8	75	3 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-116.9	1.05	1.05
Y	6	J14103	94.2	0.84	0.84
Z	7	J35800	98.2	0.93	0.93

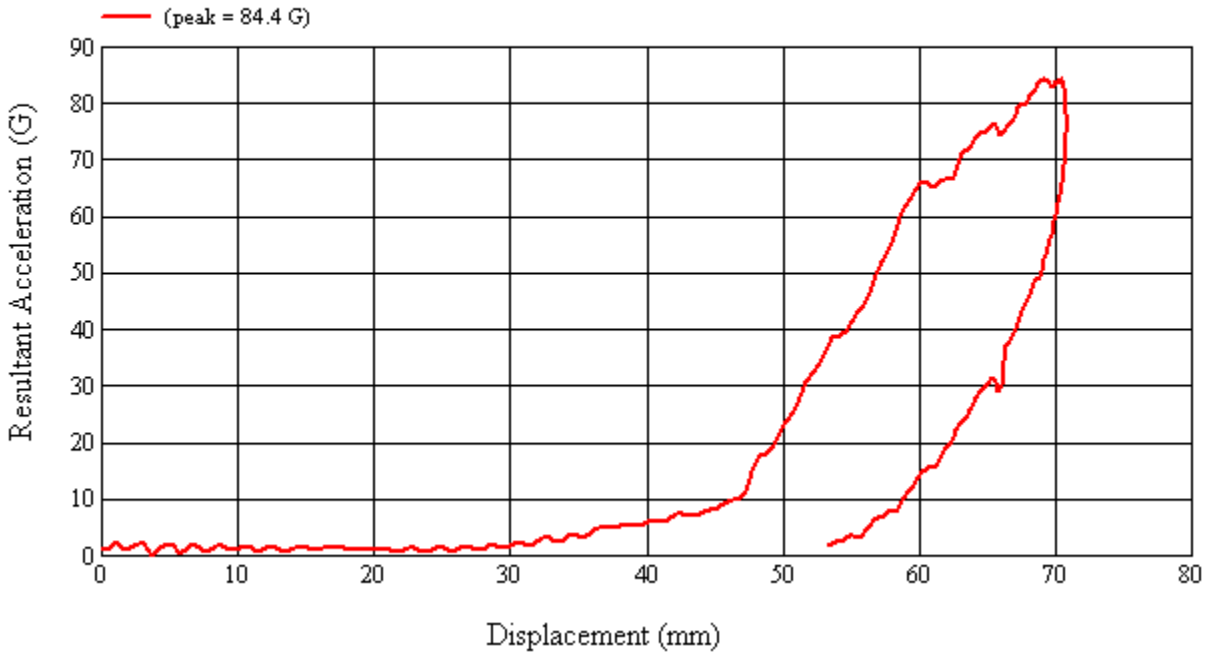
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

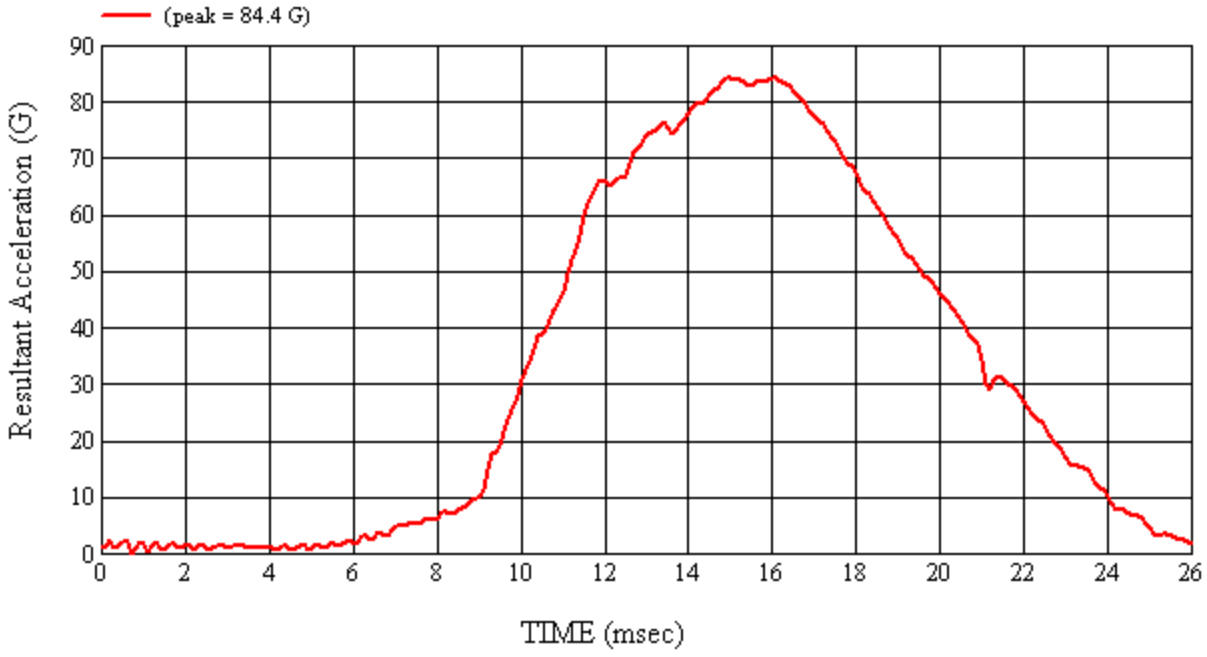
No visible damage

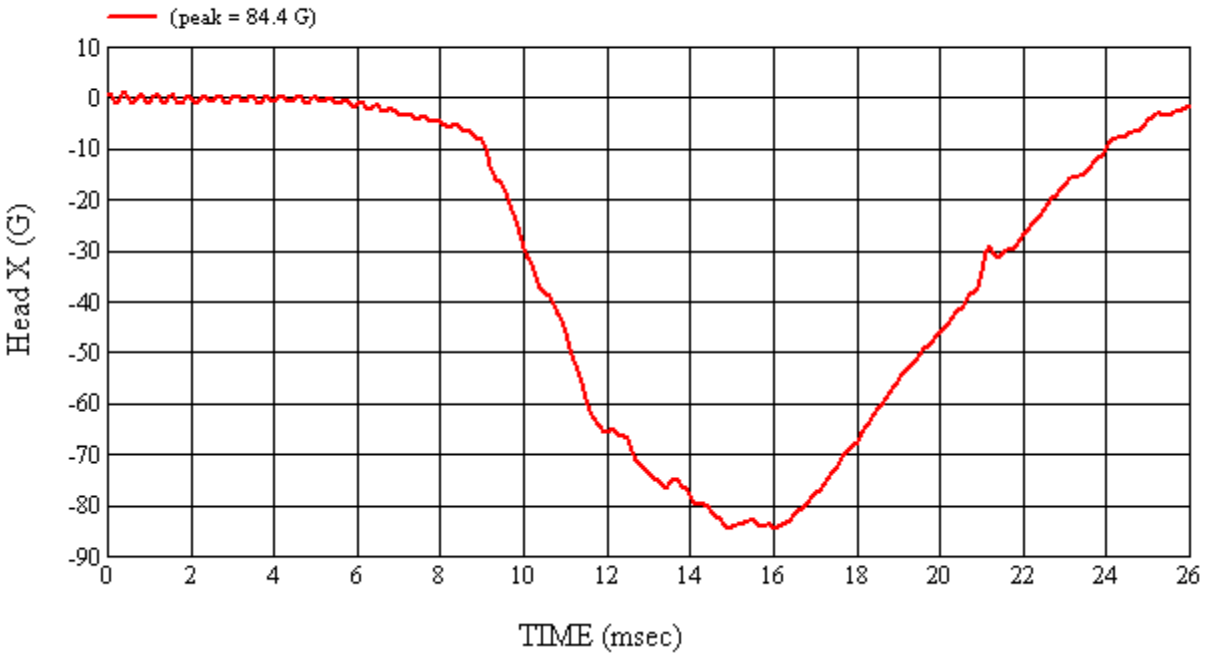
Recorded By: _____ Approved By*: _____ Date: 5/6/2010

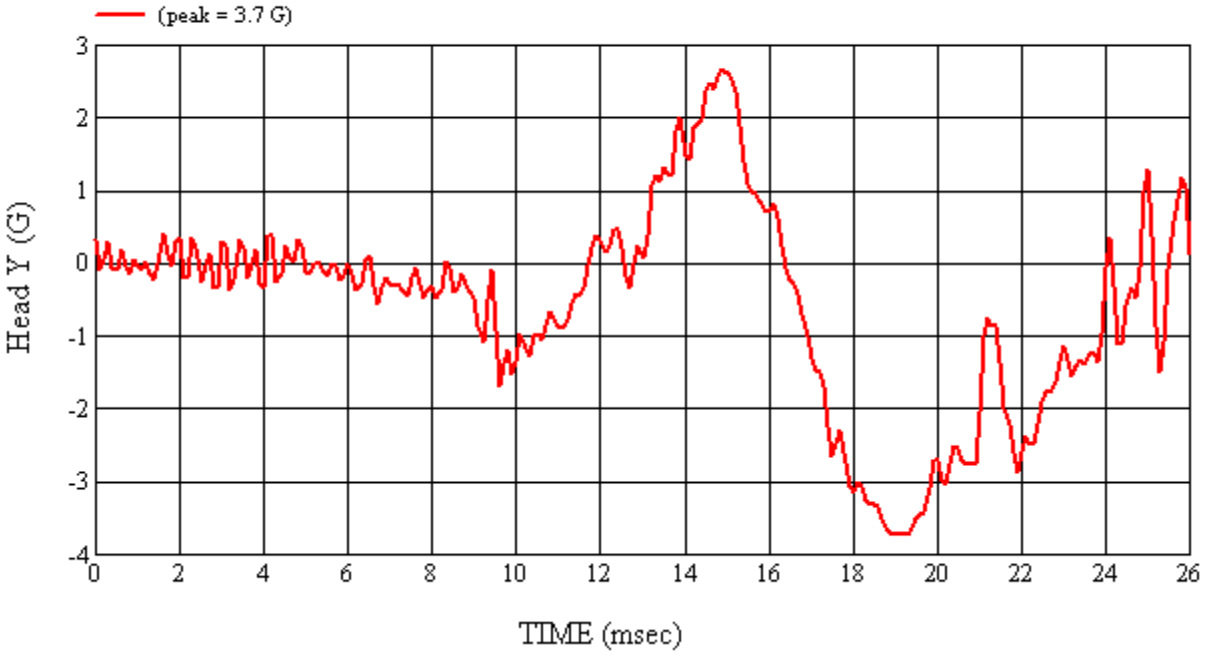
*Only necessary for NHTSA (Government) Compliance testing.

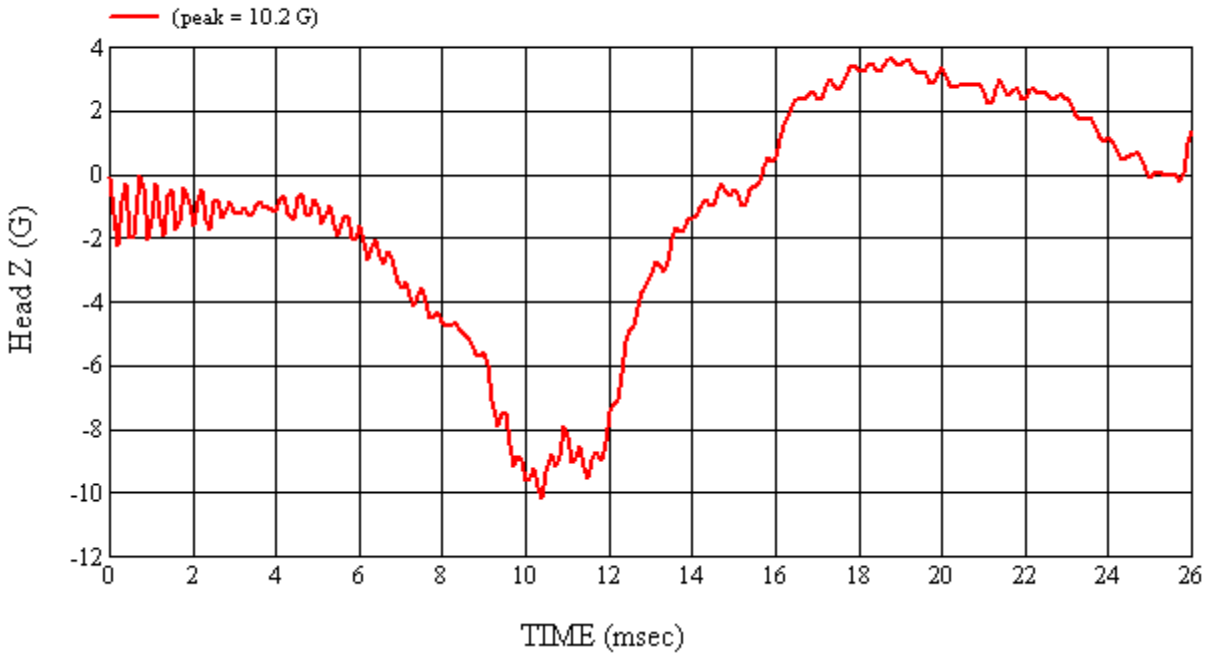
MGA Test #: U10112 Target Location: BP1, Right Side Test Date: 5/6/2010

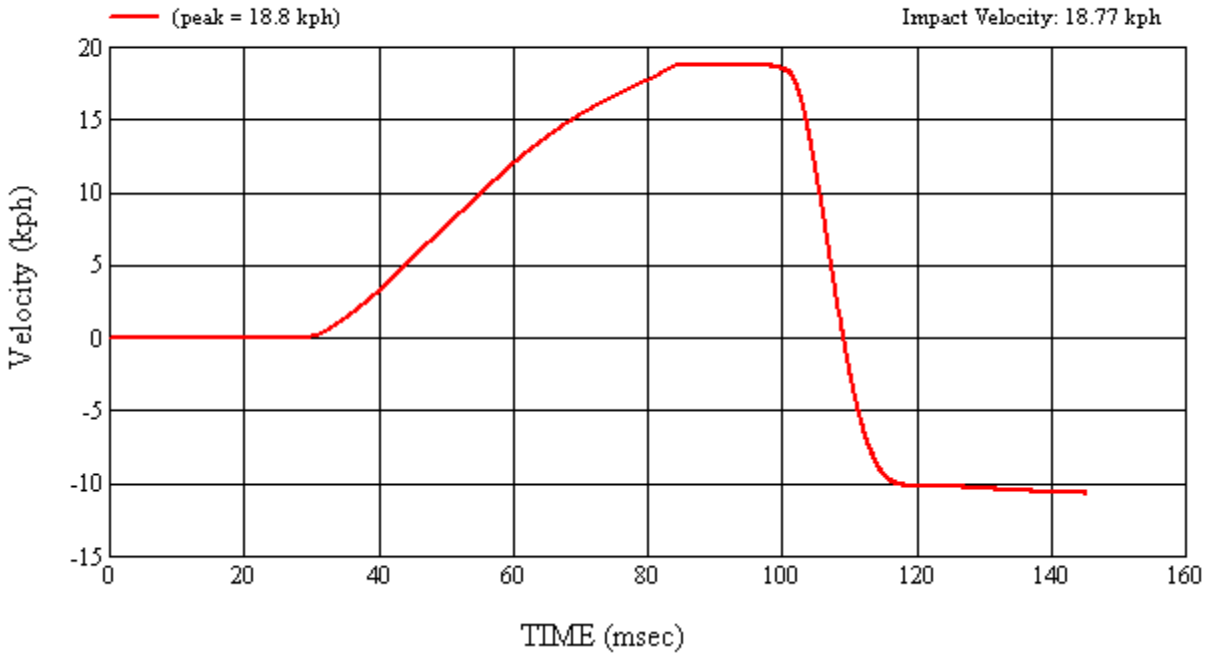


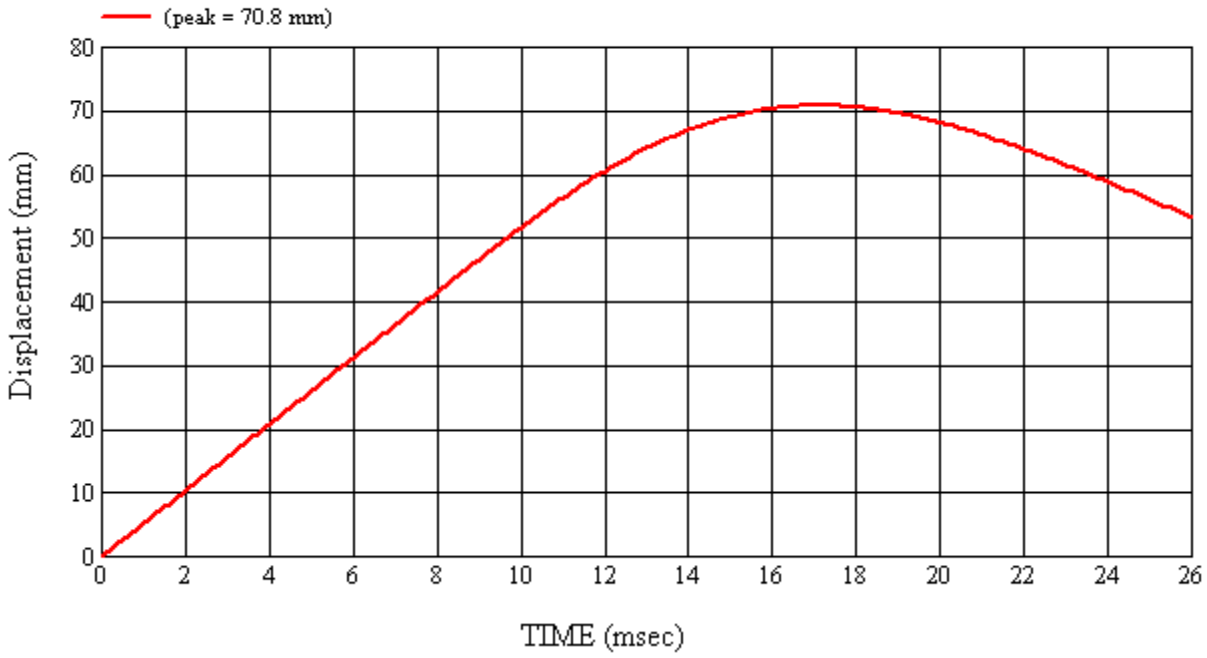


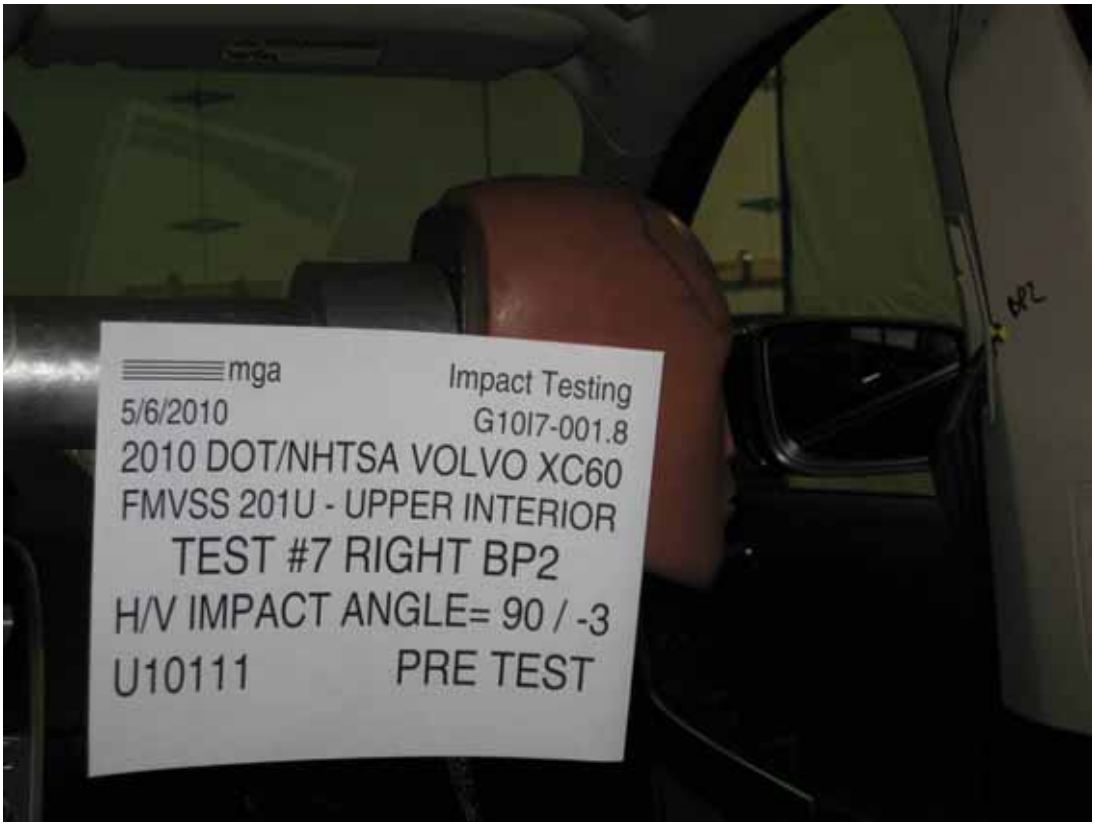

(peak = 84.4 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

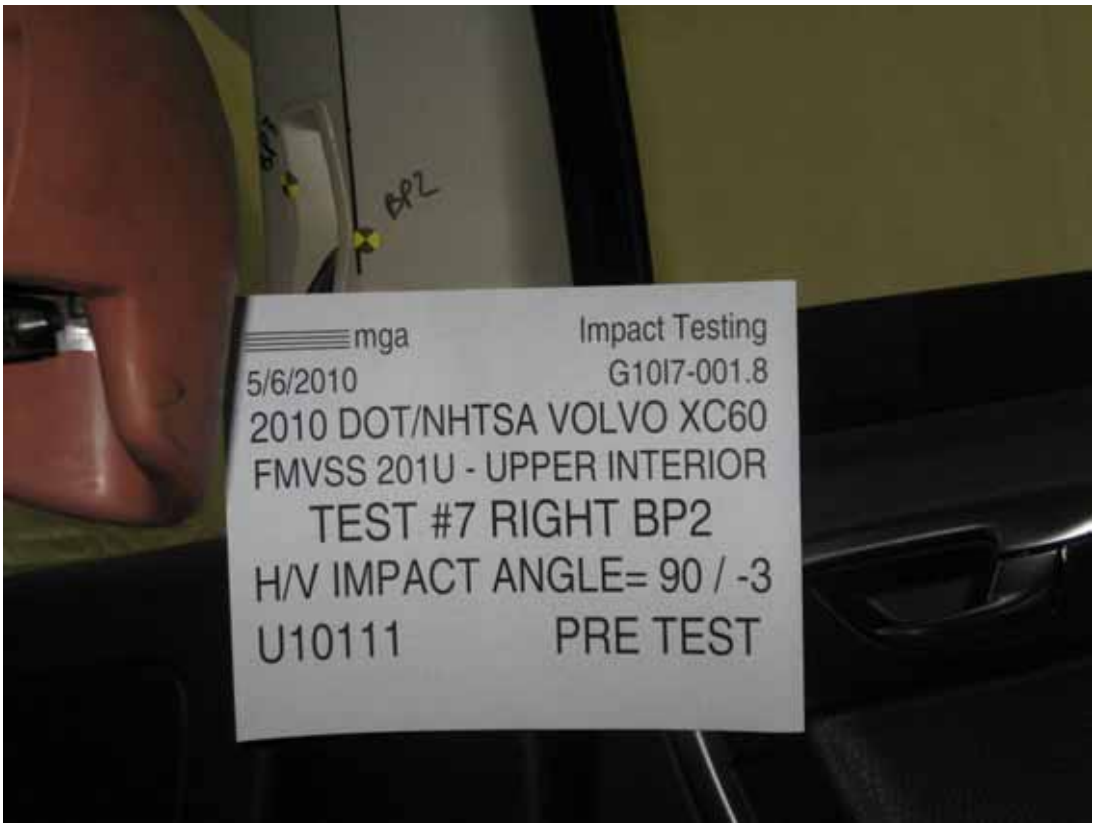

(peak = 3.7 G)
Head Y (G)
3
2
1
0
-1
-2
-3
-4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

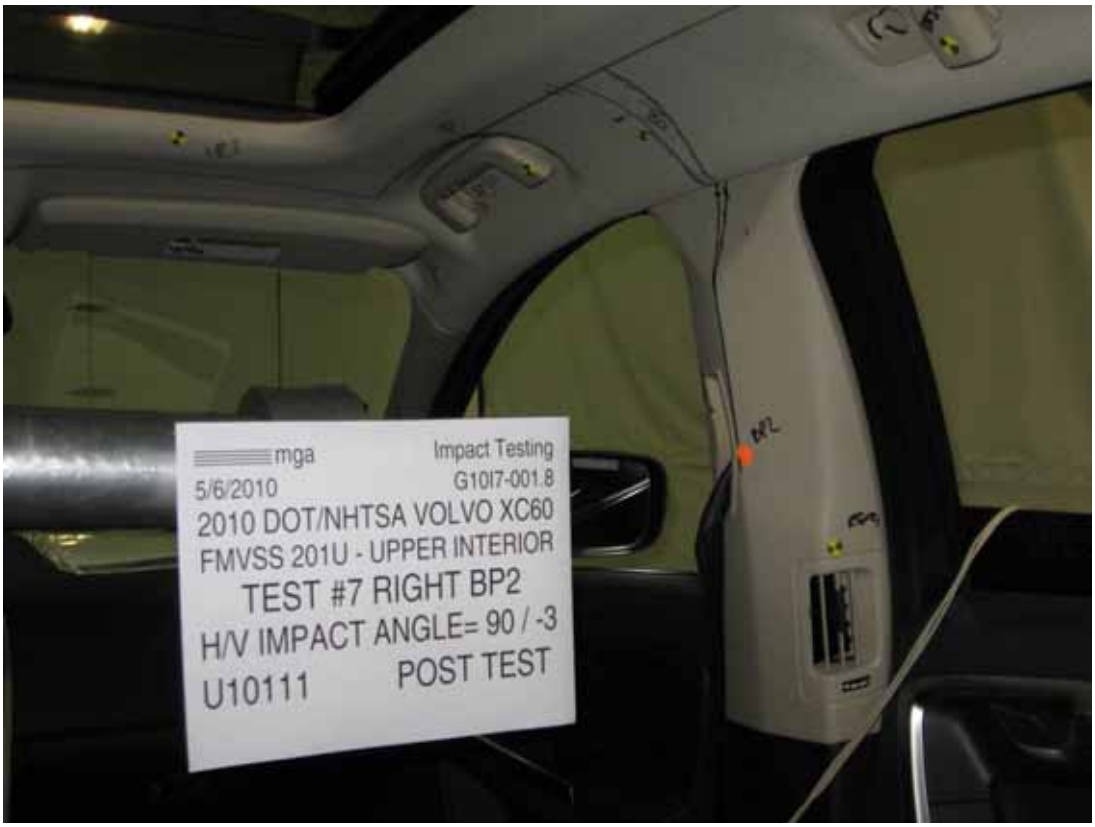

(peak = 10.2 G)
Head Z (G)
4
2
0
-2
-4
-6
-8
-10
-12
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 18.8 kph)
Impact Velocity: 18.77 kph
Velocity (kph)
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
TIME (msec)


(peak = 70.8 mm)
Displacement (mm)
0
10
20
30
40
50
60
70
80
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT BP2
H/V IMPACT ANGLE= 90 / -3
U10111
PRE TEST
BP2


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT BP2
H/V IMPACT ANGLE= 90 / -3
U10111
PRE TEST
BP2


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT BP2
H/V IMPACT ANGLE= 90 / -3
U10111
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT BP2
H/V IMPACT ANGLE= 90 / -3
U10111
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT BP2
H/V IMPACT ANGLE= 90 / -3
U10111
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Target (Vehicle Side): BP2Right

MGA Test Reference No.:U10111

Approach Horizontal Angles:90º

Approach Vertical Angles:-3º

Additional Description:

Test Number:#7

Temperature:21.6C

Humidity:38.9%

Time of Test:8:50:57 AM

FMH Serial No:[035]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
698	705	7.4	24.1	12	14 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-96.3	1.05	1.05
Y	6	J22664	95.2	0.84	0.84
Z	7	J35924	93.8	0.93	0.93

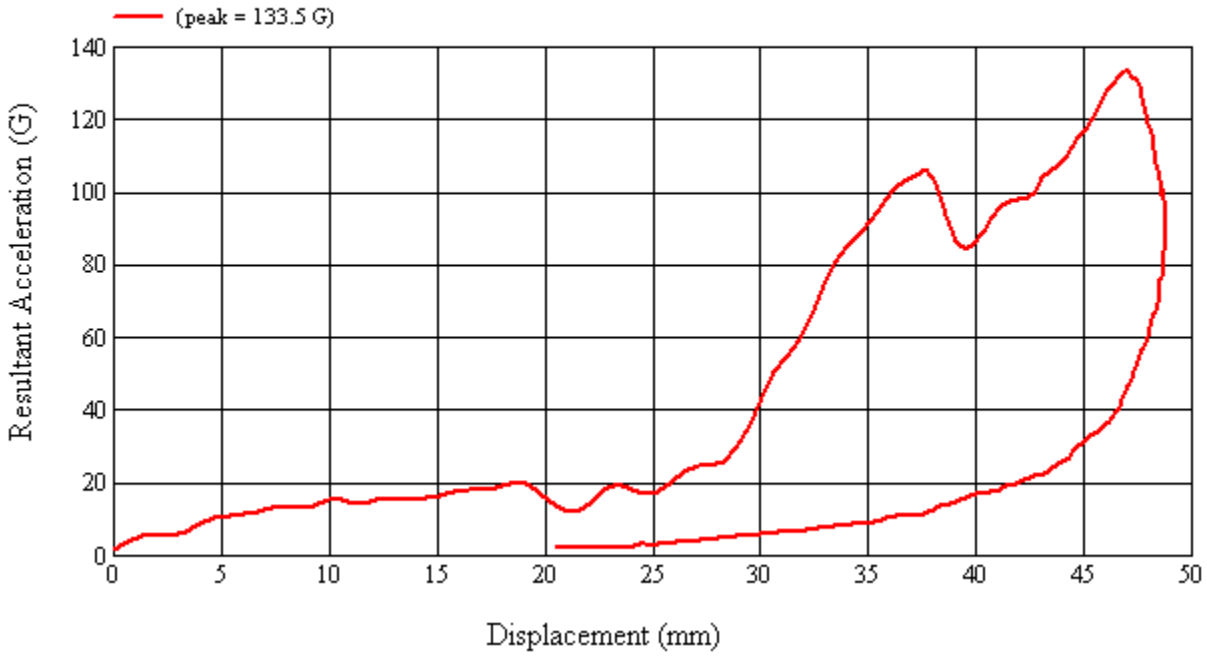
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

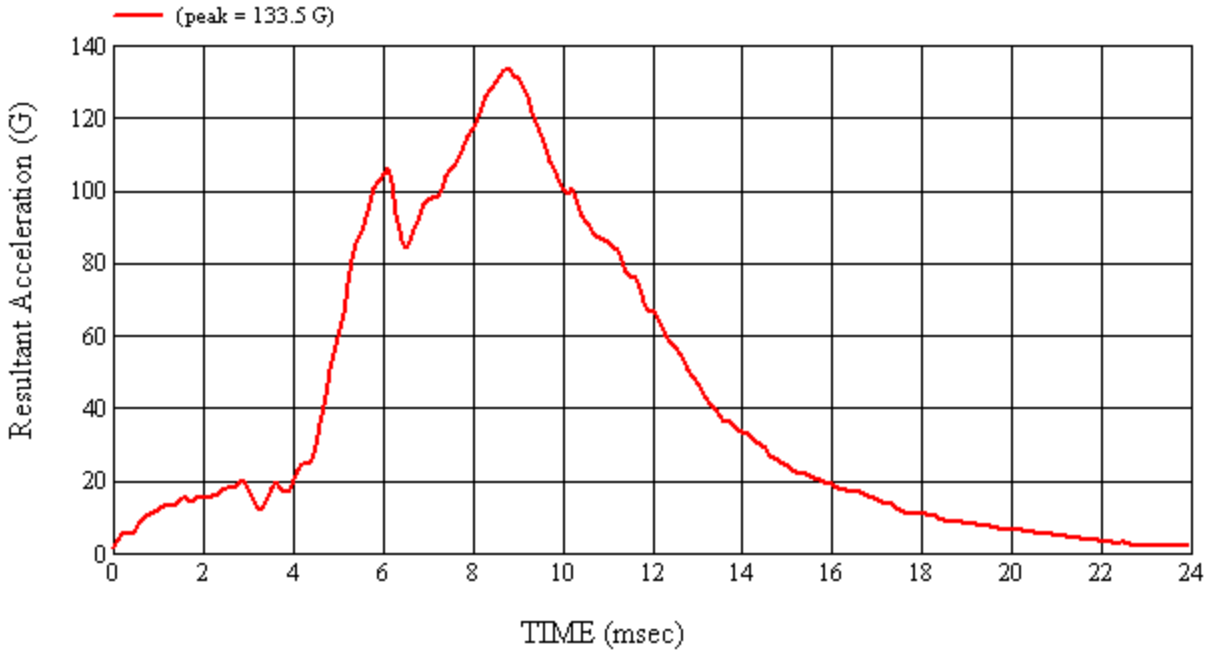
No visible damage

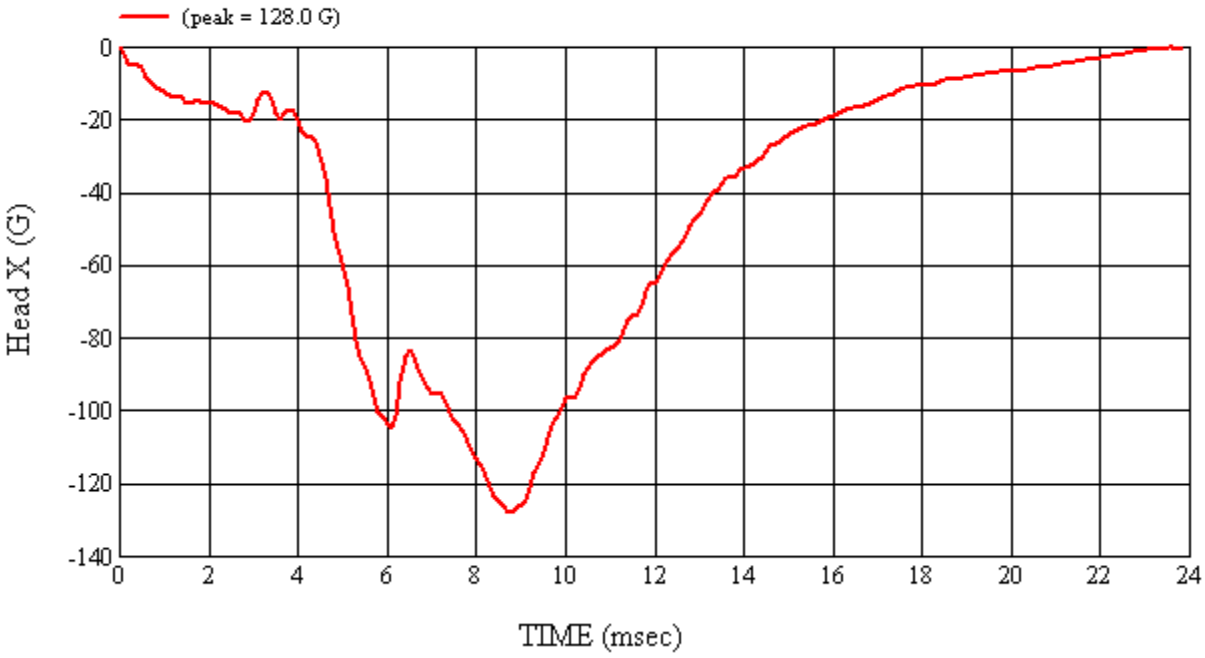
Recorded By: _____ Approved By*: _____ Date: 5/6/2010

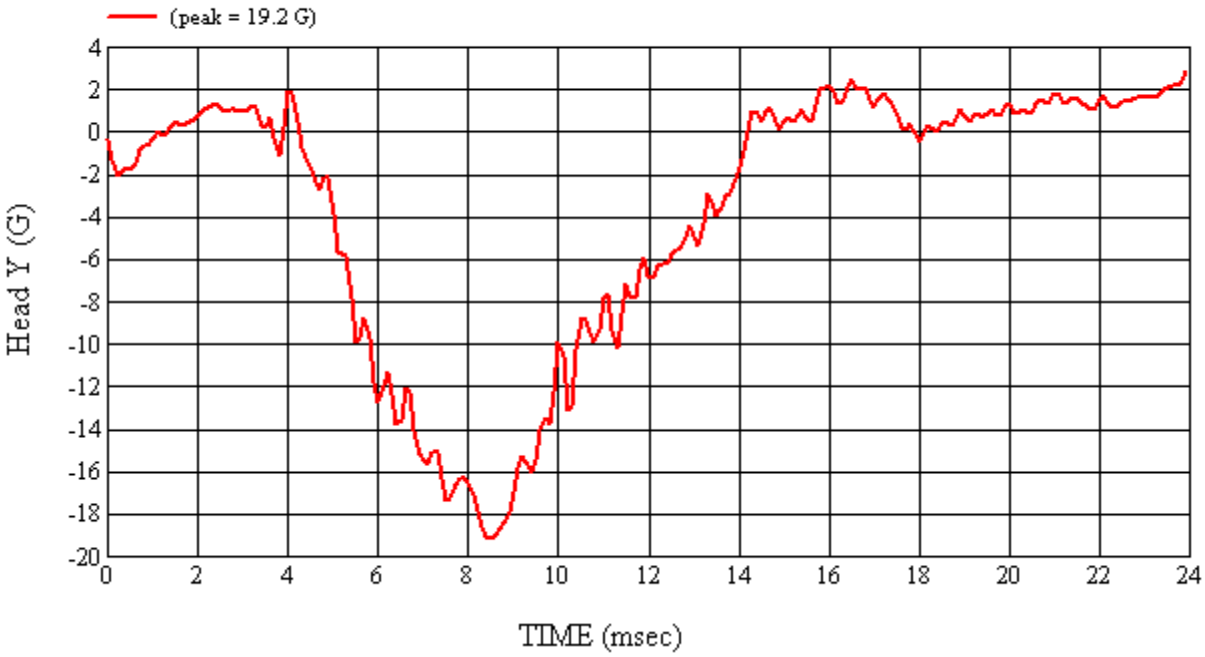
*Only necessary for NHTSA (Government) Compliance testing.

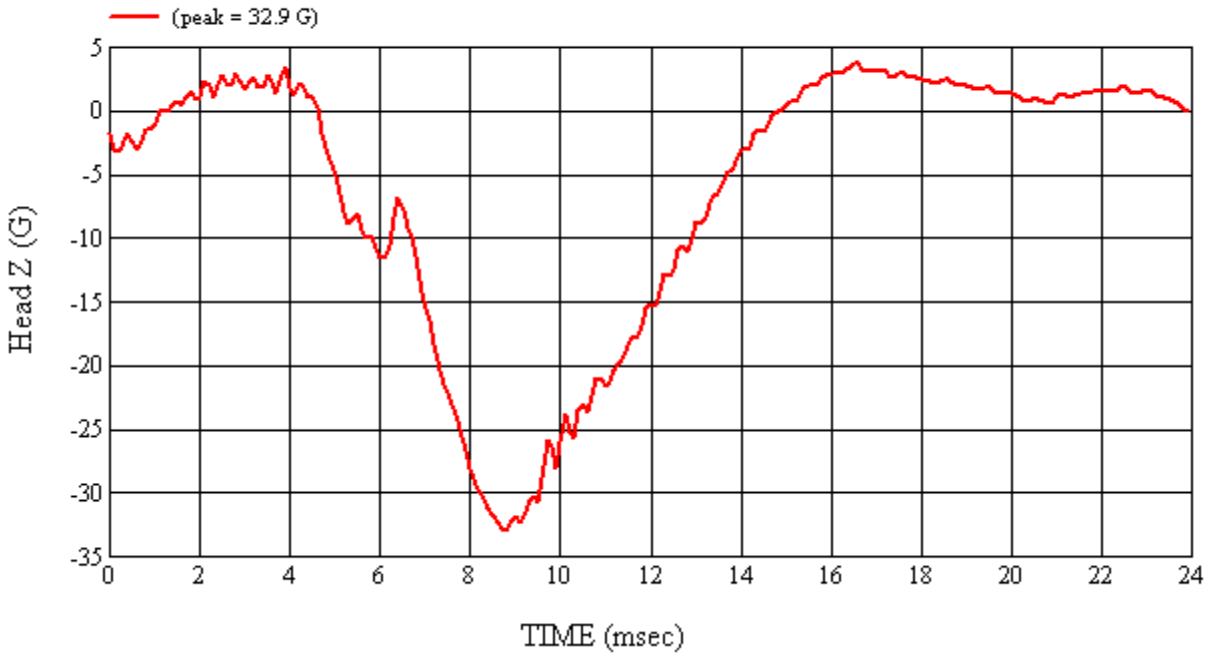
MGA Test #: U10111 Target Location: BP2, Right Side Test Date: 5/6/2010

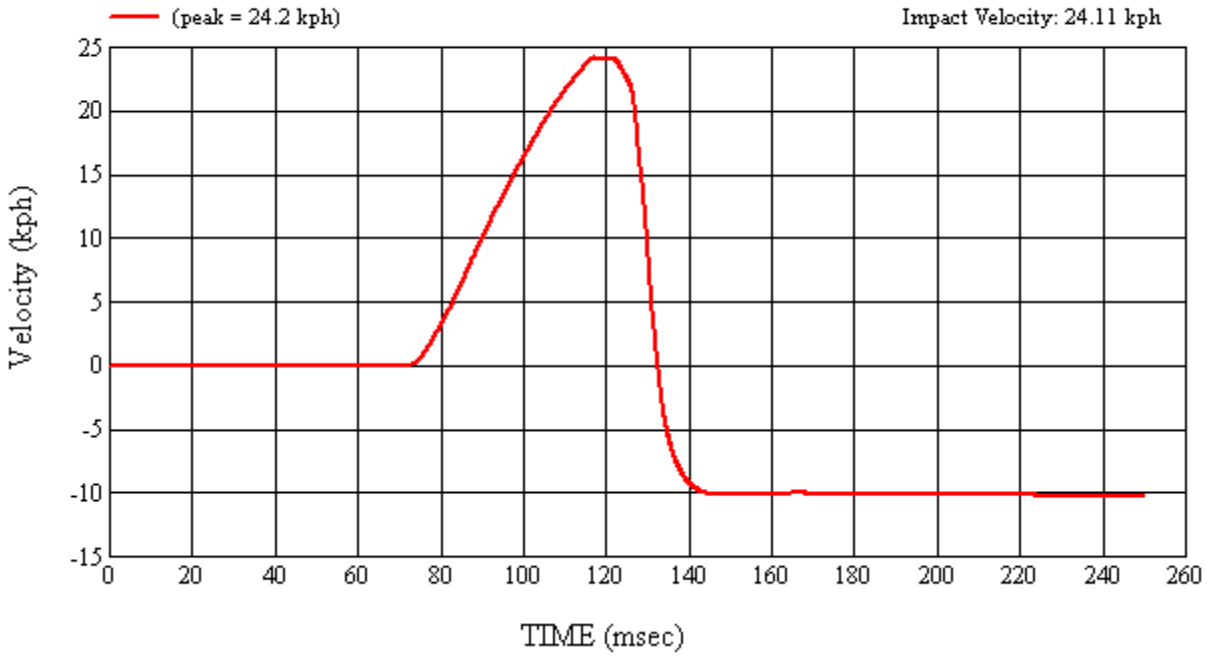


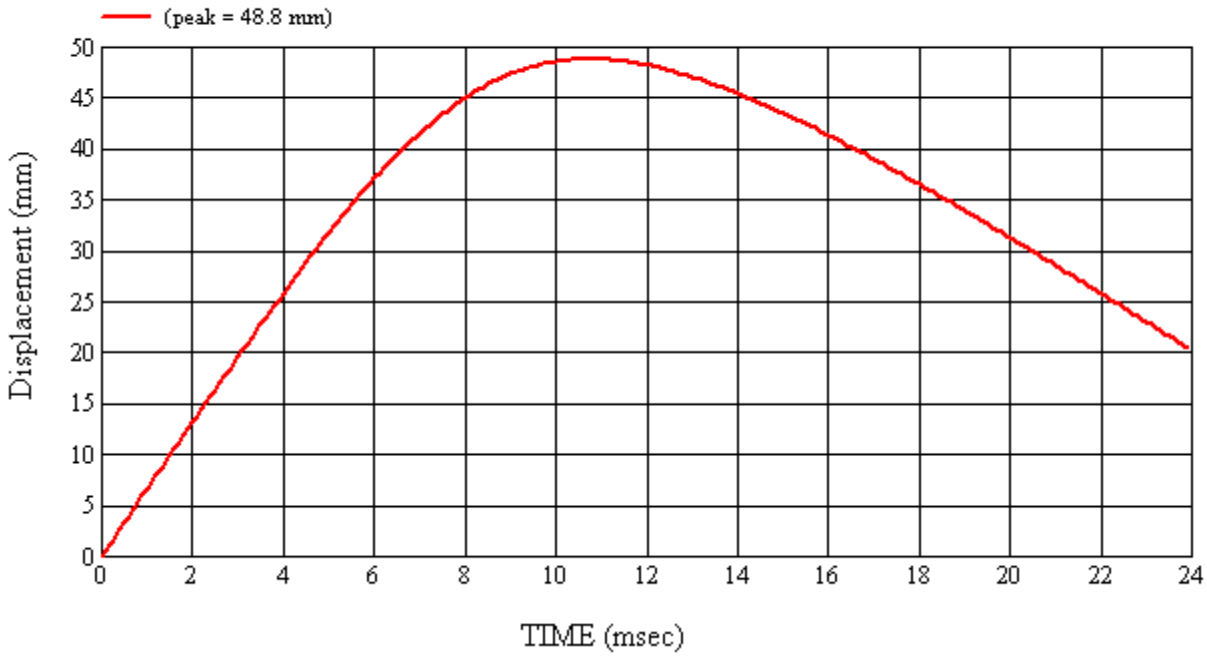



(peak = 128.0 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

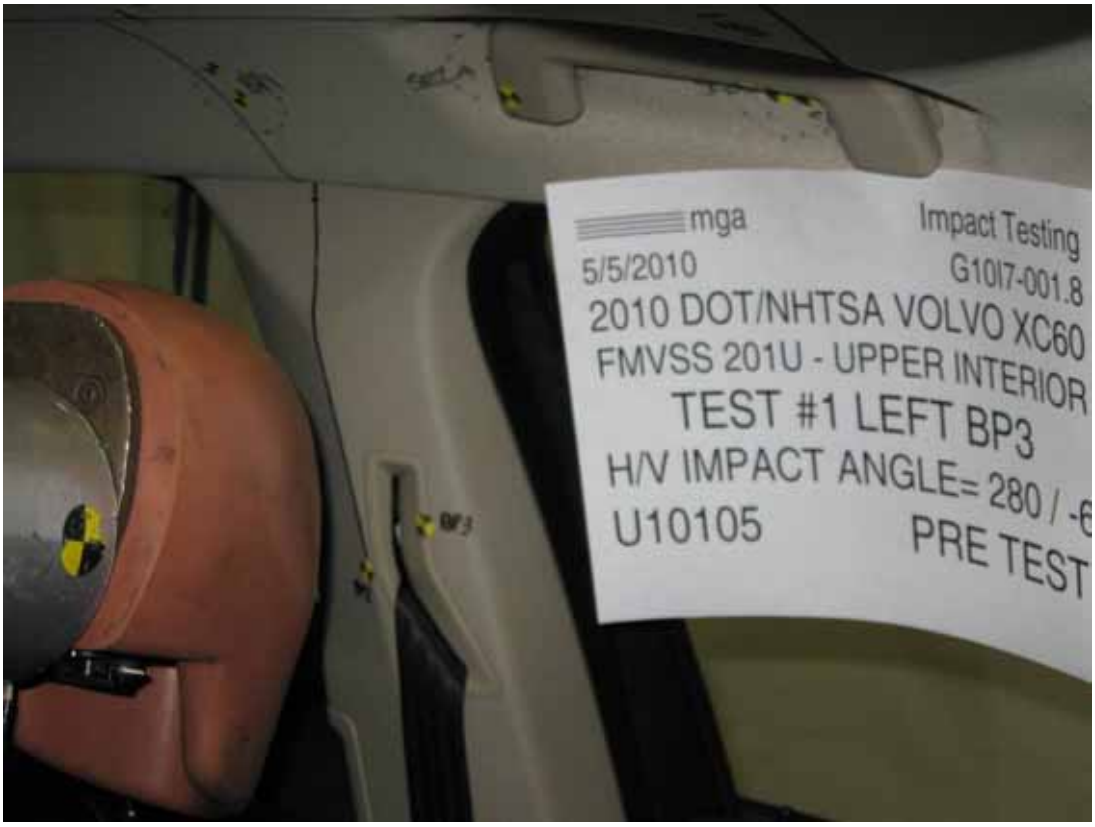

(peak = 19.2 G)
Head Y (G)
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

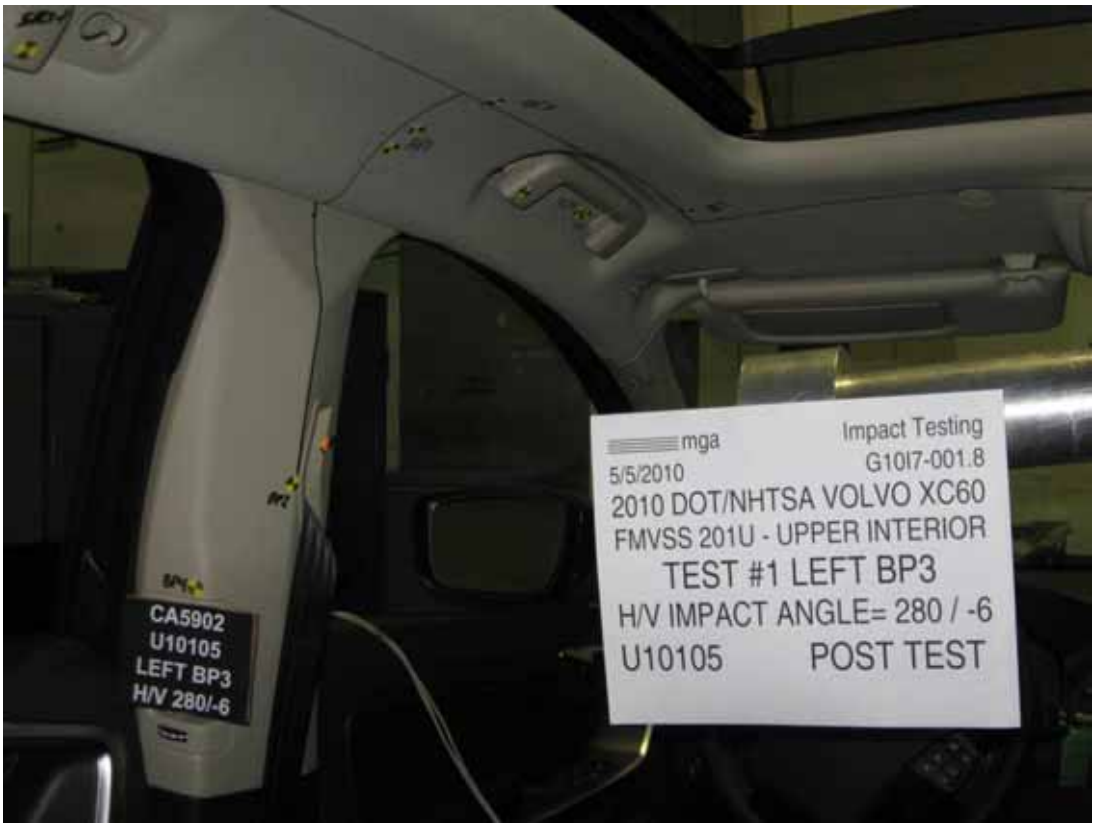

(peak = 32.9 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 24.11 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

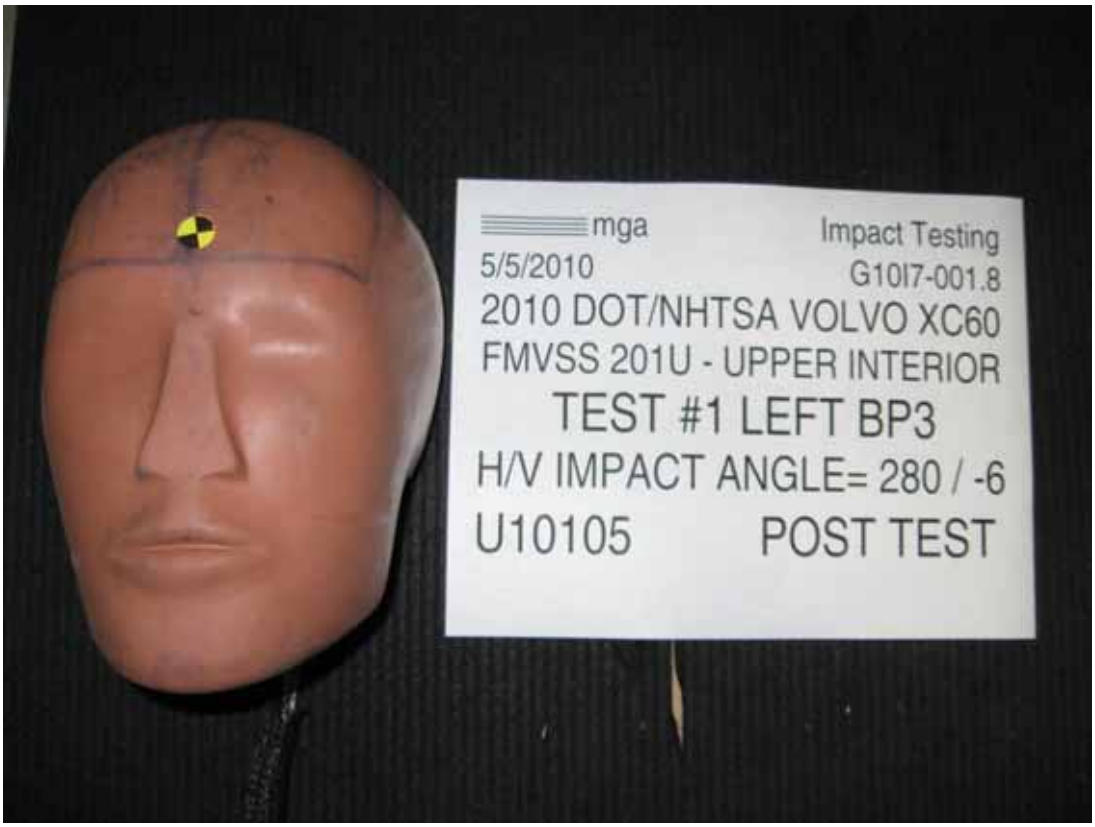

(peak = 48.8 mm)
Displacement (mm)
50
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #1 LEFT BP3
H/V IMPACT ANGLE= 280 / -6
U10105
PRE TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #1 LEFT BP3
H/V IMPACT ANGLE= 280 / -6
U10105
PRE TEST


CA5902
U10105
LEFT BP3
H/V 280/-6
mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #1 LEFT BP3
H/V IMPACT ANGLE= 280 / -6
U10105
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #1 LEFT BP3
H/V IMPACT ANGLE= 280 / -6
U10105
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #1 LEFT BP3
H/V IMPACT ANGLE= 280 / -6
U10105
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#1

Target (Vehicle Side): BP3Left

Temperature:22.8C

MGA Test Reference No.:U10105

Humidity:43.3%

Approach Horizontal Angles:280º

Time of Test:10:24:20 AM

Approach Vertical Angles:-6º

FMH Serial No:[035]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
589	560	8.9	23.8	9	2 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-96.3	1.04	1.05
Y	6	J22664	95.2	0.83	0.84
Z	7	J35924	93.8	0.92	0.93

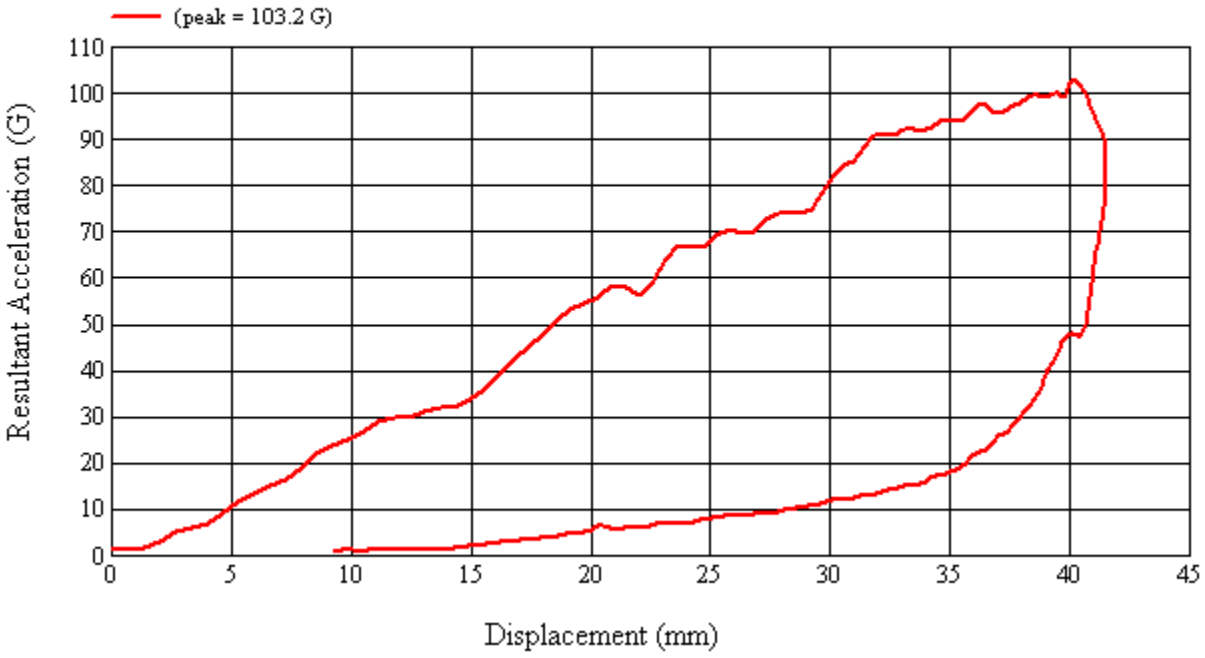
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

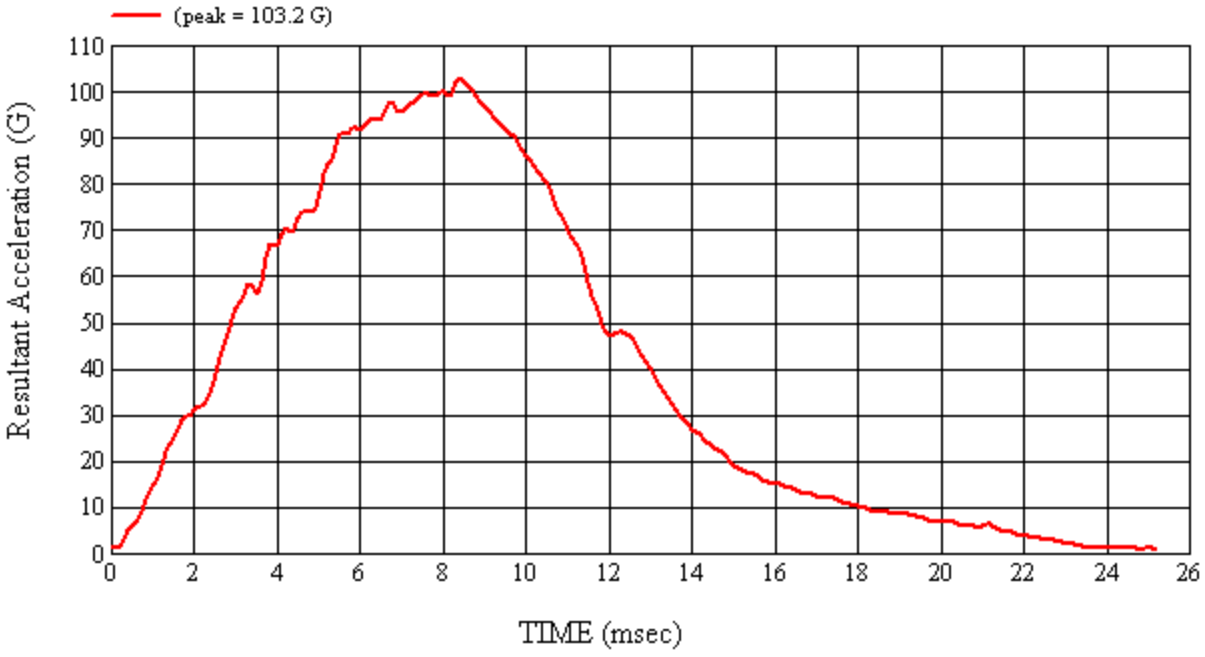
No visible damage

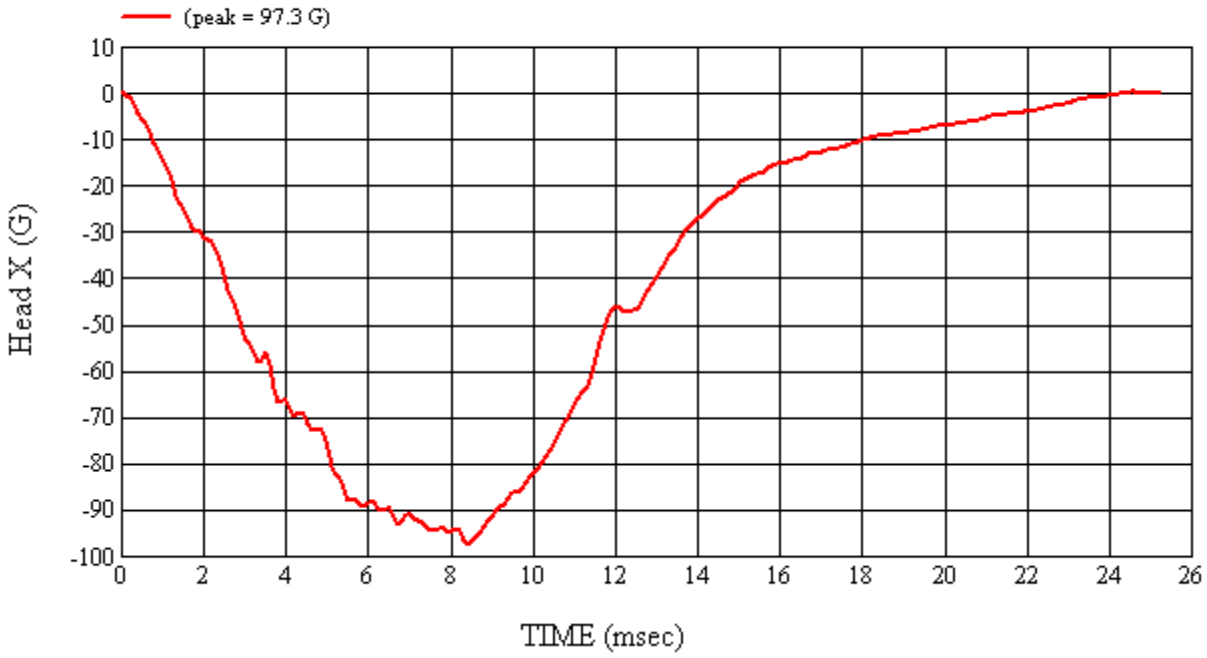
Recorded By: _____ Approved By*: _____ Date: 5/5/2010

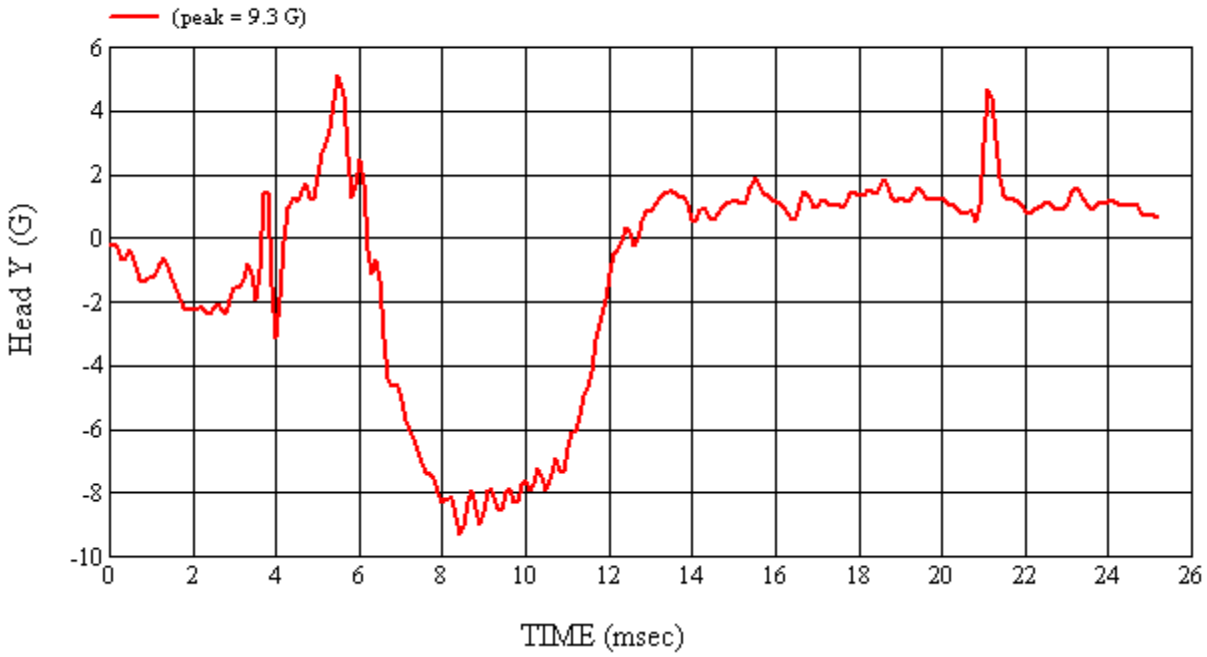
*Only necessary for NHTSA (Government) Compliance testing.

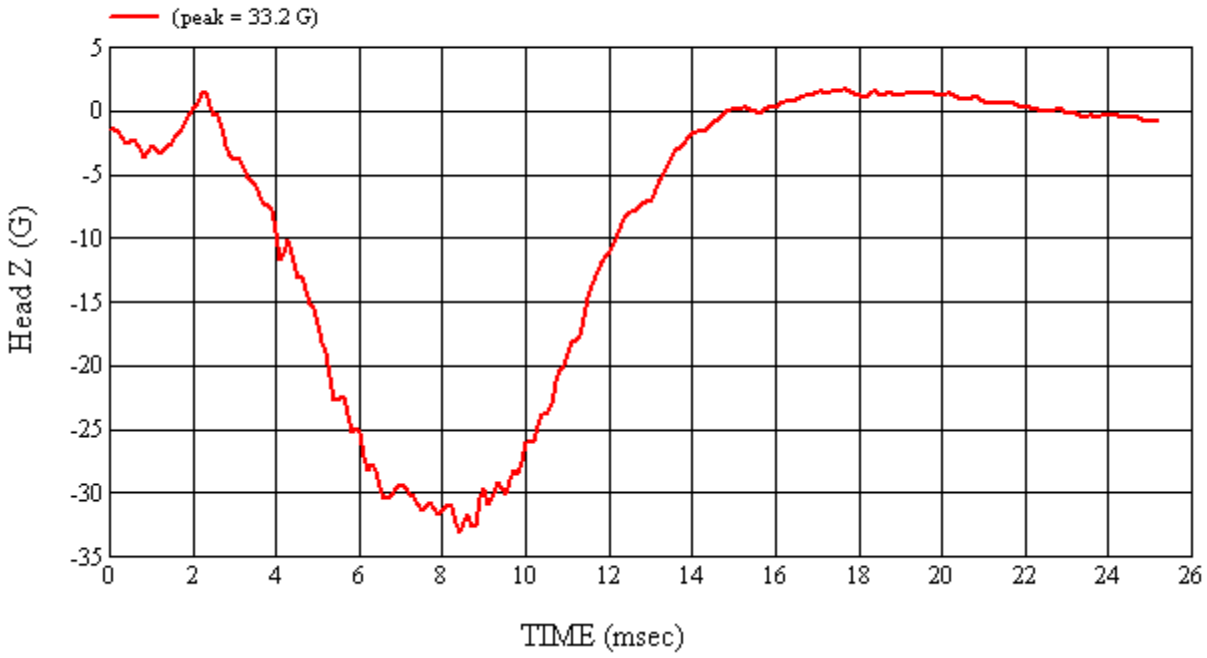
MGA Test #: U10105 Target Location: BP3, Left Side Test Date: 5/5/2010

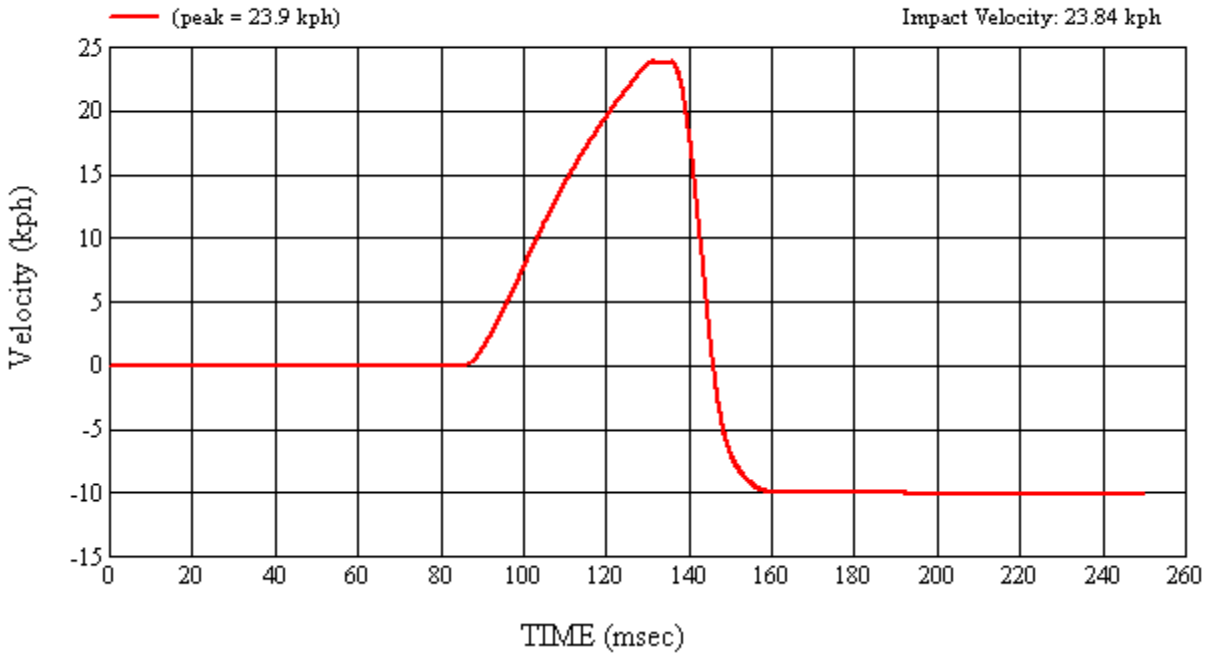


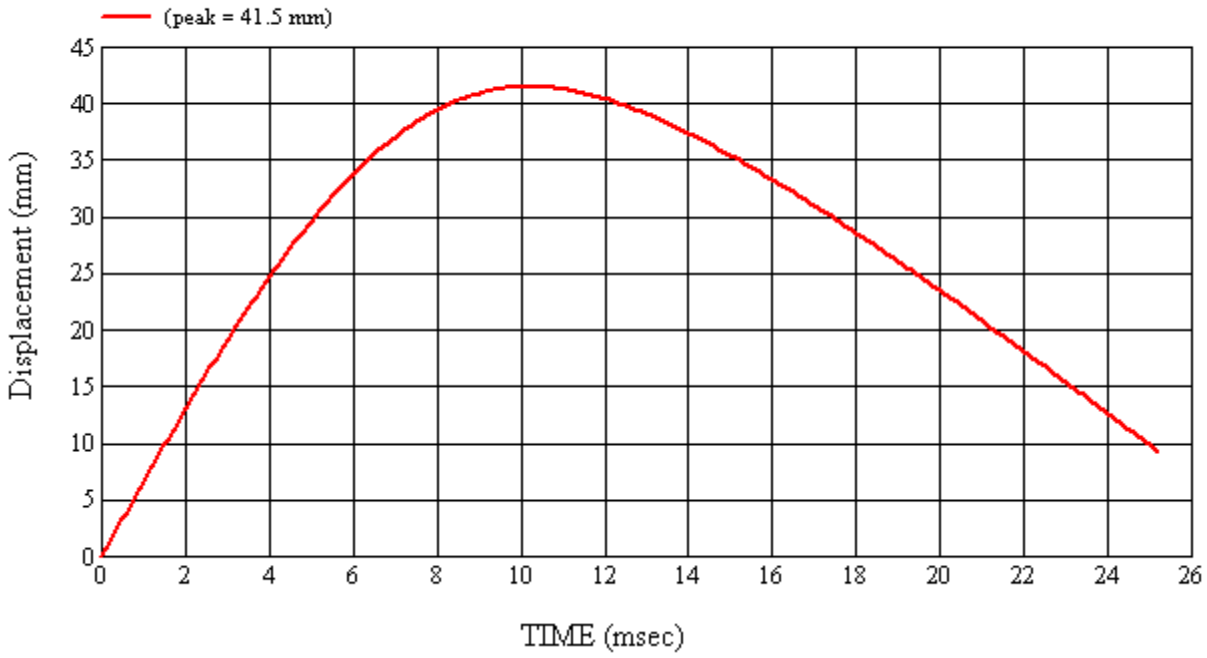



(peak = 97.3 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 9.3 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
-10
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

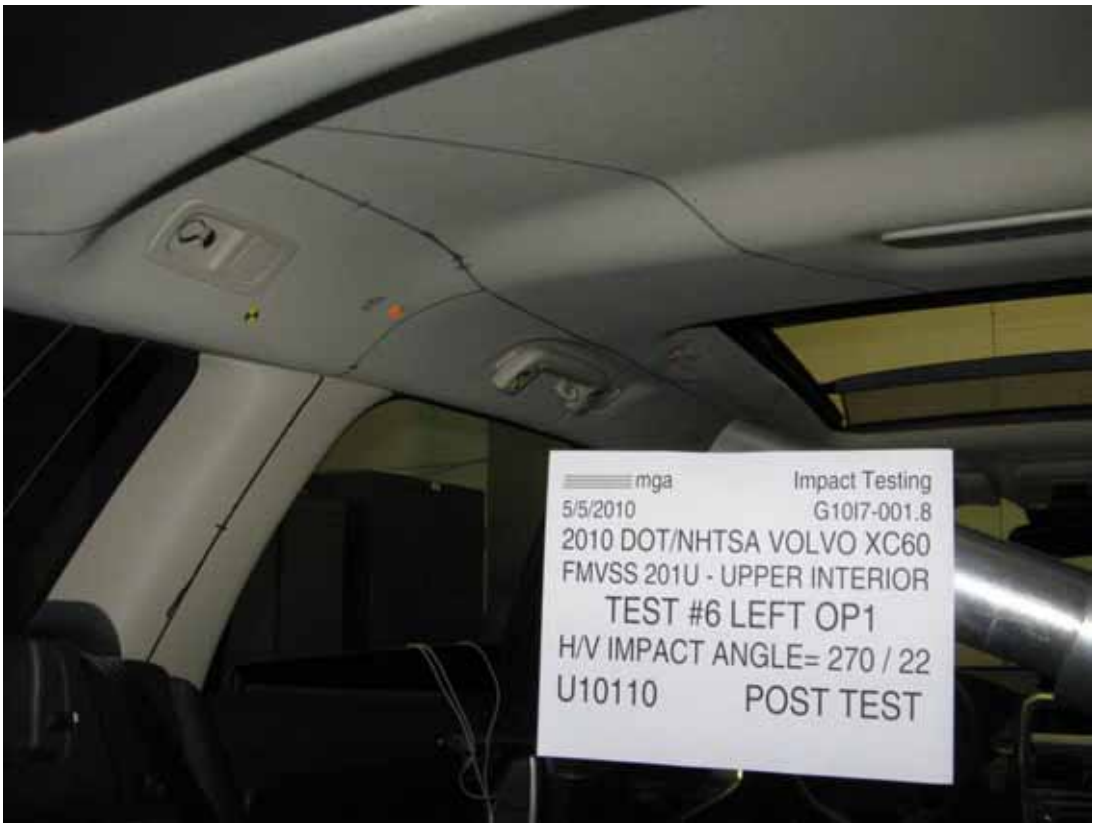

(peak = 33.2 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 23.9 kph)
Impact Velocity: 23.84 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 41.5 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #6 LEFT OP1
H/V IMPACT ANGLE= 270 / 22
U10110
PRE TEST


mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #6 LEFT OP1
H/V IMPACT ANGLE= 270 / 22
U10110
PRE TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #6 LEFT OP1
H/V IMPACT ANGLE= 270 / 22
U10110
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #6 LEFT OP1
H/V IMPACT ANGLE= 270 / 22
U10110
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #6 LEFT OP1
H/V IMPACT ANGLE= 270 / 22
U10110
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#6

Target (Vehicle Side): OP1Left

Temperature:23.5C

MGA Test Reference No.:U10110

Humidity:50.8%

Approach Horizontal Angles:270º

Time of Test:3:23:21 PM

Approach Vertical Angles:22º

FMH Serial No:[038]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
462	392	6	18.7	36	1 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.5	1.05	1.05
Y	6	J36197	109.5	0.84	0.84
Z	7	J36353	99.5	0.92	0.93

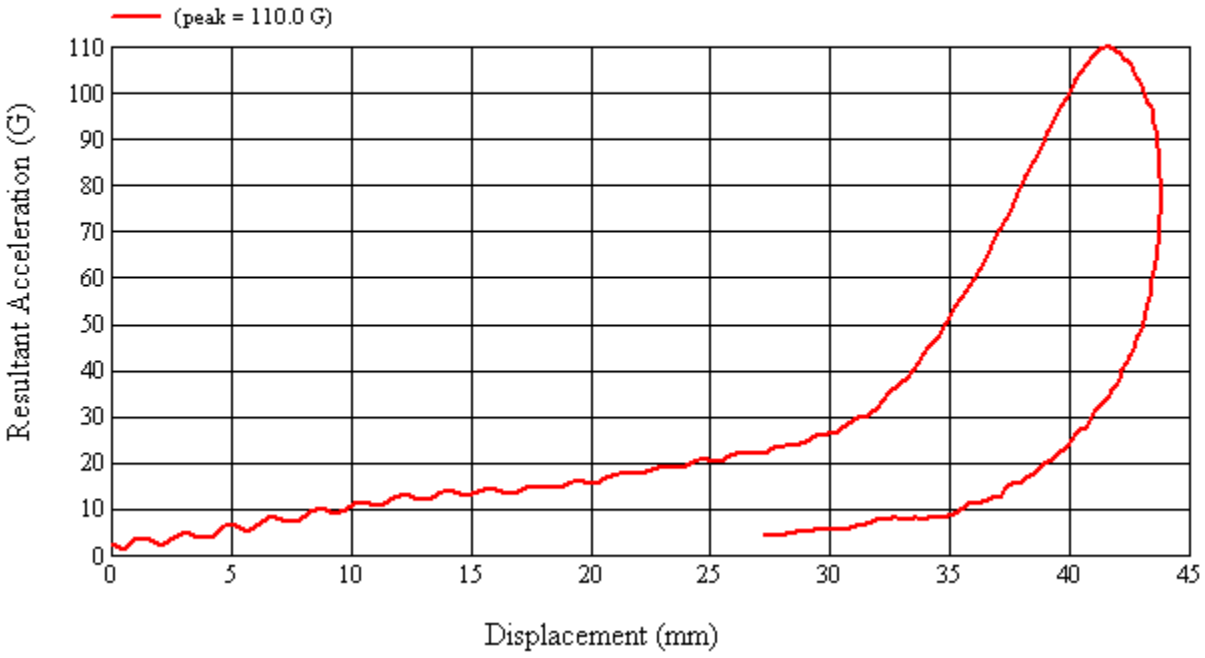
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

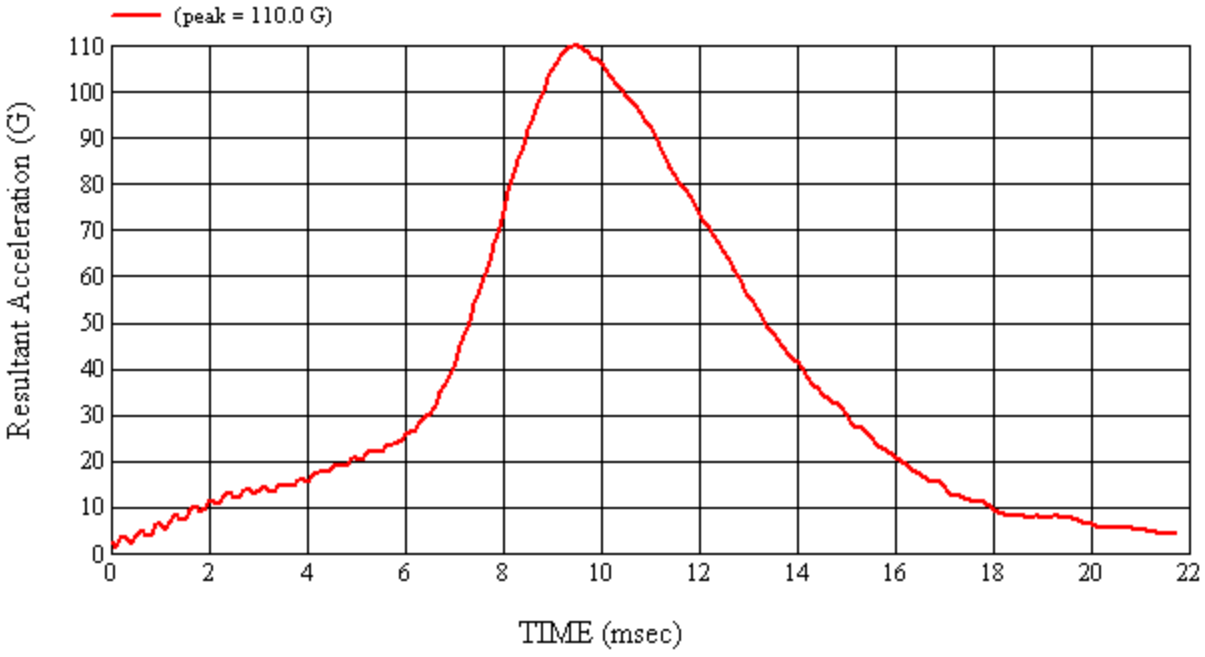
No visible damage

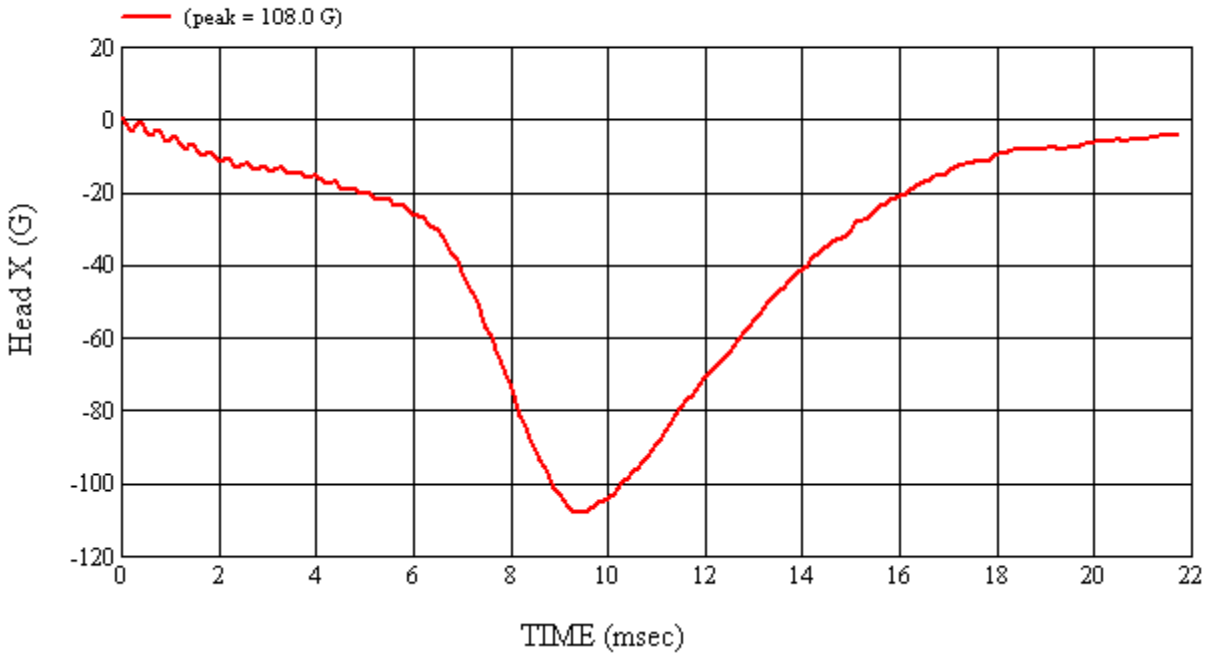
Recorded By: _____ Approved By*: _____ Date: 5/5/2010

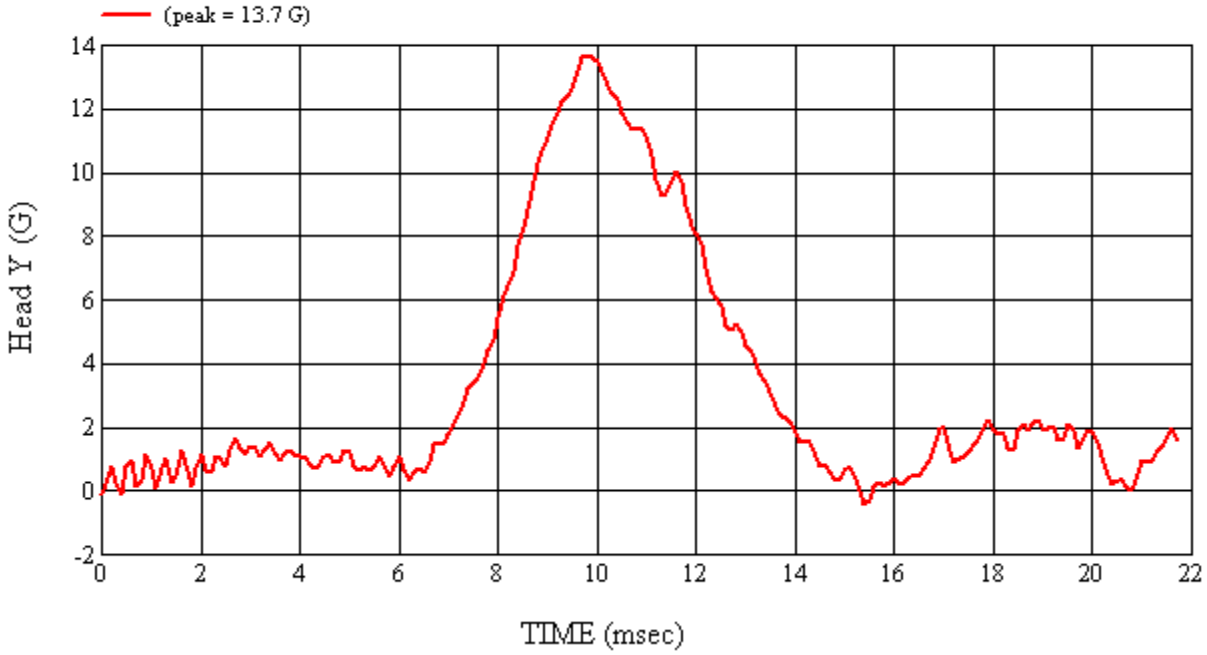
*Only necessary for NHTSA (Government) Compliance testing.

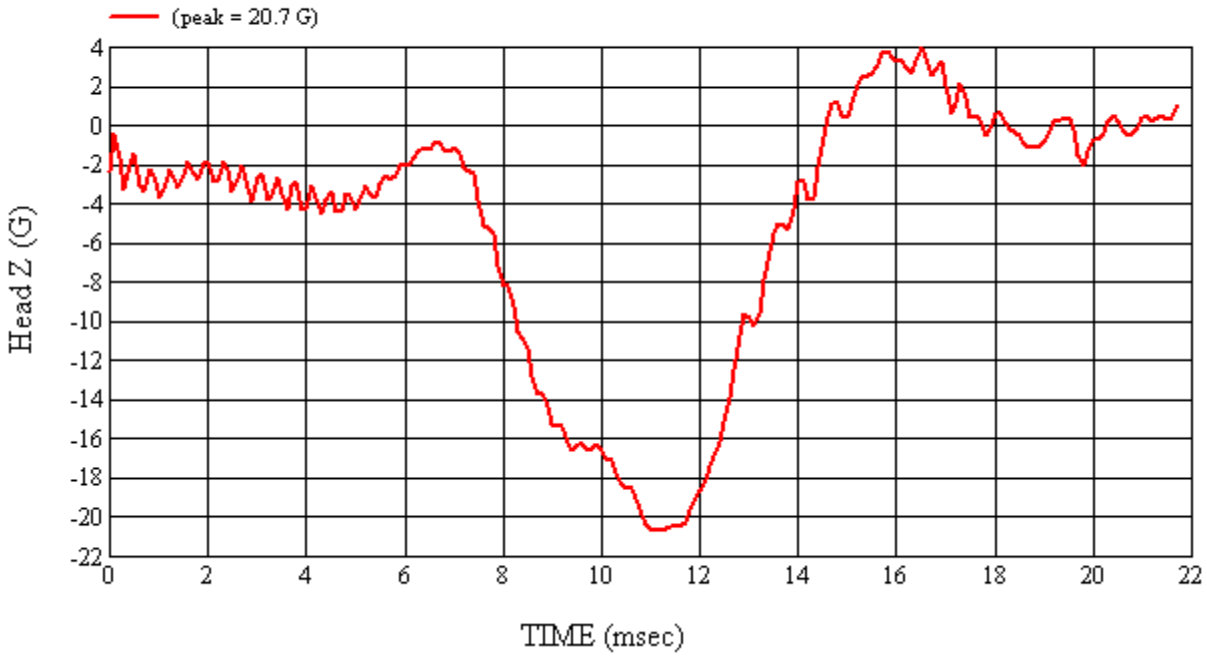
MGA Test #: U10110 Target Location: OP1, Left Side Test Date: 5/5/2010

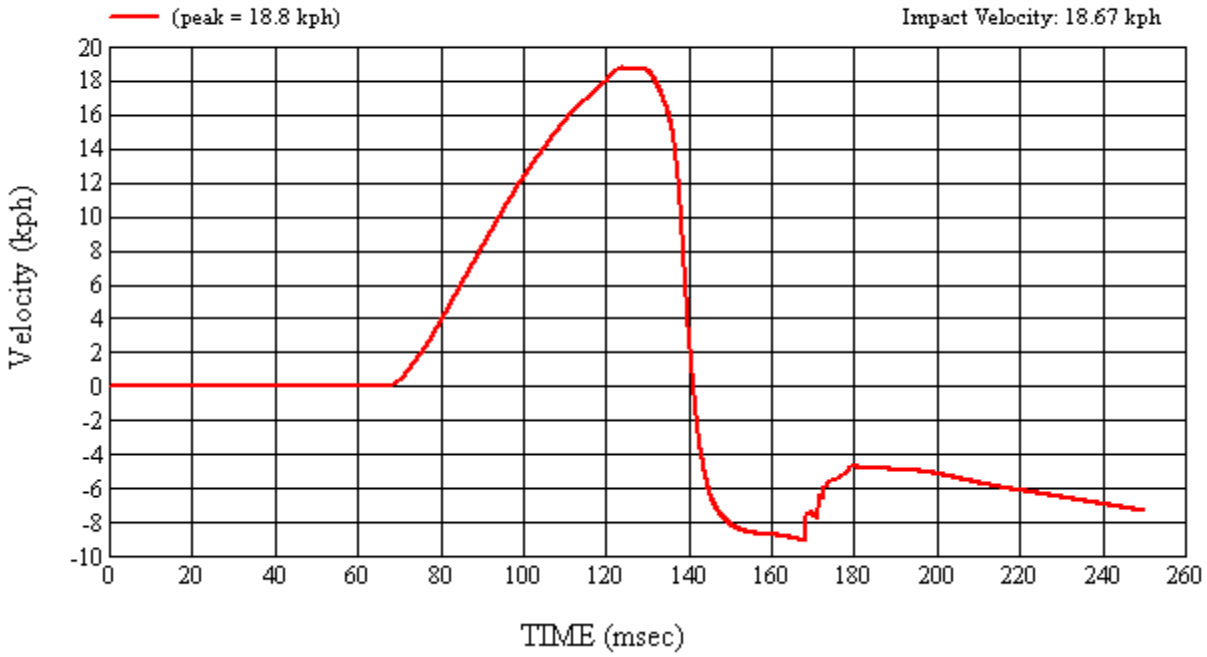


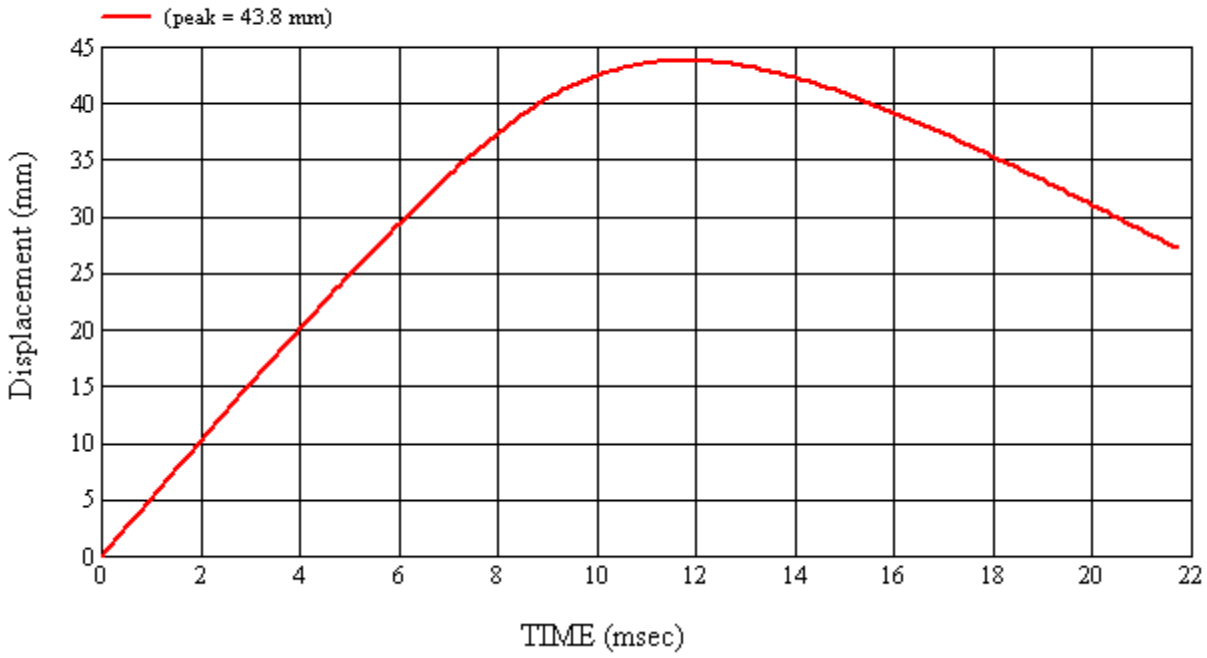


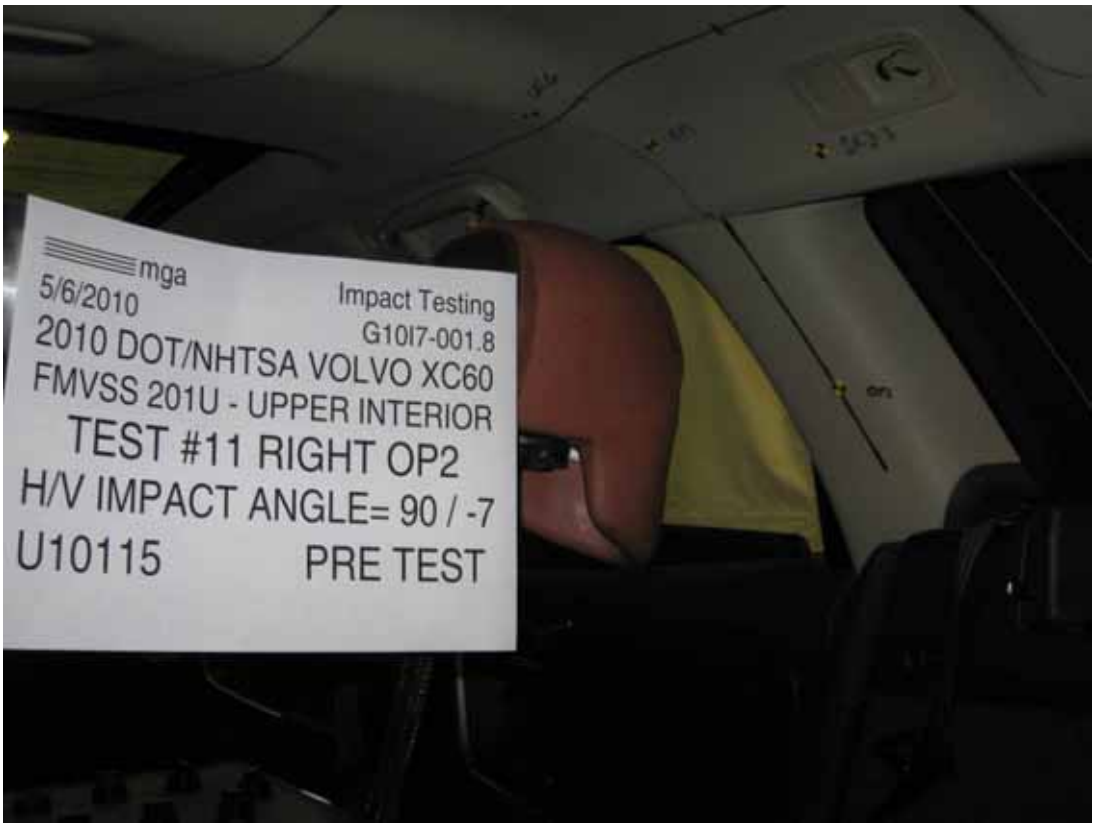

(peak = 108.0 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 13.7 G)
Head Y (G)
14
12
10
8
6
4
2
0
-2
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)

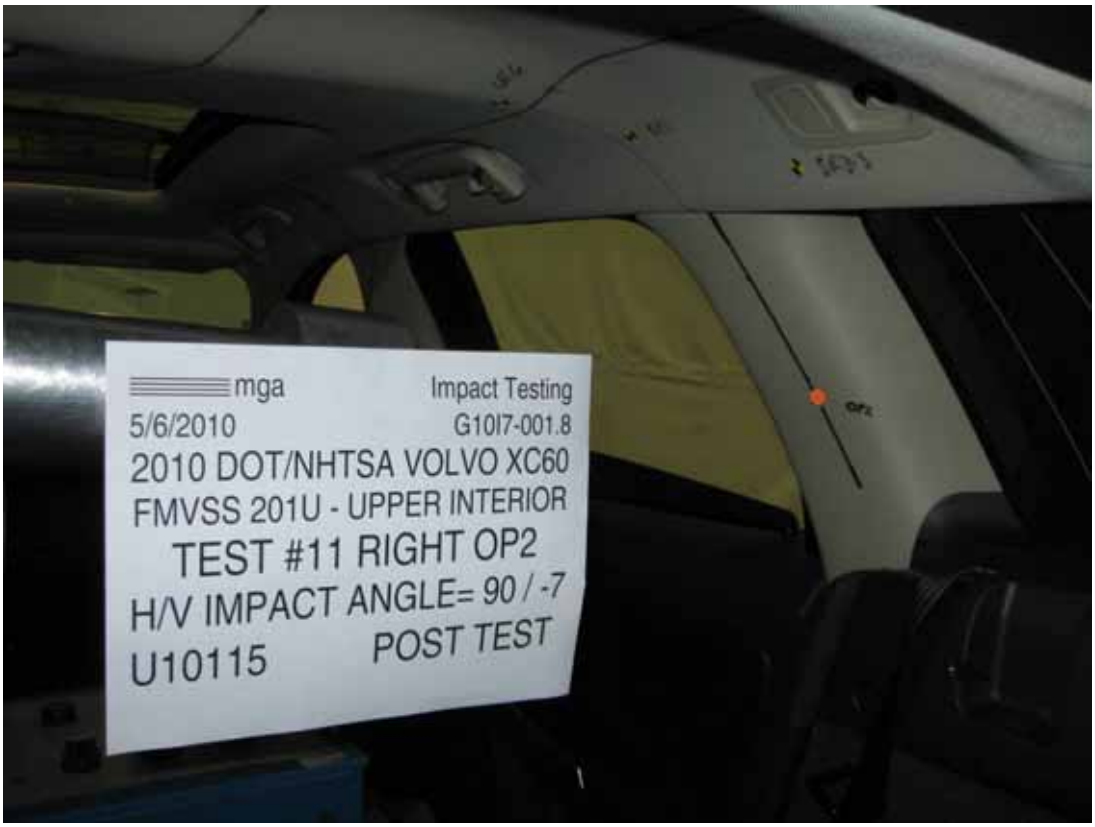

(peak = 20.7 G)
Head Z (G)
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)

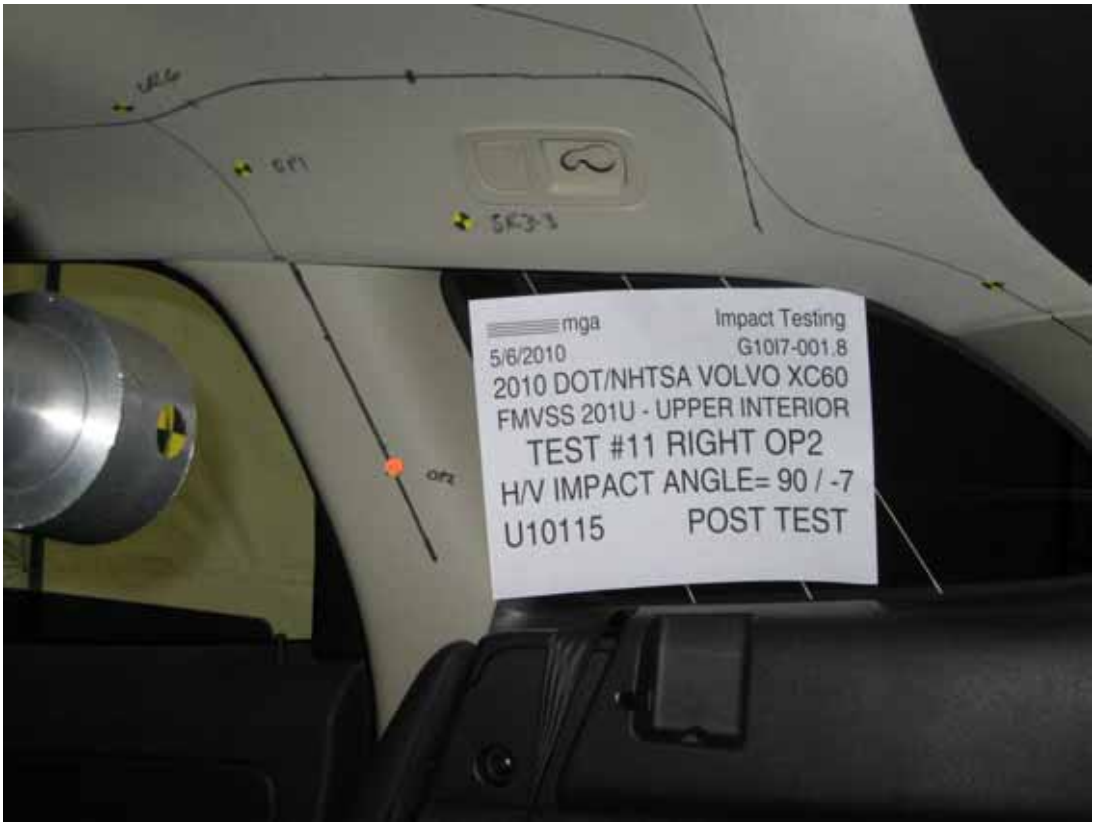

(peak = 18.8 kph)
Impact Velocity: 18.67 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 43.8 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT OP2
H/V IMPACT ANGLE= 90 / -7
U10115
PRE TEST


mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT OP2
H/V IMPACT ANGLE= 90 / -7
U10115
PRE TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT OP2
H/V IMPACT ANGLE= 90 / -7
U10115
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT OP2
H/V IMPACT ANGLE= 90 / -7
U10115
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT OP2
H/V IMPACT ANGLE= 90 / -7
U10115
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Target (Vehicle Side): OP2Right

MGA Test Reference No.:U10115

Approach Horizontal Angles:90º

Approach Vertical Angles:-7º

Additional Description:

Test Number:#11

Temperature:22.2C

Humidity:37.7%

Time of Test:1:59:26 PM

FMH Serial No:[037]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
571	537	7.8	24.1	23	7 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-116.9	1.05	1.05
Y	6	J14103	94.2	0.84	0.84
Z	7	J35800	98.2	0.93	0.93

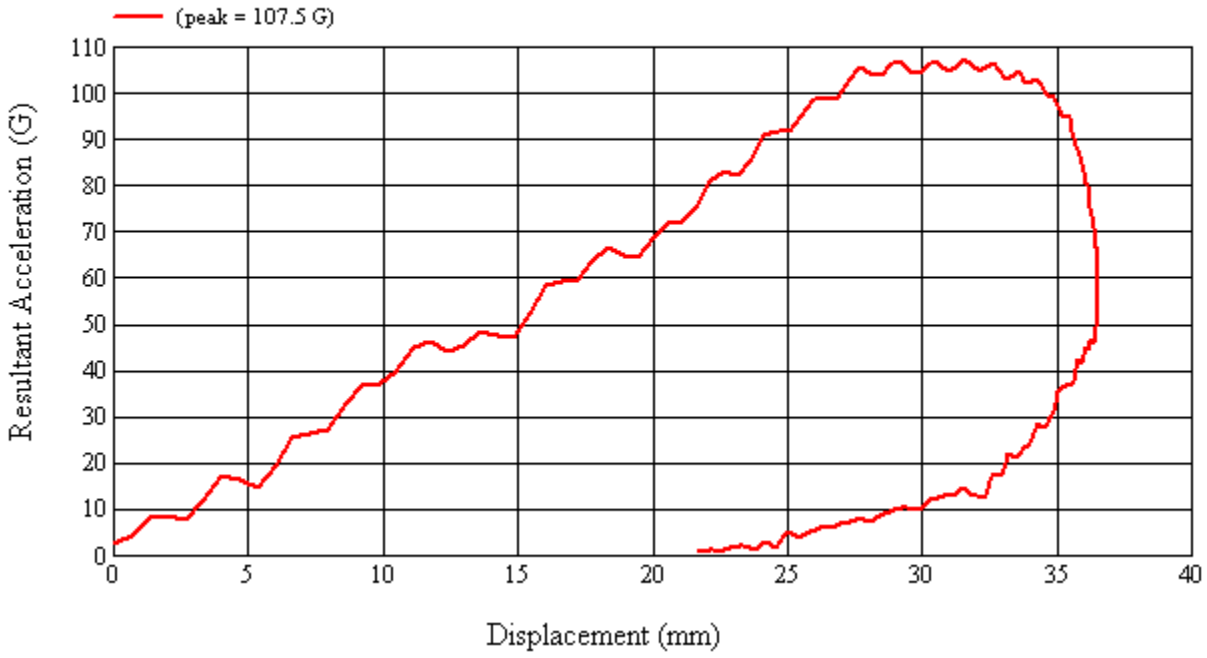
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

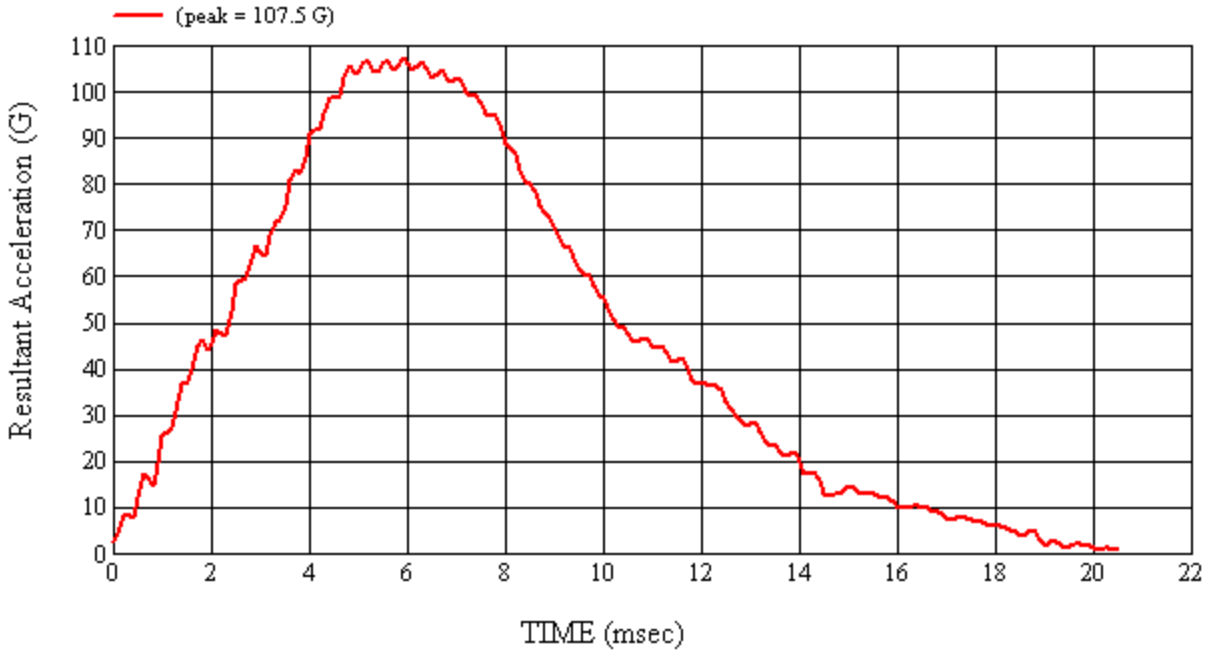
No visible damage

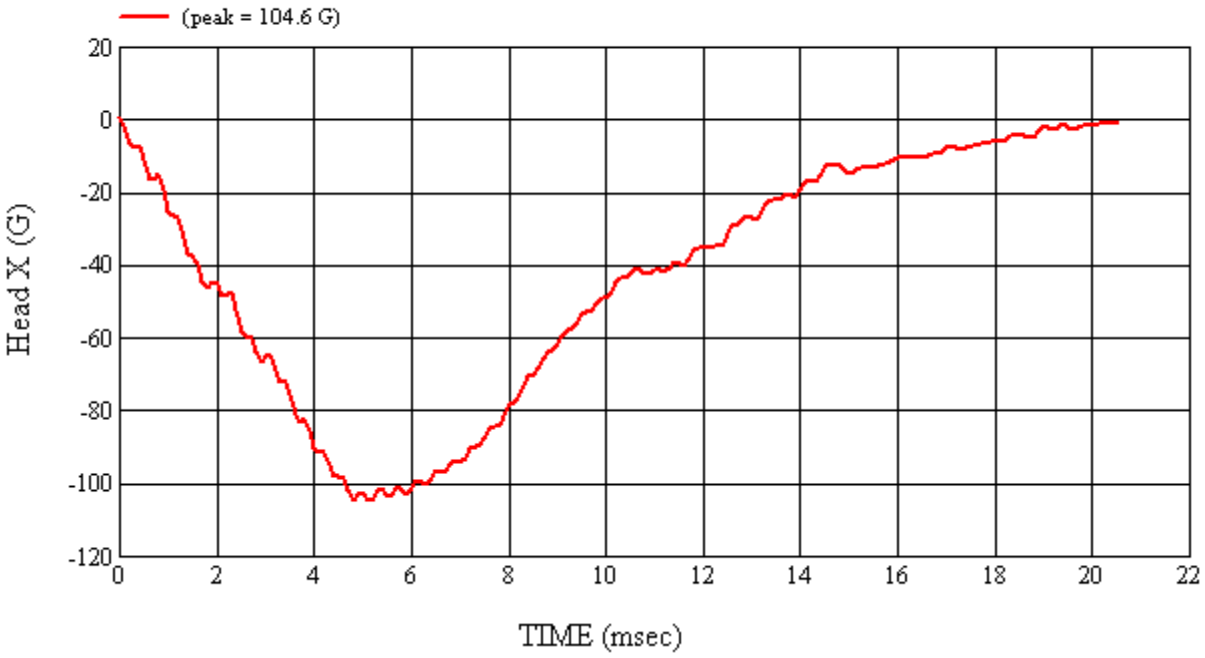
Recorded By: _____ Approved By*: _____ Date: 5/6/2010

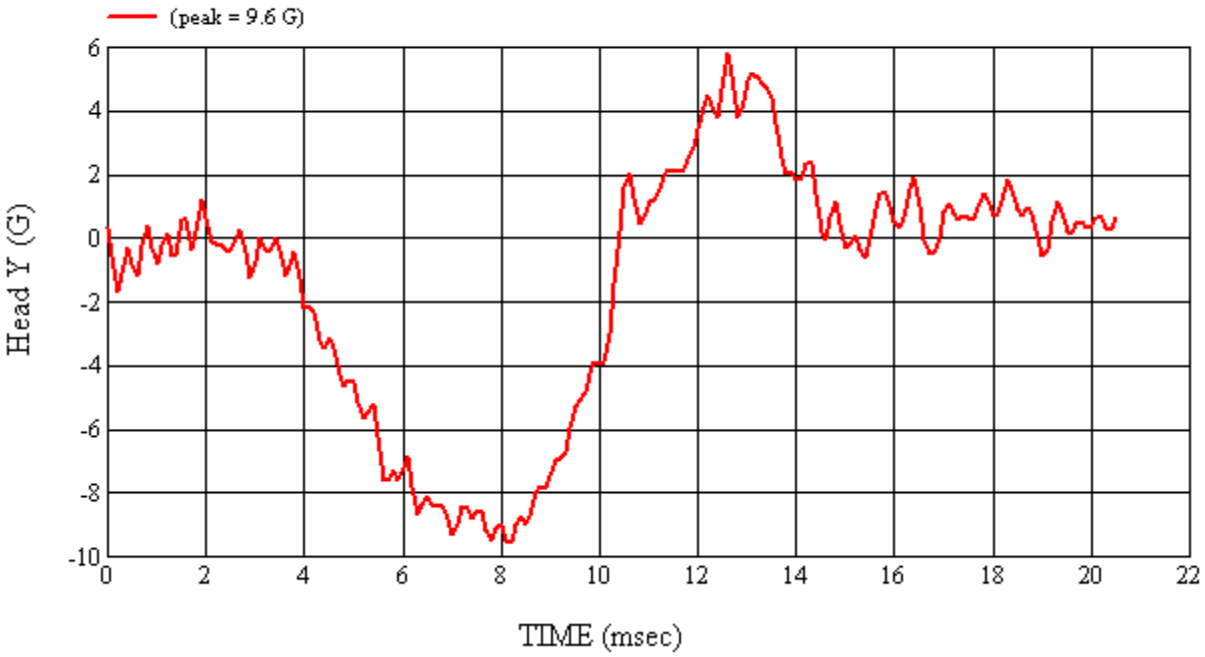
*Only necessary for NHTSA (Government) Compliance testing.

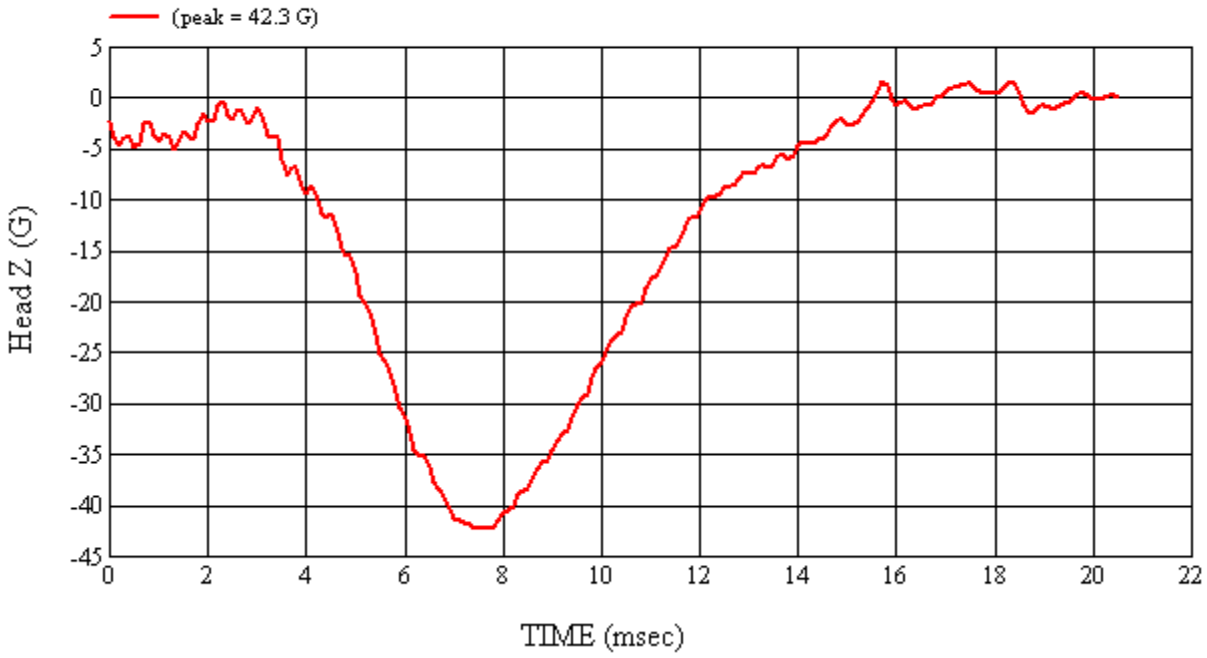
MGA Test #: U10115 Target Location: OP2, Right Side Test Date: 5/6/2010

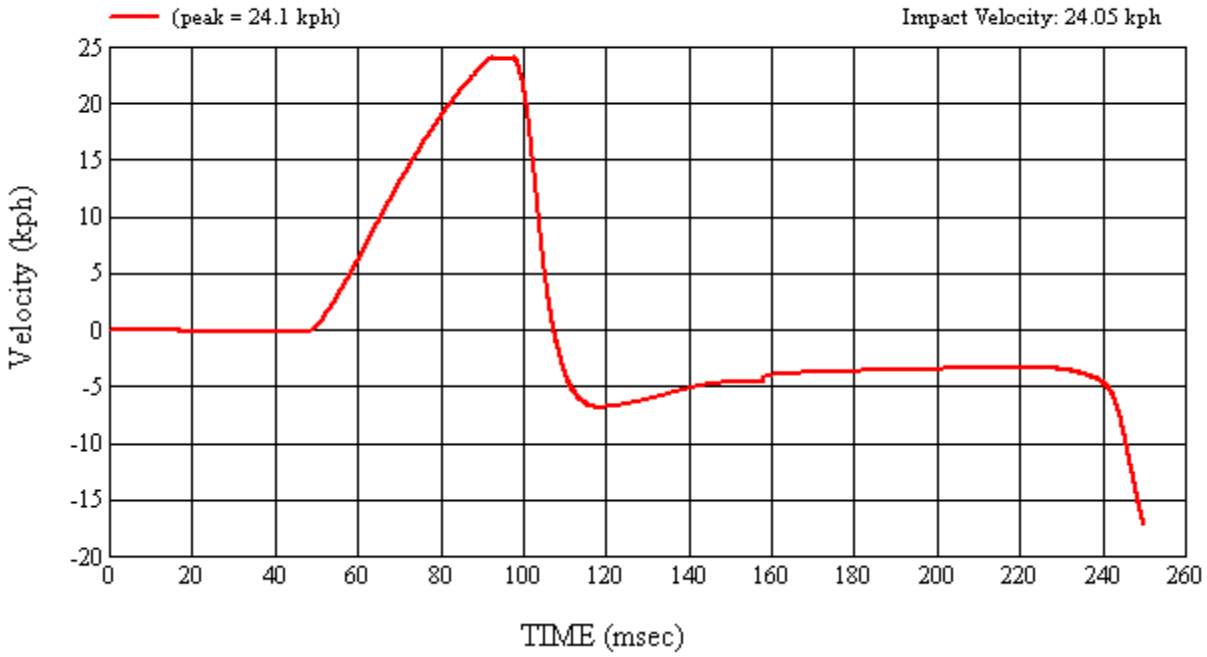


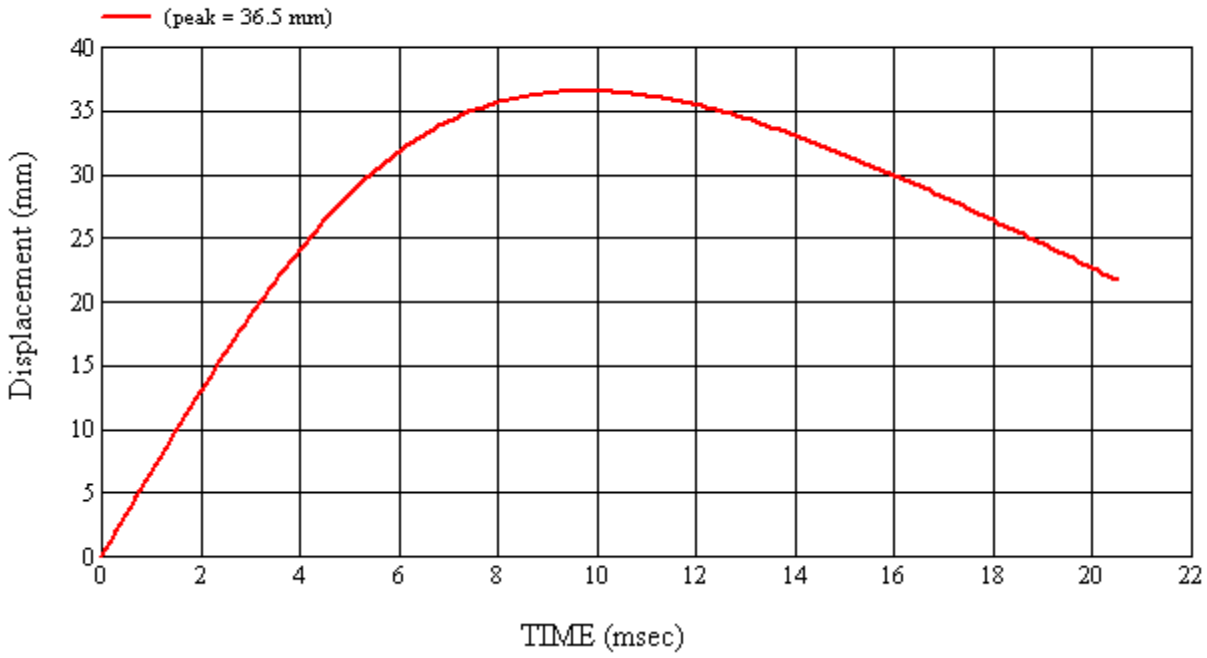



(peak = 104.6 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 9.6 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
-10
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 42.3 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)

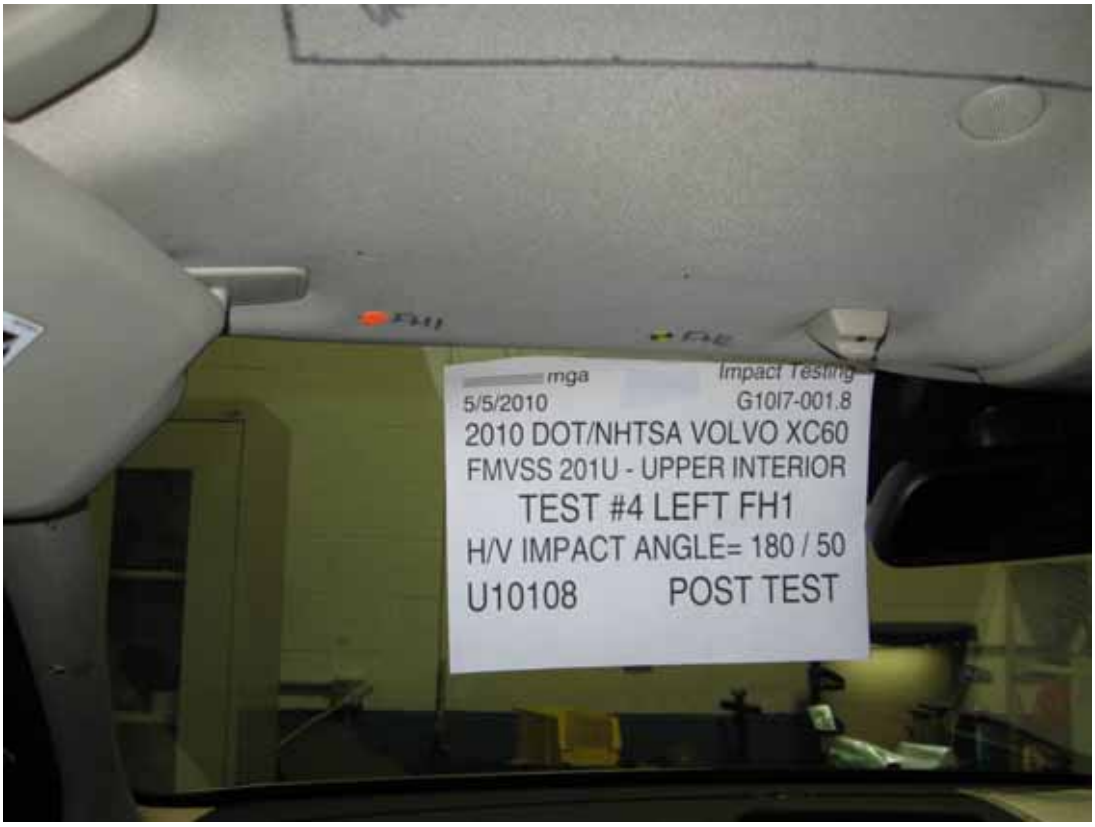

(peak = 24.1 kph)
Impact Velocity: 24.05 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 36.5 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


WARNING
mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U10108
PRE TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U10108
PRE TEST


WARNING
mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U10108
POST TEST


FH1
mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U10108
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U10108
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#4

Target (Vehicle Side): FH1Left

Temperature:23.9C

MGA Test Reference No.:U10108

Humidity:45.4%

Approach Horizontal Angles:180º

Time of Test:1:28:17 PM

Approach Vertical Angles:50º

FMH Serial No:[035]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
728	744	3.8	24.0	18	5 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-96.3	1.05	1.05
Y	6	J22664	95.2	0.84	0.84
Z	7	J35924	93.8	0.93	0.92

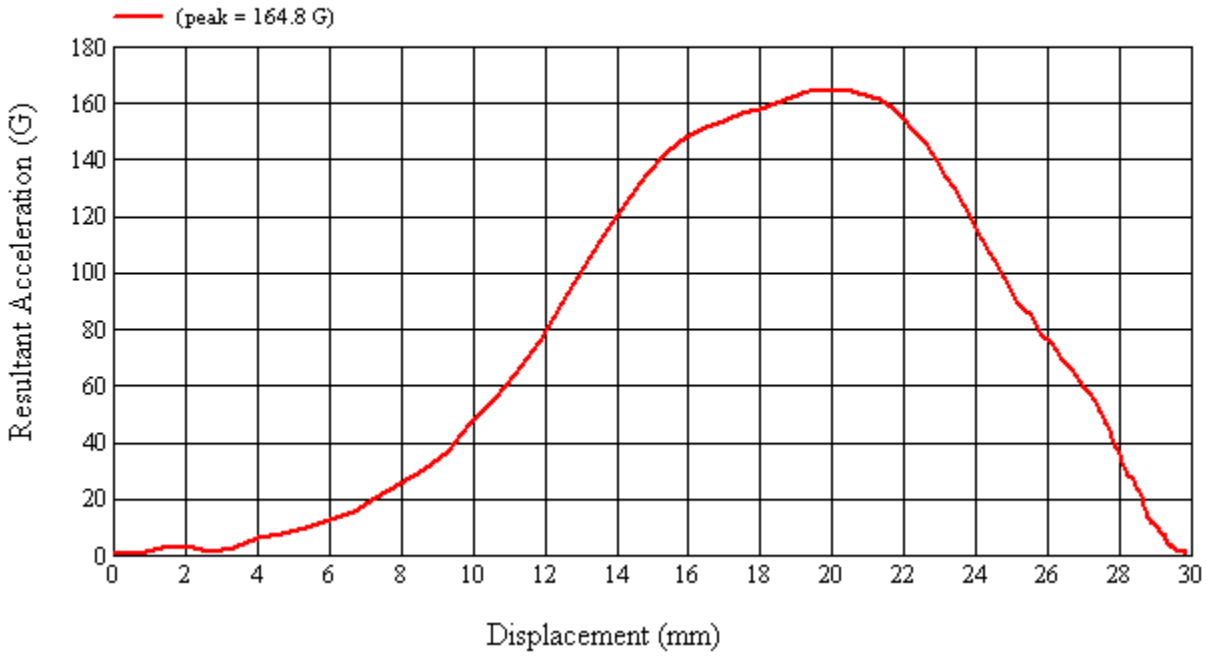
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

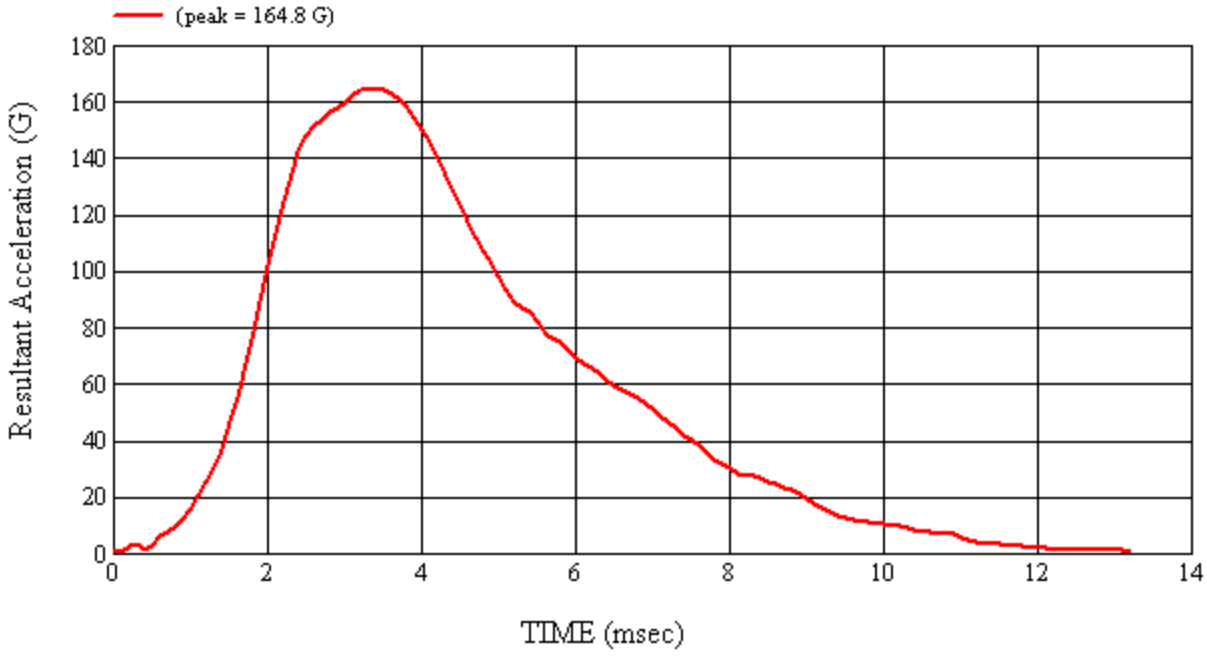
No visible damage

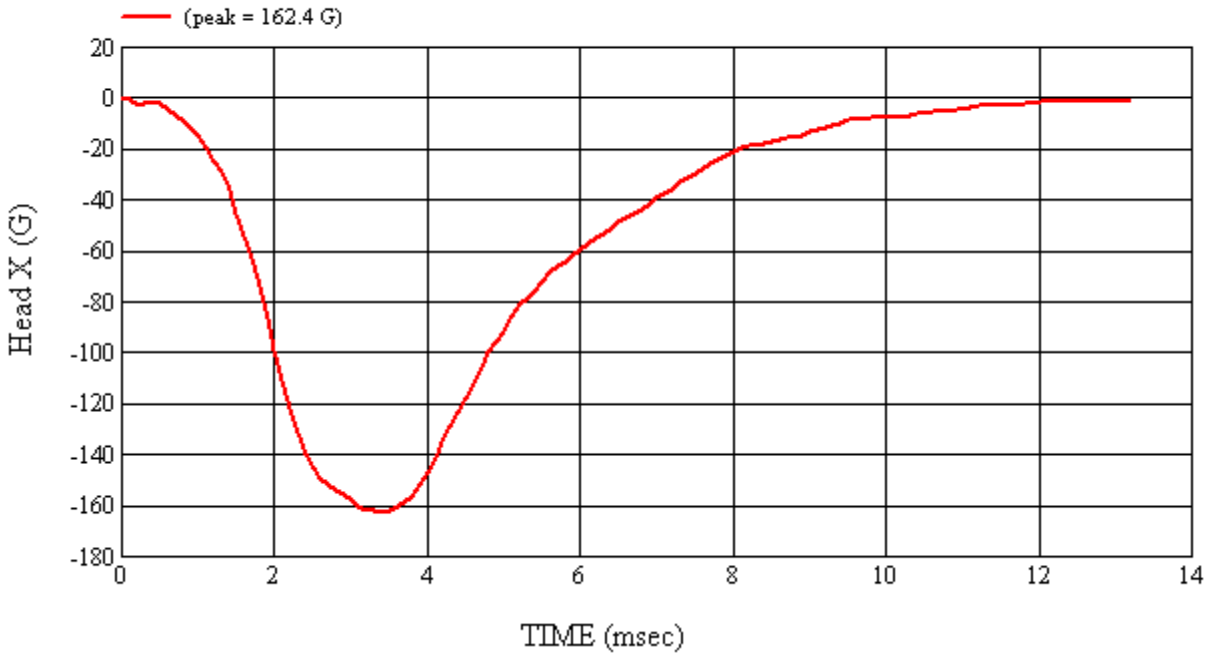
Recorded By: _____ Approved By*: _____ Date: 5/5/2010

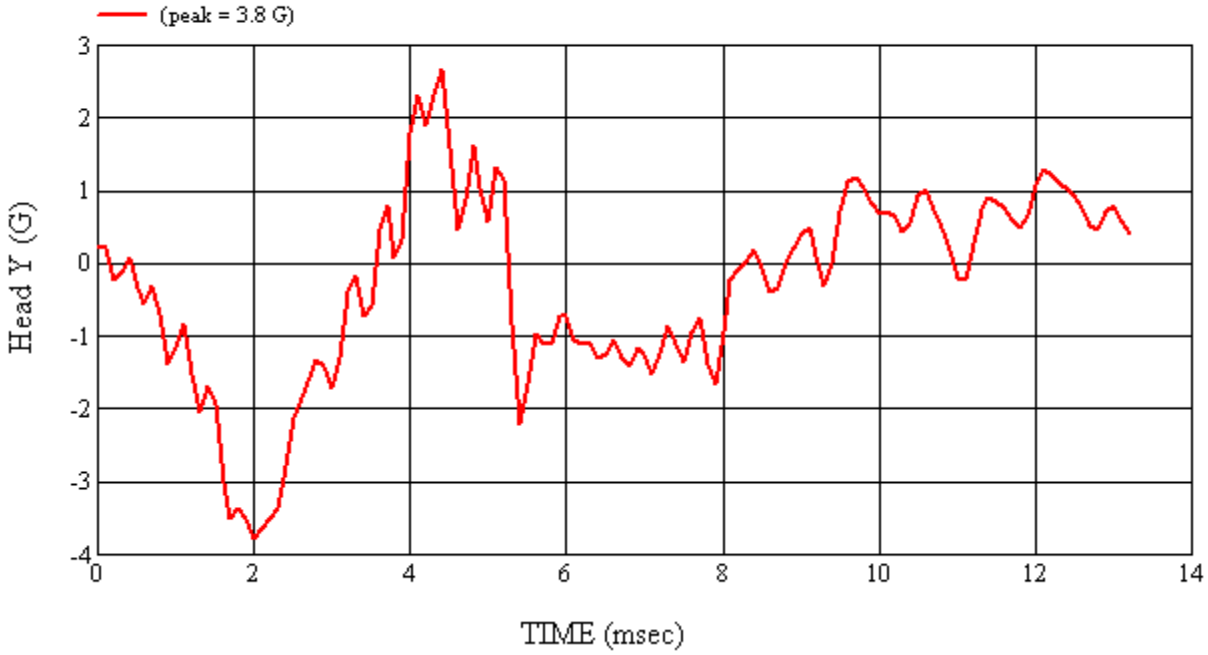
*Only necessary for NHTSA (Government) Compliance testing.

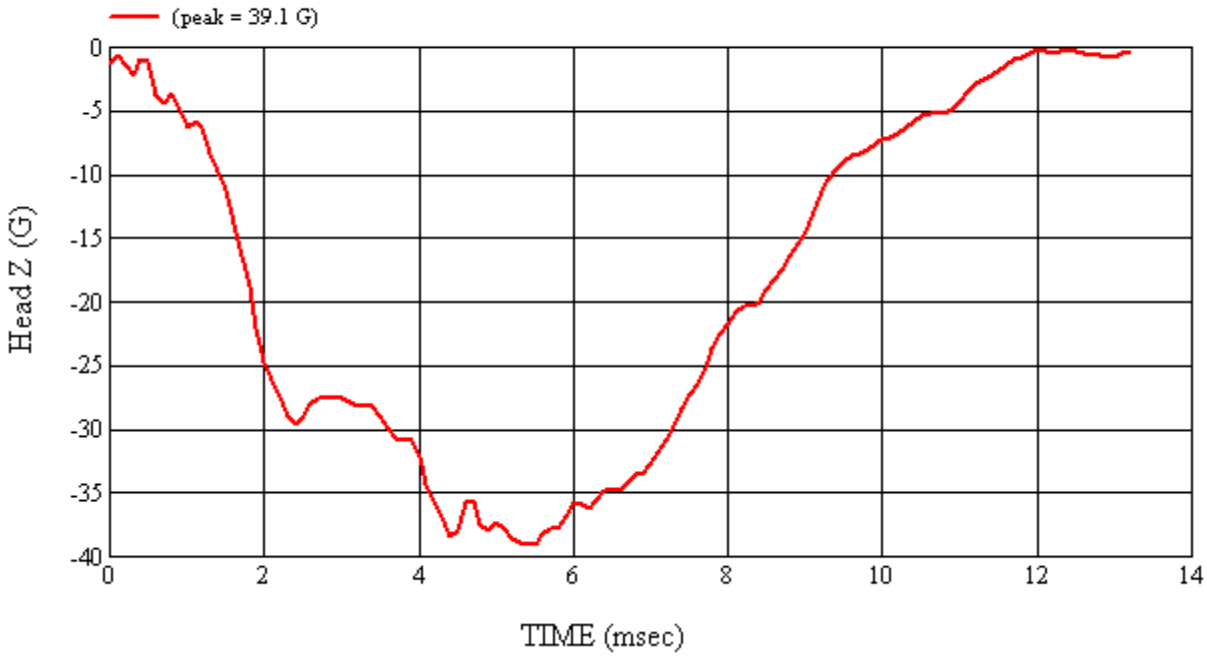
MGA Test #: U10108 Target Location: FH1, Left Side Test Date: 5/5/2010

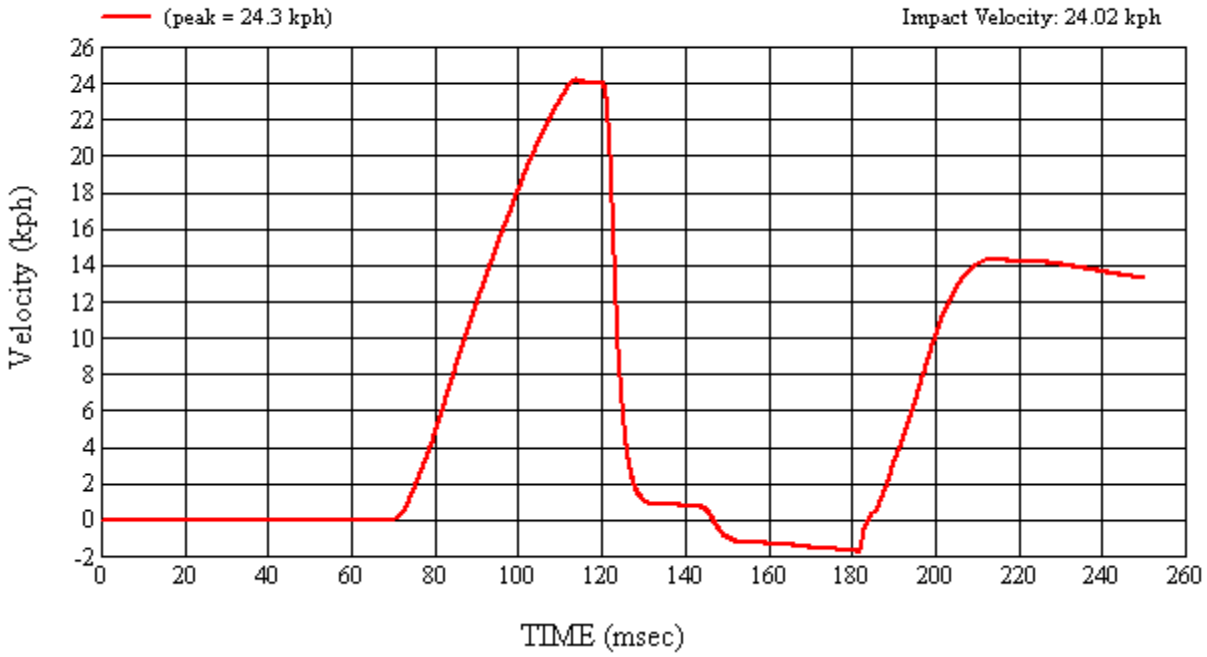


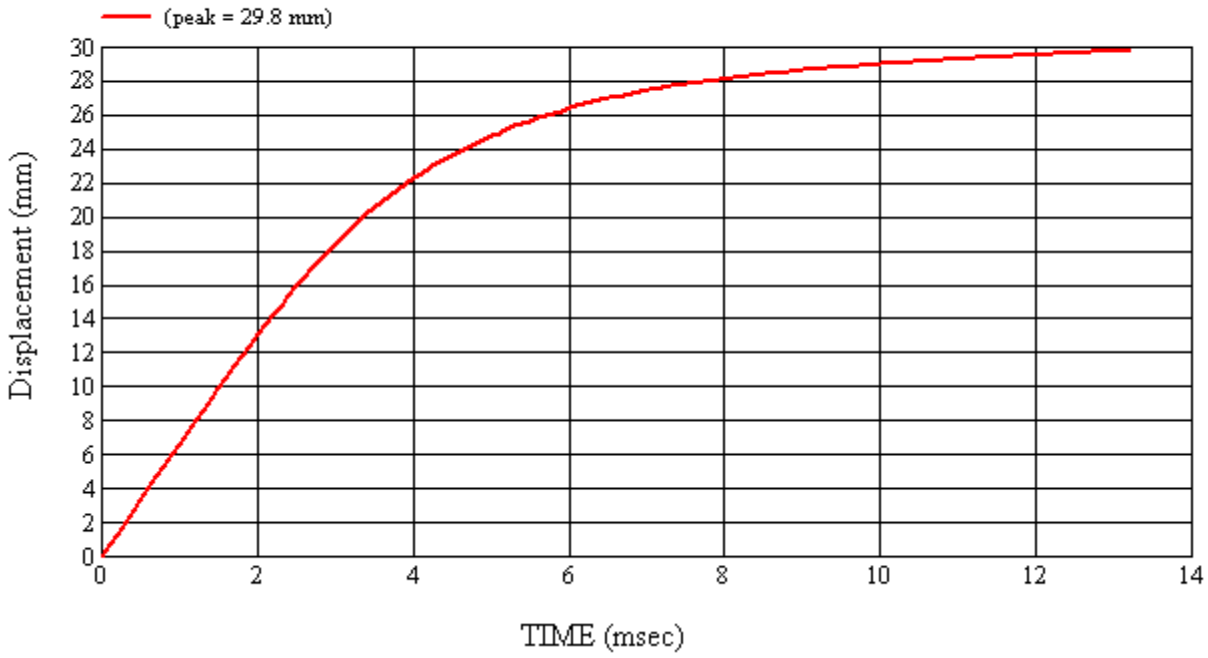



(peak = 162.4 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
0
2
4
6
8
10
12
14
TIME (msec)


(peak = 3.8 G)
Head Y (G)
3
2
1
0
-1
-2
-3
-4
0
2
4
6
8
10
12
14
TIME (msec)


(peak = 39.1 G)
Head Z (G)
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
TIME (msec)

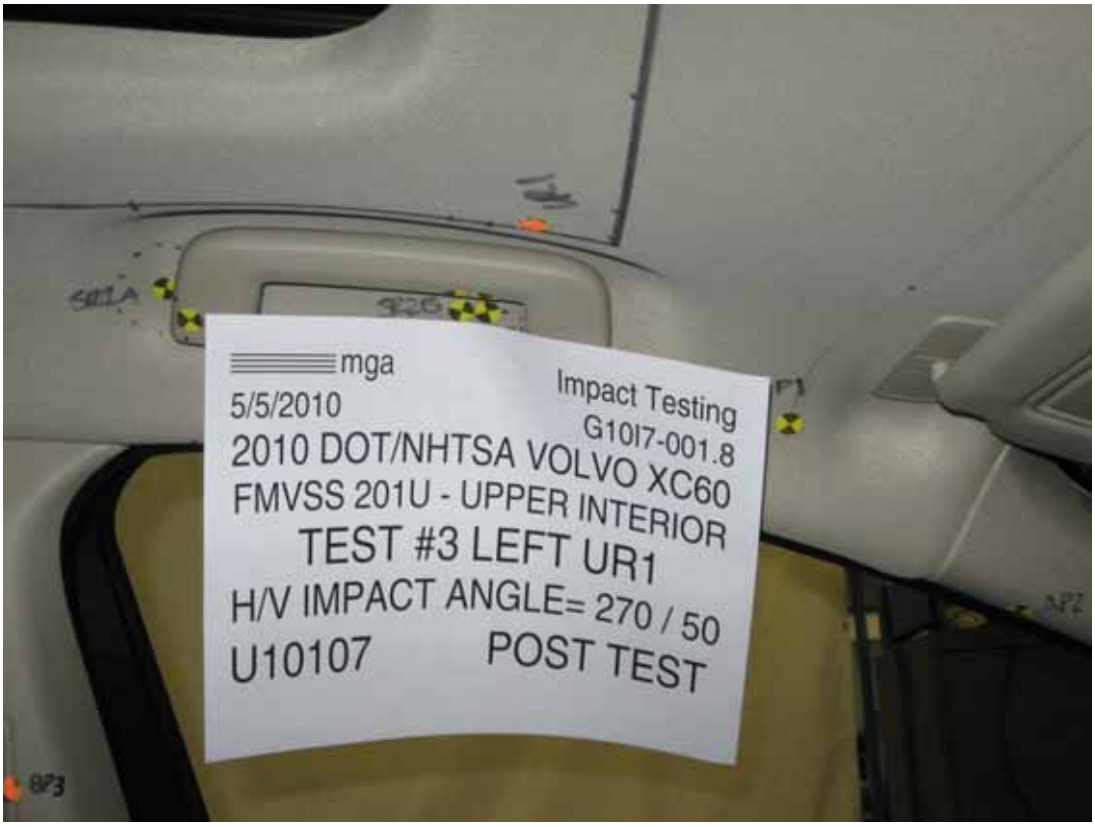

(peak = 24.3 kph)
Impact Velocity: 24.02 kph
Velocity (kph)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 29.8 mm)
Displacement (mm)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
14
TIME (msec)


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR1
H/V IMPACT ANGLE= 270 / 50
U10107
PRE TEST


mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR1
H/V IMPACT ANGLE= 270 / 50
U10107
PRE TEST


mga
Impact Testing
G10I7-001.8
5/5/2010
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR1
H/V IMPACT ANGLE= 270 / 50
U10107
POST TEST


mga
Impact Testing
G10I7-001.8
5/5/2010
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR1
H/V IMPACT ANGLE= 270 / 50
U10107
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR1
H/V IMPACT ANGLE= 270 / 50
U10107
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#3

Target (Vehicle Side): UR1Left

Temperature:23.2C

MGA Test Reference No.:U10107

Humidity:43.3%

Approach Horizontal Angles:270º

Time of Test:11:48:41 AM

Approach Vertical Angles:50º

FMH Serial No:[038]

Additional Description:At SR1

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
719	732	7.7	24.0	33	6 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.5	1.05	1.05
Y	6	J36197	109.5	0.84	0.83
Z	7	J36353	99.5	0.92	0.92

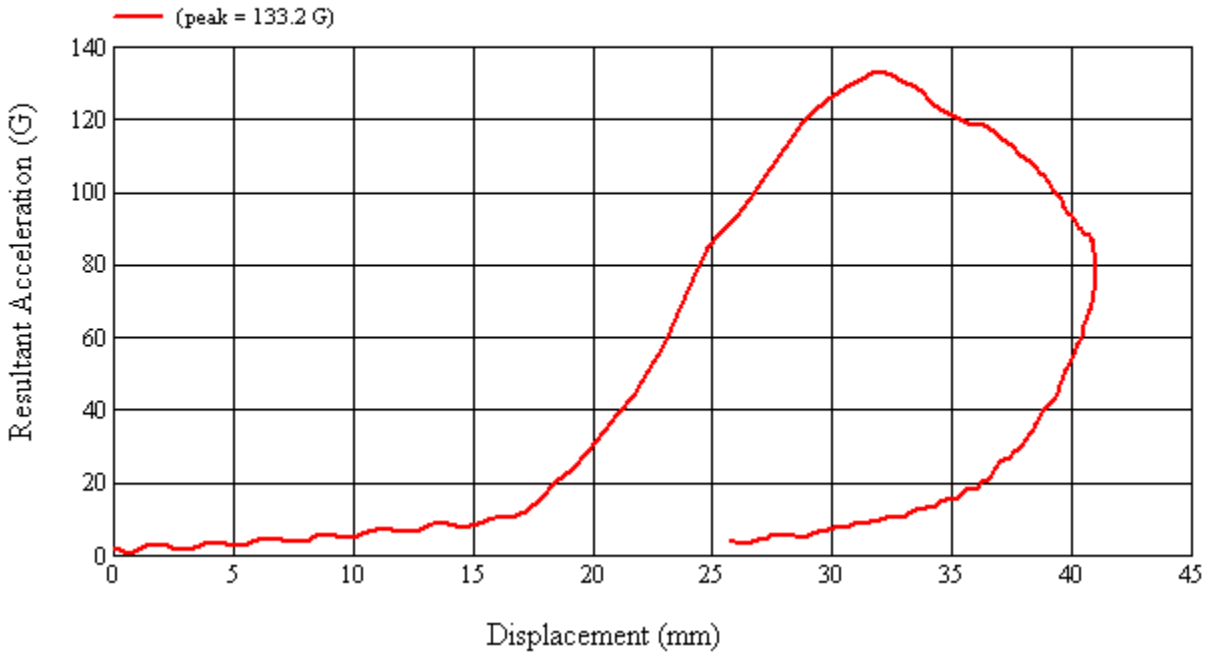
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

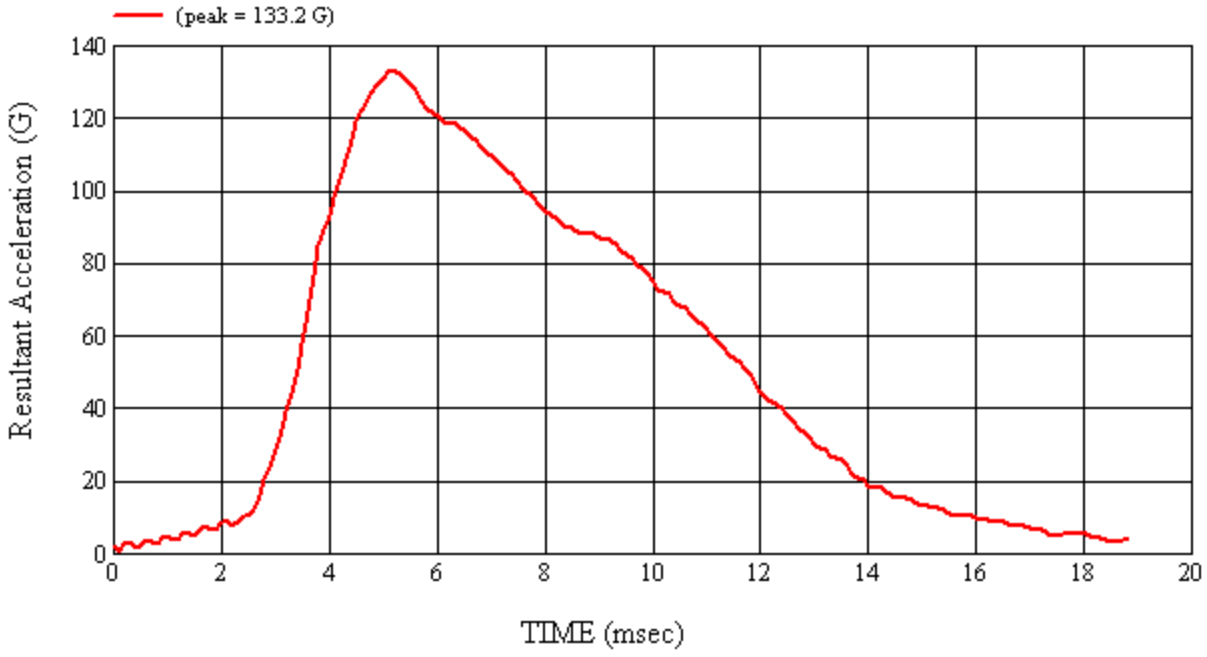
Headliner deformation, grab handle compression

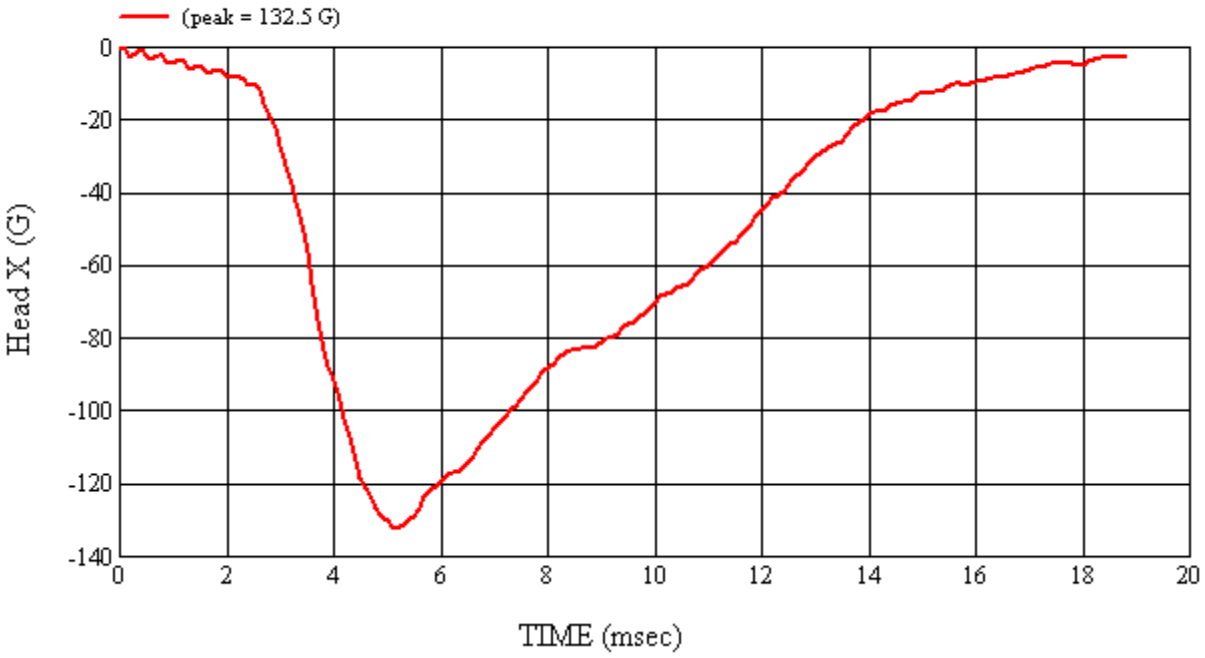
Recorded By: _____ Approved By*: _____ Date: 5/5/2010

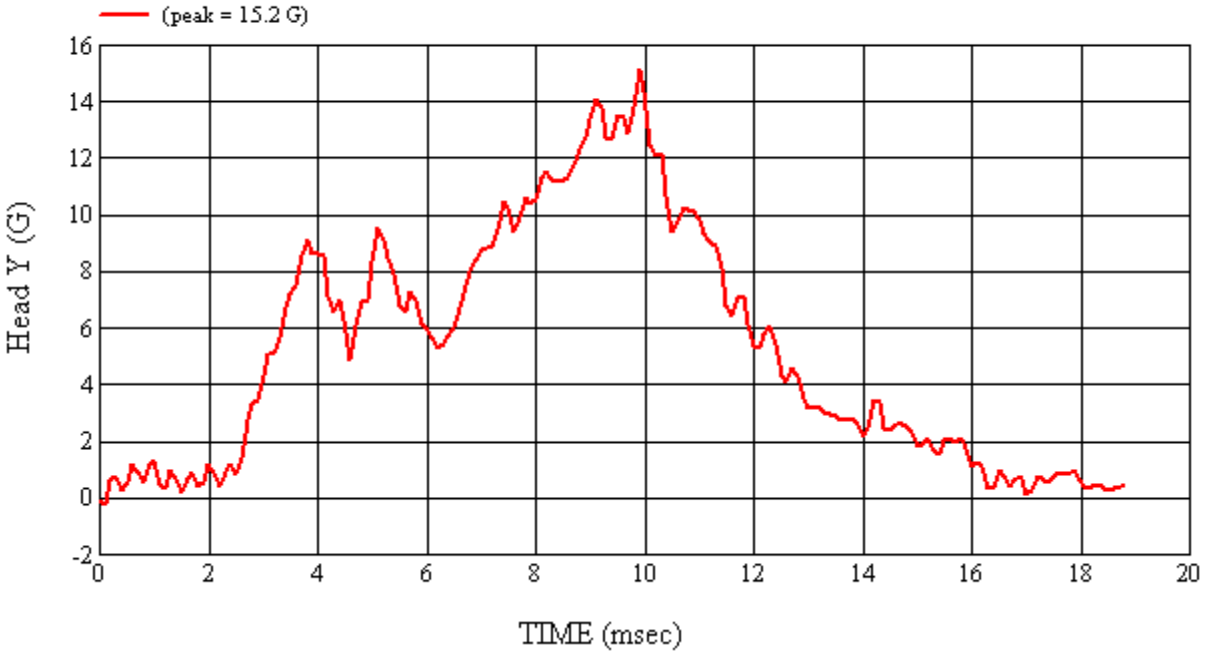
*Only necessary for NHTSA (Government) Compliance testing

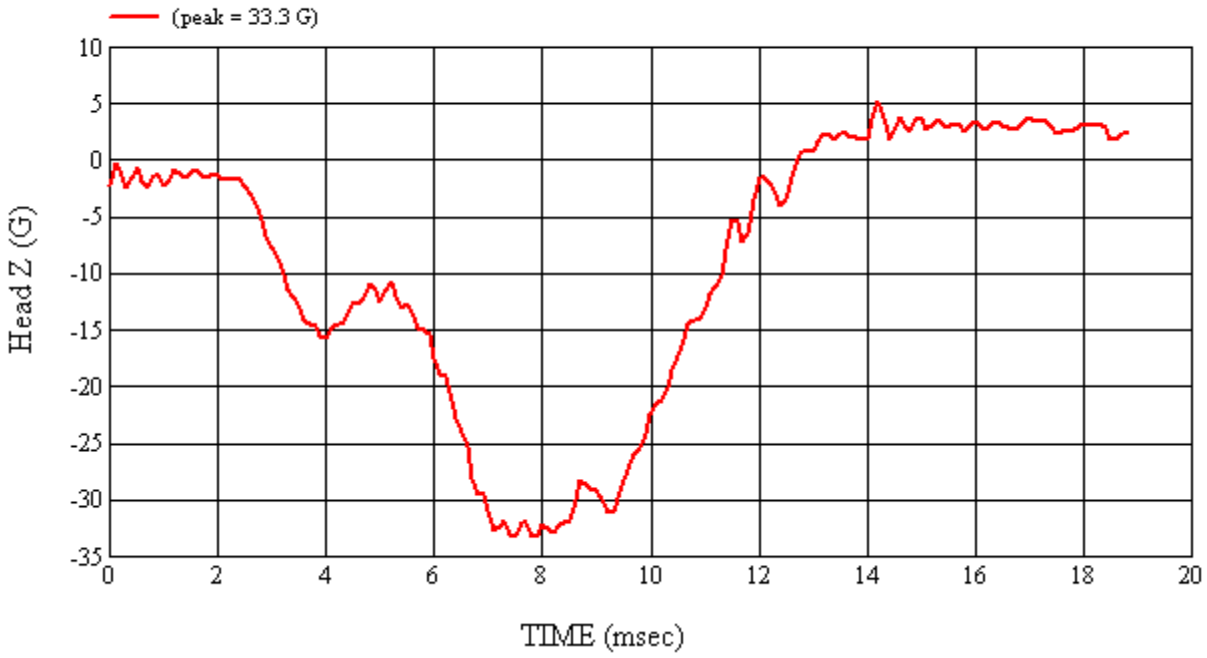
MGA Test #: U10107 Target Location: UR1, Left Side Test Date: 5/5/2010

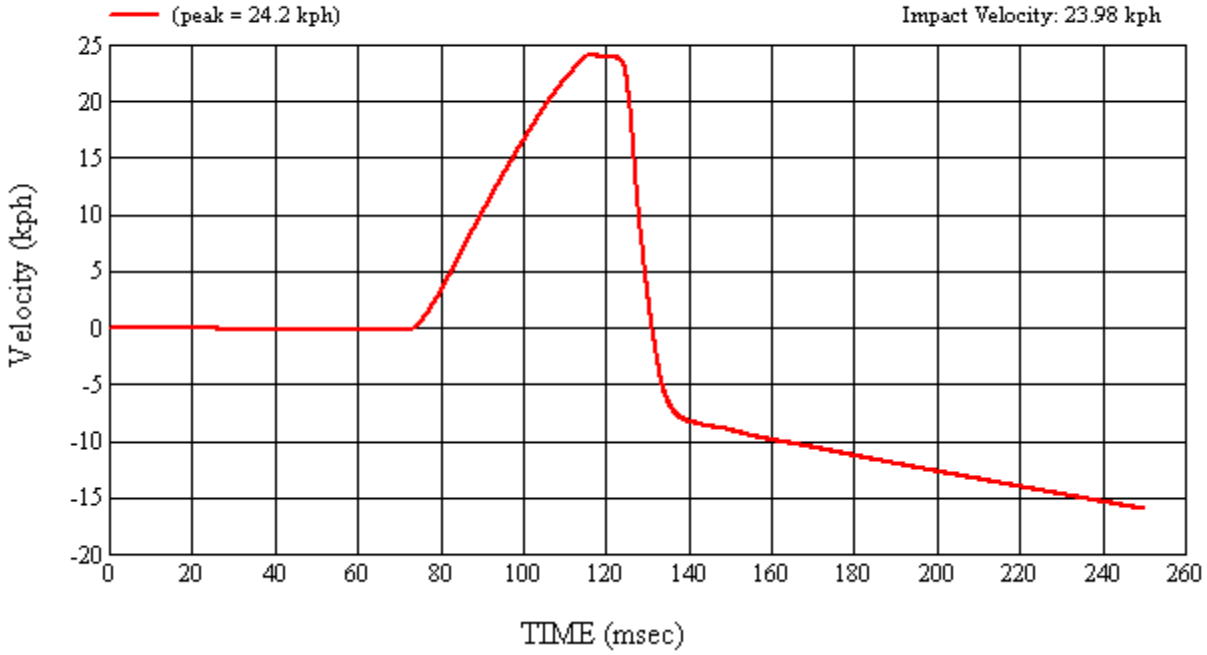


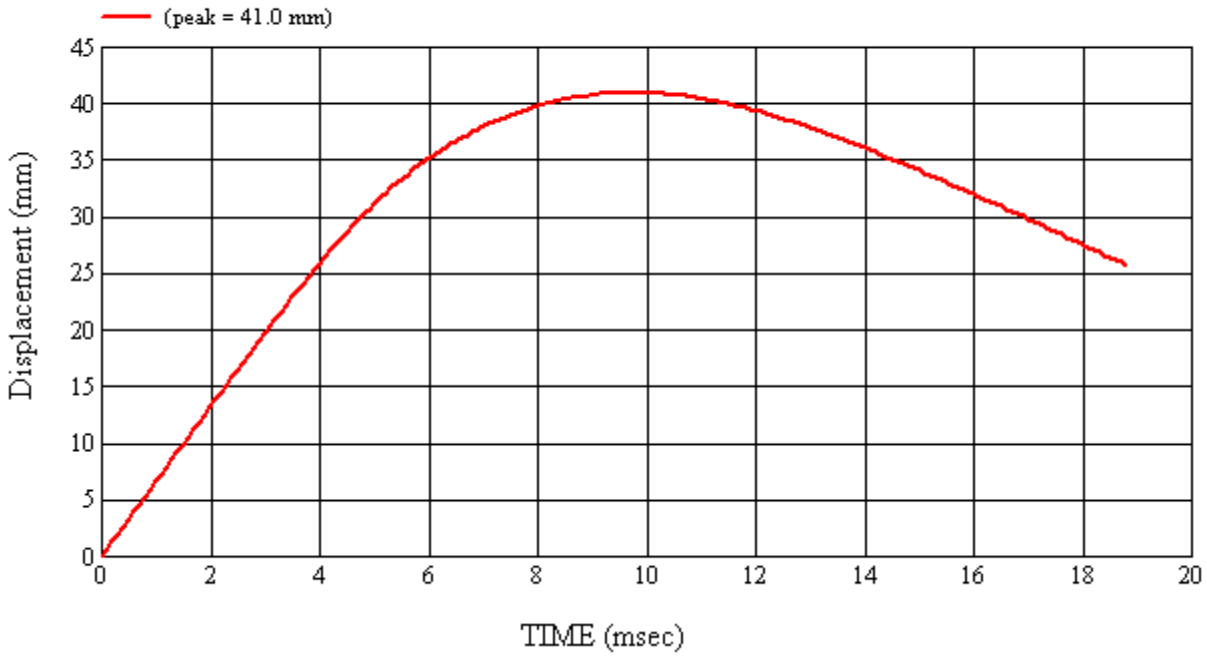



(peak = 132.5 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 15.2 G)
Head Y (G)
16
14
12
10
8
6
4
2
0
-2
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

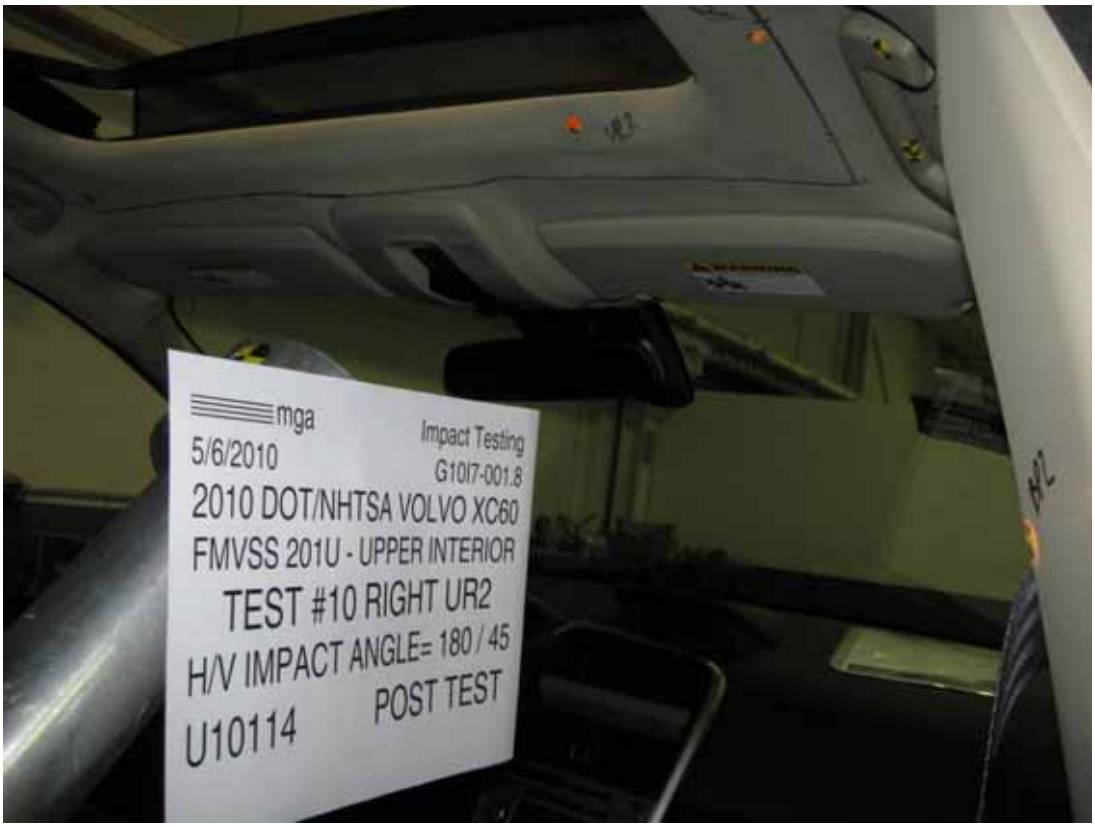

(peak = 33.3 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 23.98 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 41.0 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


UR2
mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR2
H/V IMPACT ANGLE= 180 / 45
U10114
PRE TEST


mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR2
H/V IMPACT ANGLE= 180 / 45
U10114
PRE TEST
CA5902
U10114
RIGHT UR2
H/V 180/45


mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR2
H/V IMPACT ANGLE= 180 / 45
U10114
POST TEST


UR2
mga
5/6/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR2
H/V IMPACT ANGLE= 180 / 45
U10114
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR2
H/V IMPACT ANGLE= 180 / 45
U10114
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#10

Target (Vehicle Side): UR2Right

Temperature:22.0C

MGA Test Reference No.:U10114

Humidity:38.6%

Approach Horizontal Angles:180º

Time of Test:12:01:03 PM

Approach Vertical Angles:45º

FMH Serial No:[035]

Additional Description: At front of sunroof

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
398	308	18.3	24.1	7	1 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-96.3	1.05	1.05
Y	6	J22664	95.2	0.84	0.84
Z	7	J35924	93.8	0.93	0.93

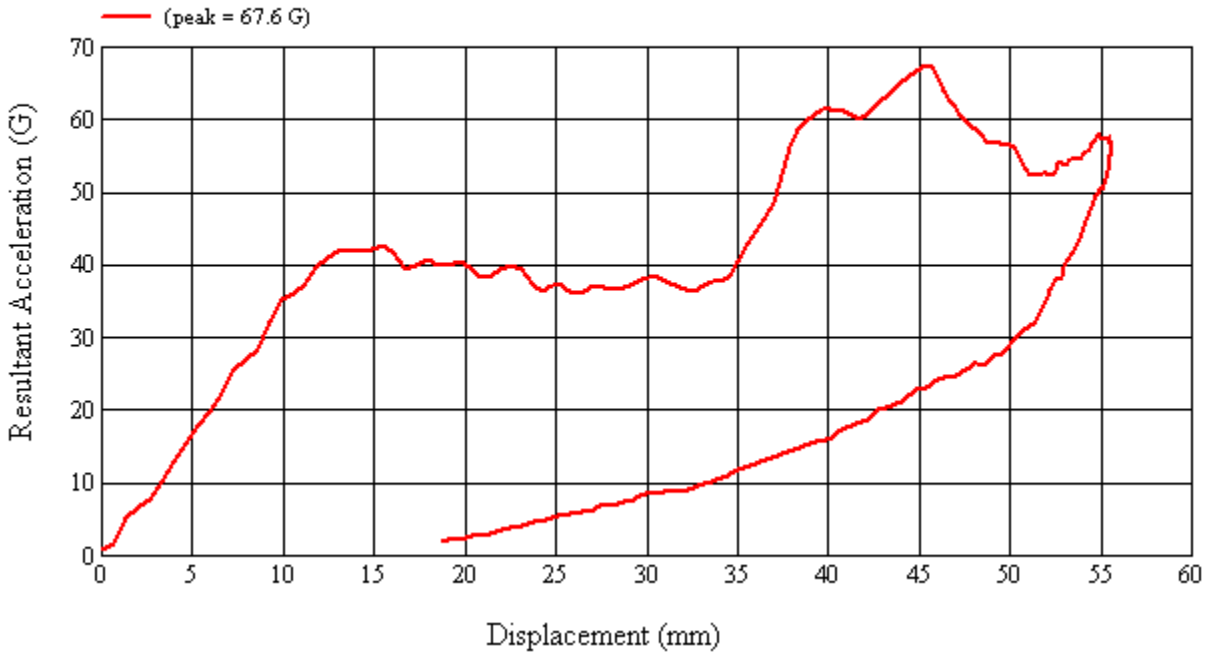
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

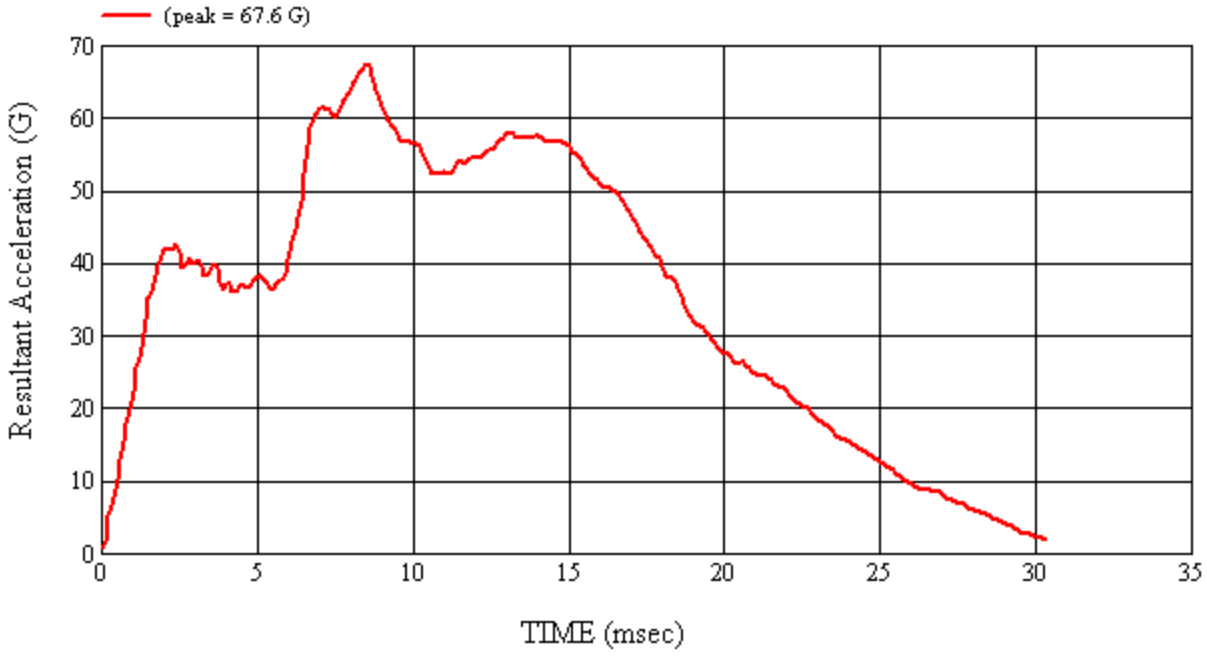
Headliner deformation

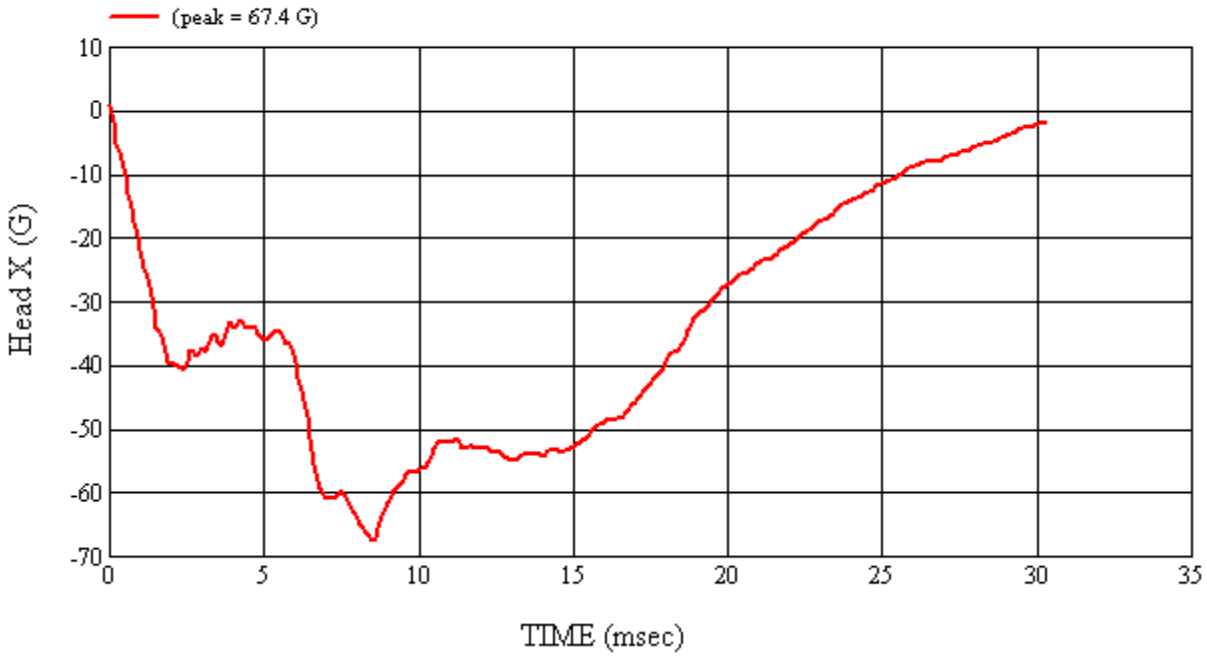
Recorded By: _____ Approved By*: _____ Date: 5/6/2010

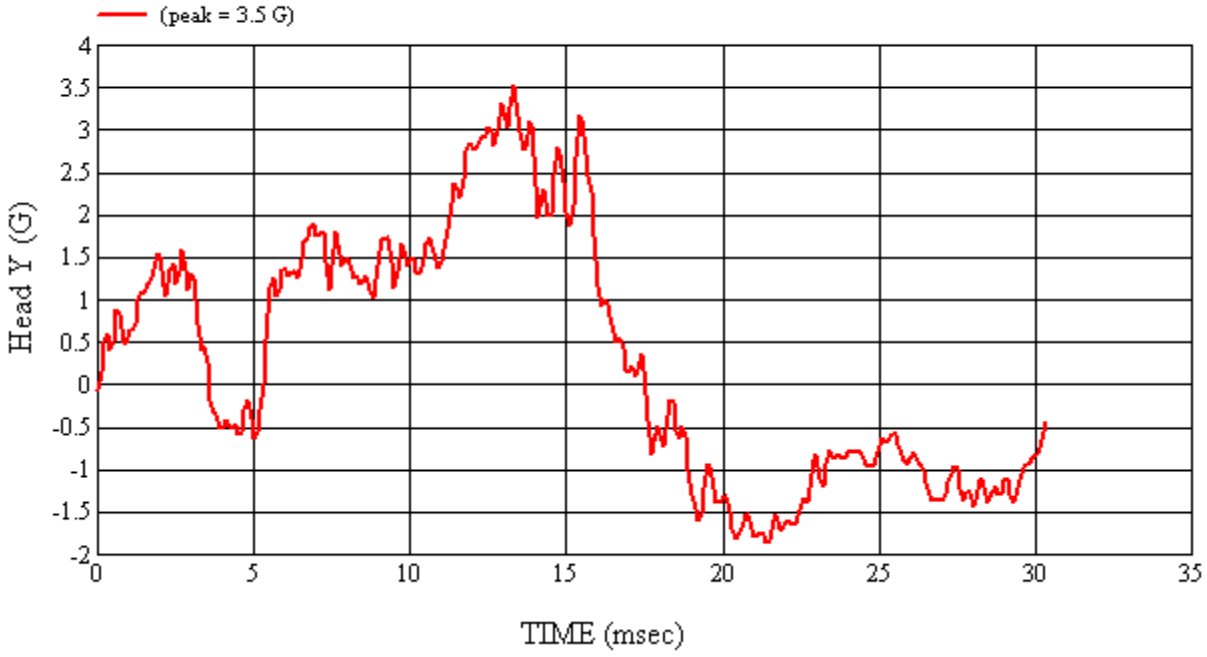
*Only necessary for NHTSA (Government) Compliance testing.

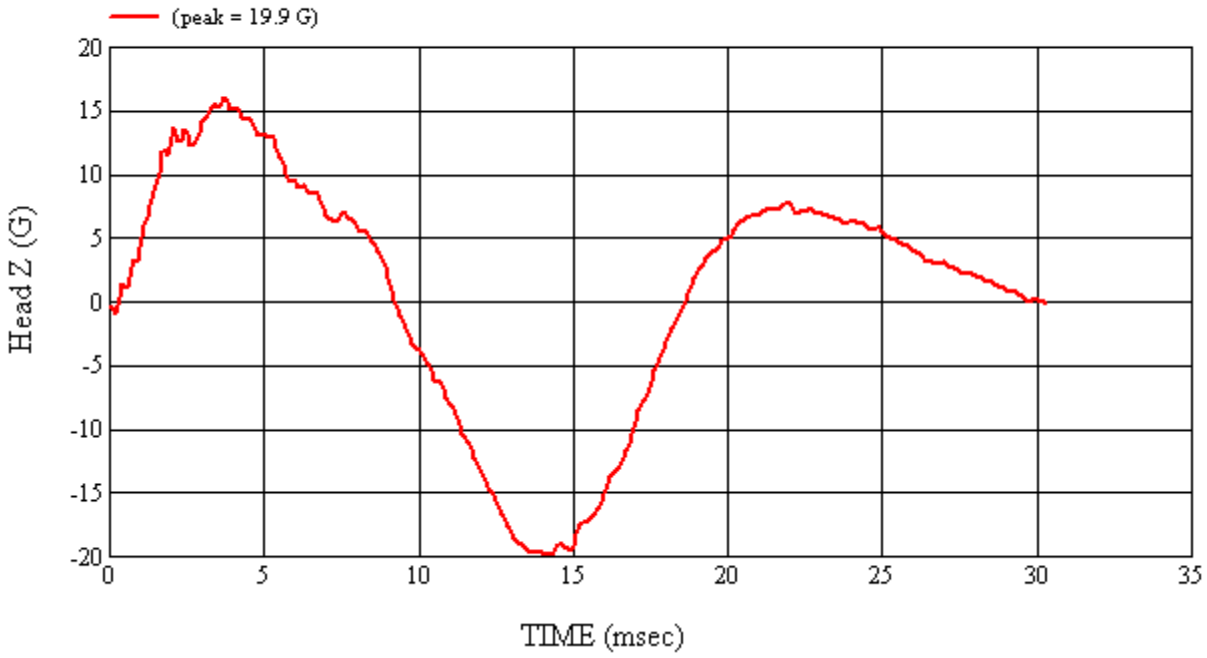
MGA Test #: U10114 Target Location: UR2, Right Side Test Date: 5/6/2010

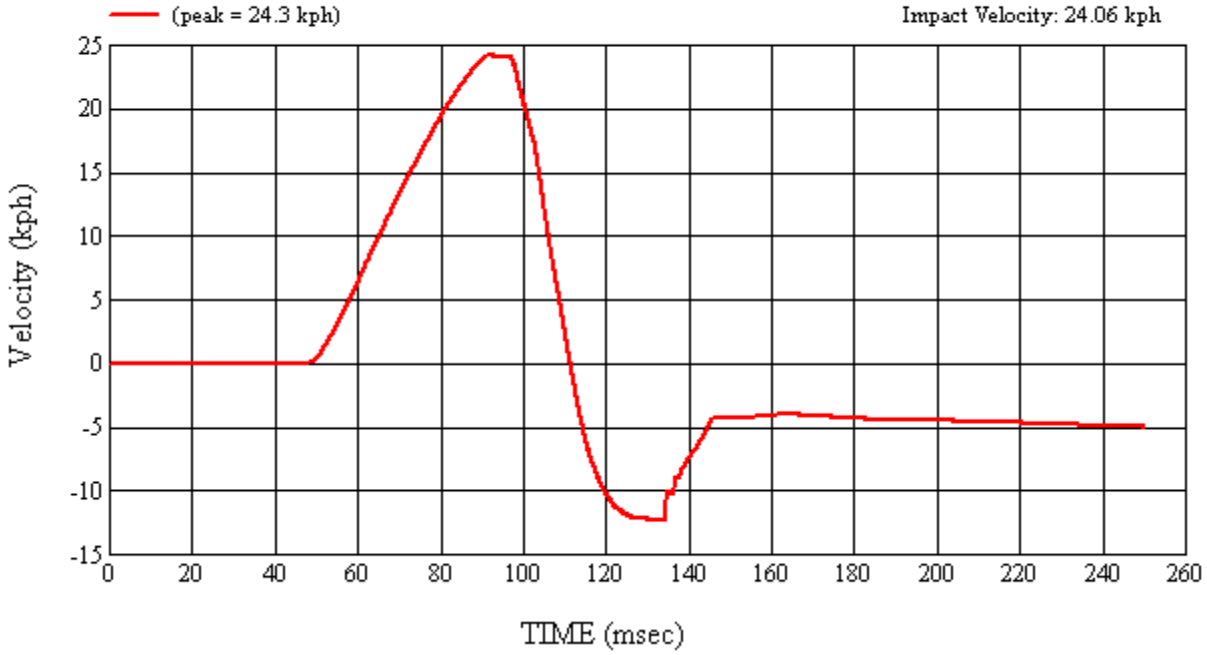


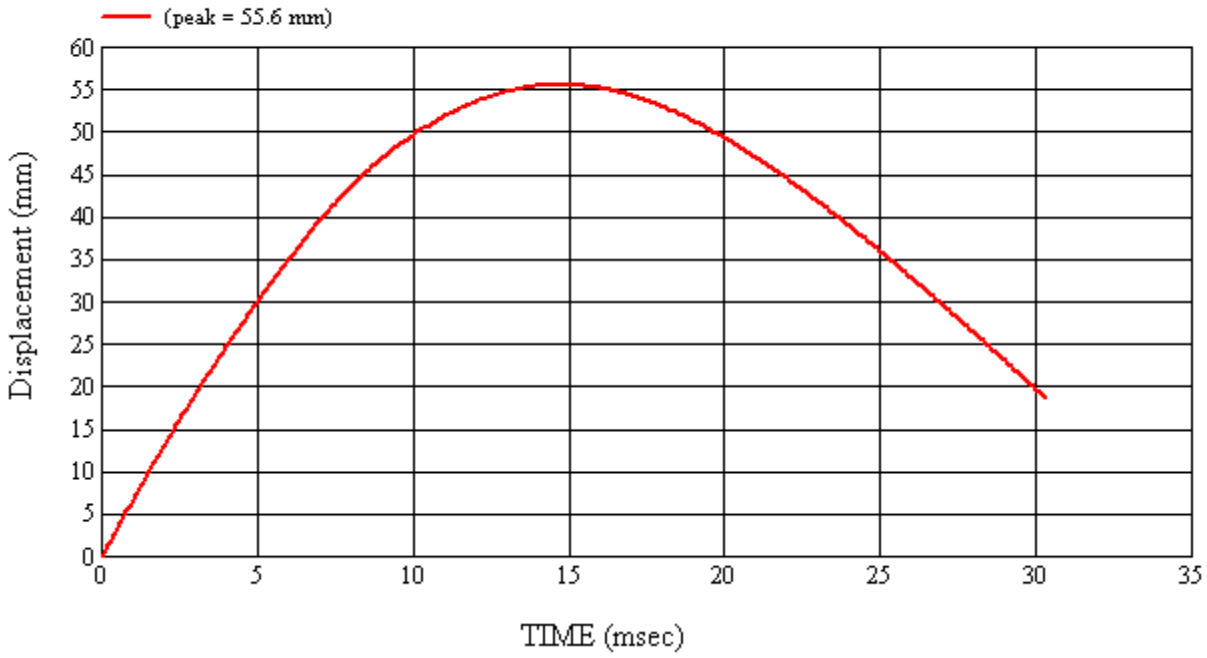



(peak = 67.4 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
0
5
10
15
20
25
30
35
TIME (msec)


(peak = 3.5 G)
Head Y (G)
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
5
10
15
20
25
30
35
TIME (msec)


(peak = 19.9 G)
Head Z (G)
20
15
10
5
0
-5
-10
-15
-20
0
5
10
15
20
25
30
35
TIME (msec)


(peak = 24.3 kph)
Impact Velocity: 24.06 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 55.6 mm)
Displacement (mm)
60
55
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
35
TIME (msec)


CA5902
U10113
RIGHT UR3
H/V 90/50
mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR3
H/V IMPACT ANGLE= 90 / 50
U10113
PRE TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR3
H/V IMPACT ANGLE= 90 / 50
U10113
PRE TEST


CA5902
U10113
RIGHT UR3
H/V 90/50
mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR3
H/V IMPACT ANGLE= 90 / 50
U10113
POST TEST


UR3
SR2A
SR2B
mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR3
H/V IMPACT ANGLE= 90 / 50
U10113
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR3
H/V IMPACT ANGLE= 90 / 50
U10113
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#9

Target (Vehicle Side): UR3Right

Temperature:22.1C

MGA Test Reference No.:U10113

Humidity:38.2%

Approach Horizontal Angles:90º

Time of Test:10:47:59 AM

Approach Vertical Angles:50º

FMH Serial No:[038]

Additional Description:At SR2A

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
680	680	8.1	23.9	26	2 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.5	1.05	1.05
Y	6	J36197	109.5	0.84	0.84
Z	7	J36353	99.5	0.93	0.93

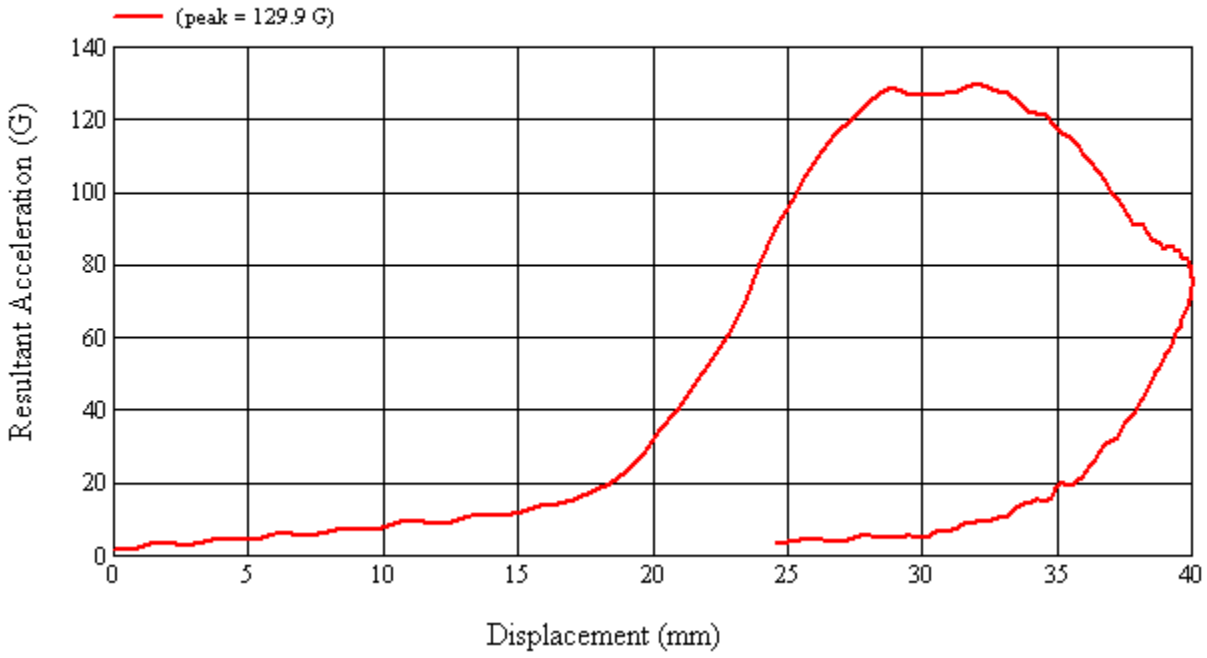
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

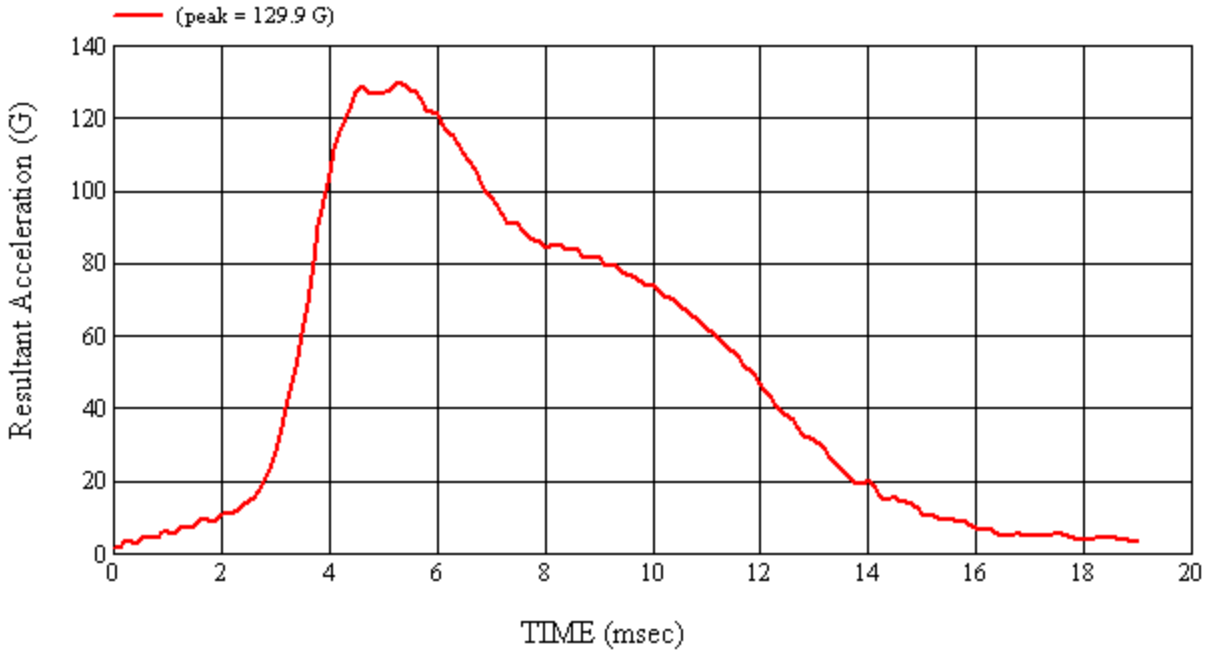
Headliner deformation, grab handle compression

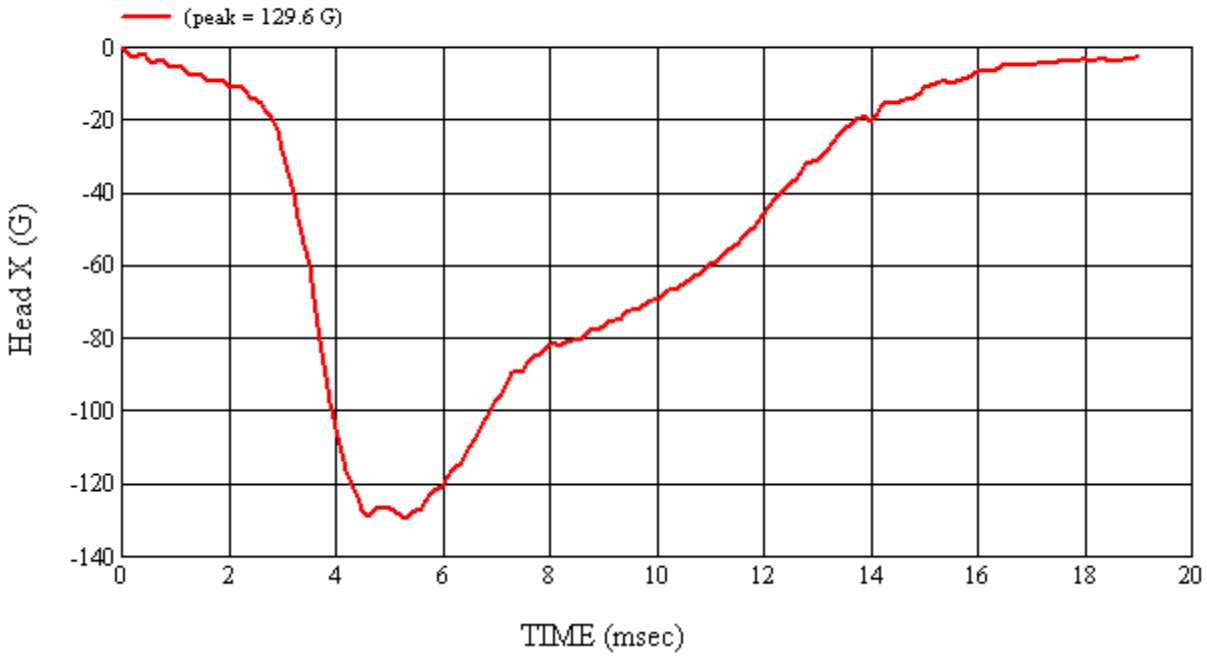
Recorded By: _____ Approved By*: _____ Date: 5/6/2010

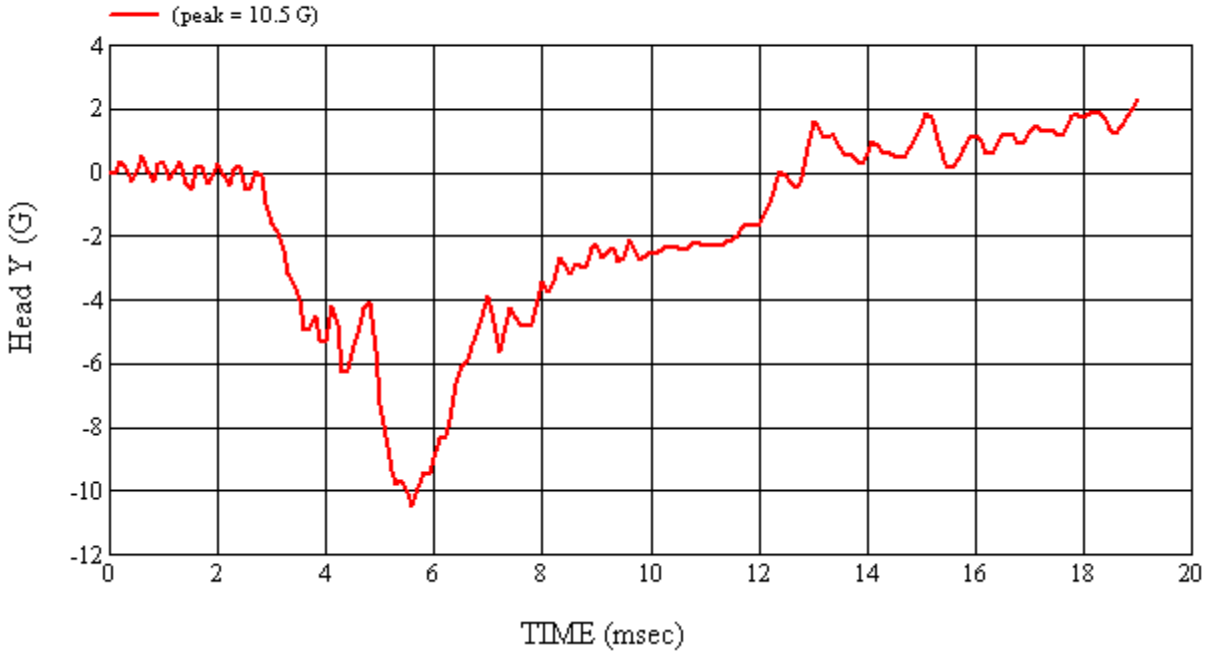
*Only necessary for NHTSA (Government) Compliance testing.

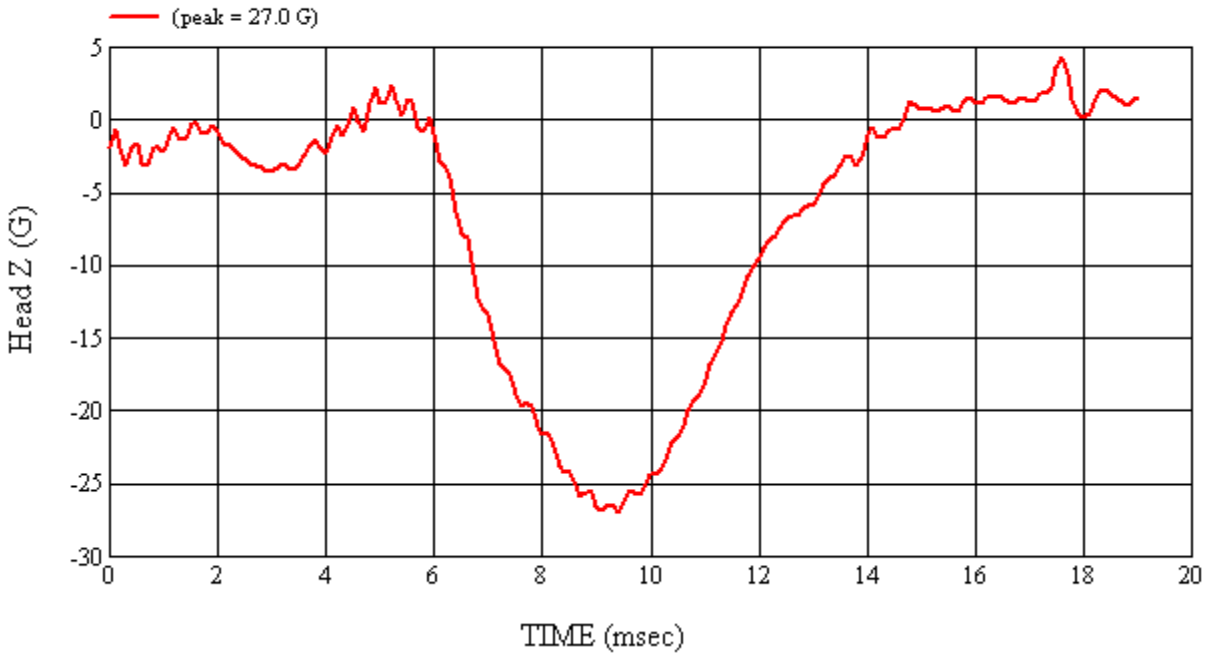
MGA Test #: U10113 Target Location: UR3, Right Side Test Date: 5/6/2010

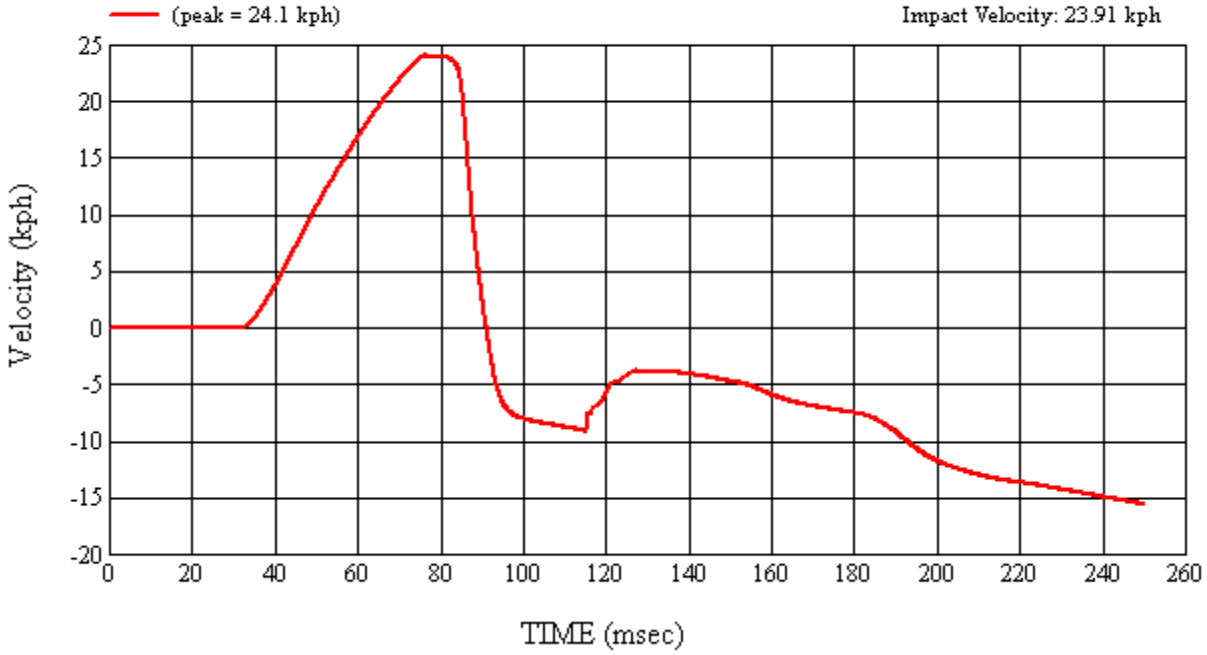


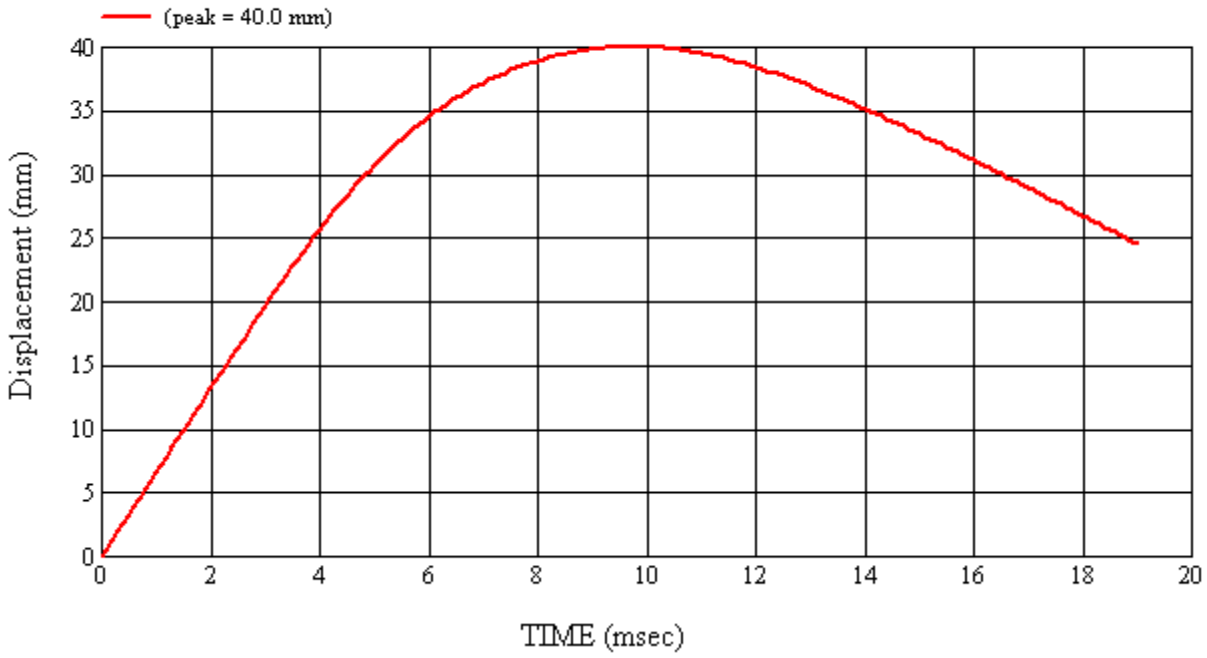



(peak = 129.6 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

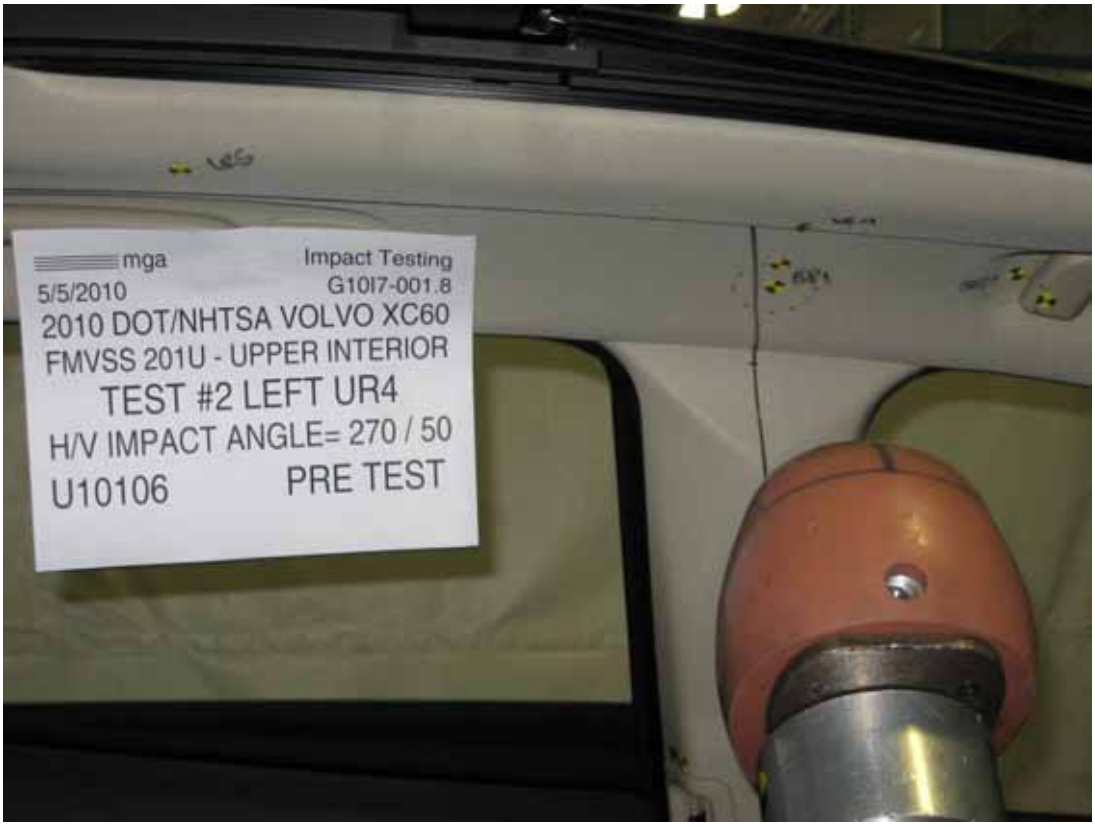

(peak = 10.5 G)
Head Y (G)
4
2
0
-2
-4
-6
-8
-10
-12
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 27.0 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

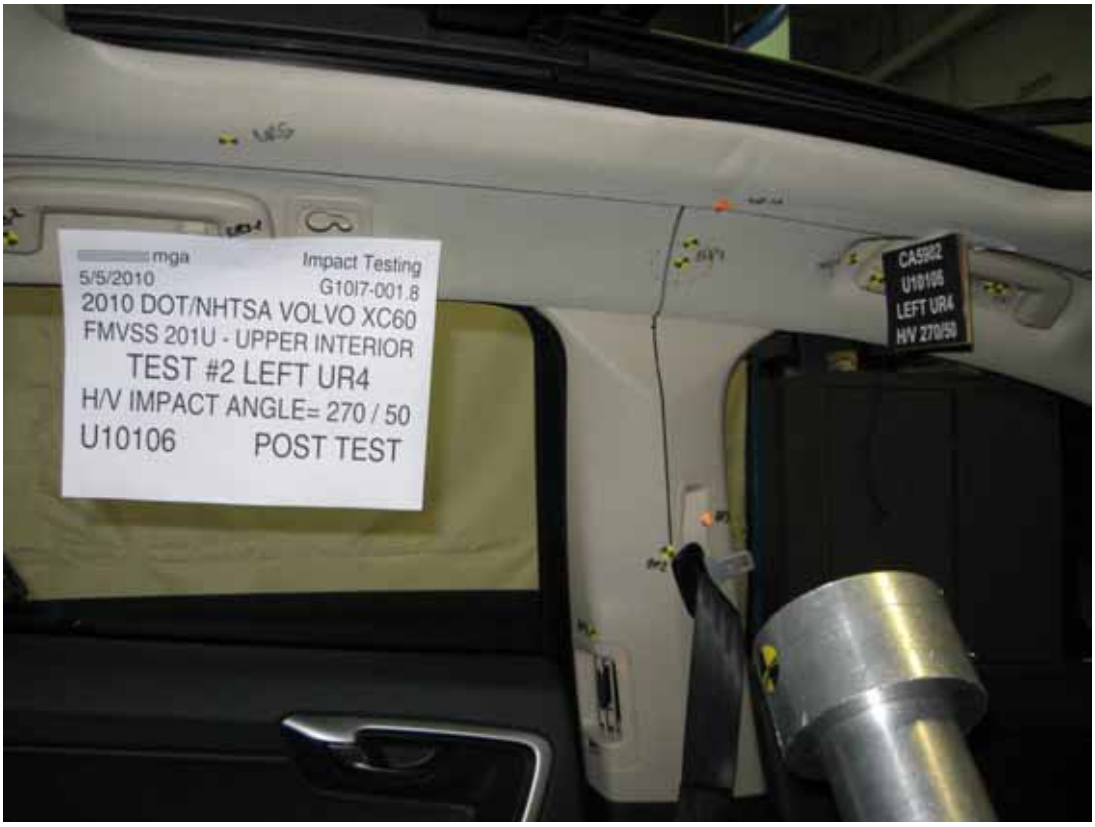

(peak = 24.1 kph)
Impact Velocity: 23.91 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 40.0 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR4
H/V IMPACT ANGLE= 270 / 50
U10106
PRE TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR4
H/V IMPACT ANGLE= 270 / 50
U10106
PRE TEST


CA5902
U10106
LEFT UR4
H/V 270/50
mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR4
H/V IMPACT ANGLE= 270 / 50
U10106
POST TEST


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR4
H/V IMPACT ANGLE= 270 / 50
U10106
POST TEST
CA5902
U10106
LEFT UR4
H/V 270/50


mga
Impact Testing
5/5/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR4
H/V IMPACT ANGLE= 270 / 50
U10106
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Target (Vehicle Side): UR4Left

MGA Test Reference No.:U10106

Approach Horizontal Angles:270º

Approach Vertical Angles:50º

Additional Description: At BP

Test Number:#2

Temperature:23.0C

Humidity:43.3%

Time of Test:11:10:31 AM

FMH Serial No:[037]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
625	608	5.4	24.1	25	7 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-116.9	1.04	1.05
Y	6	J14103	94.2	0.83	0.83
Z	7	J35800	98.2	0.92	0.92

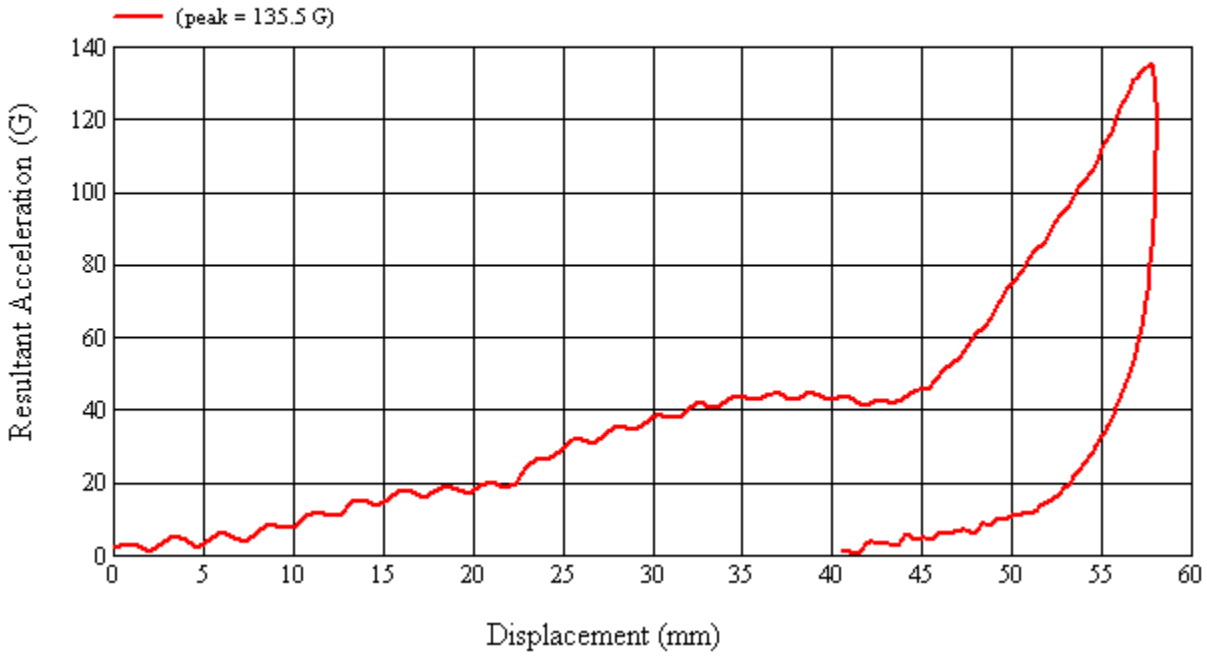
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

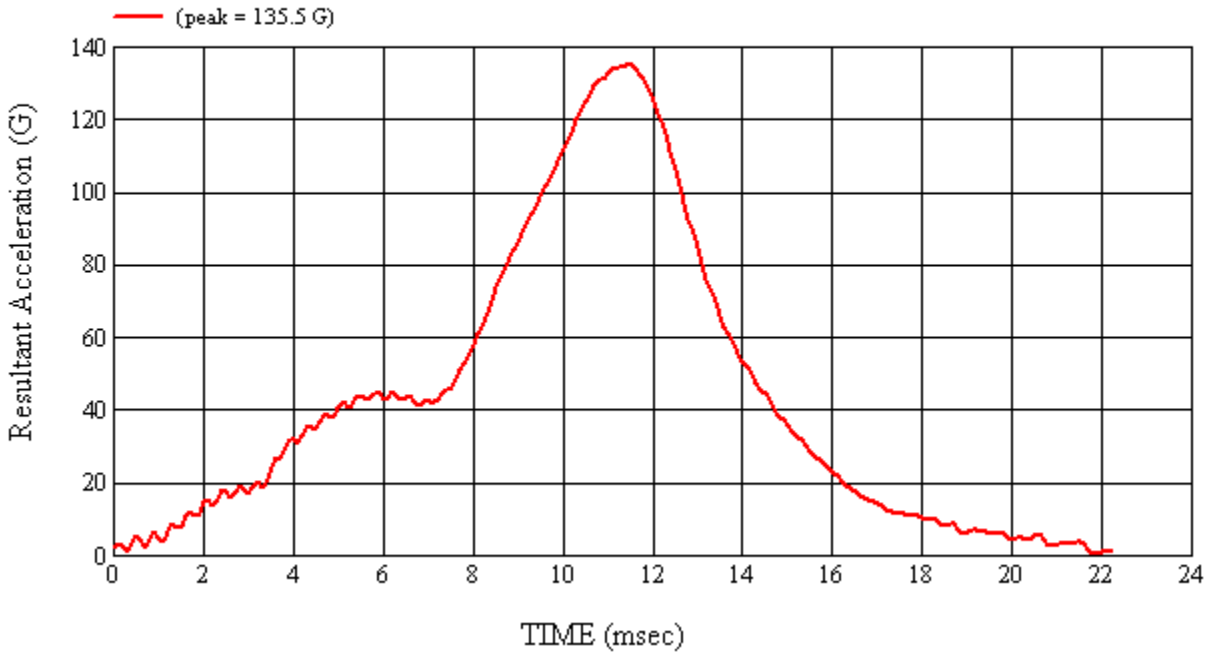
Headliner deformation

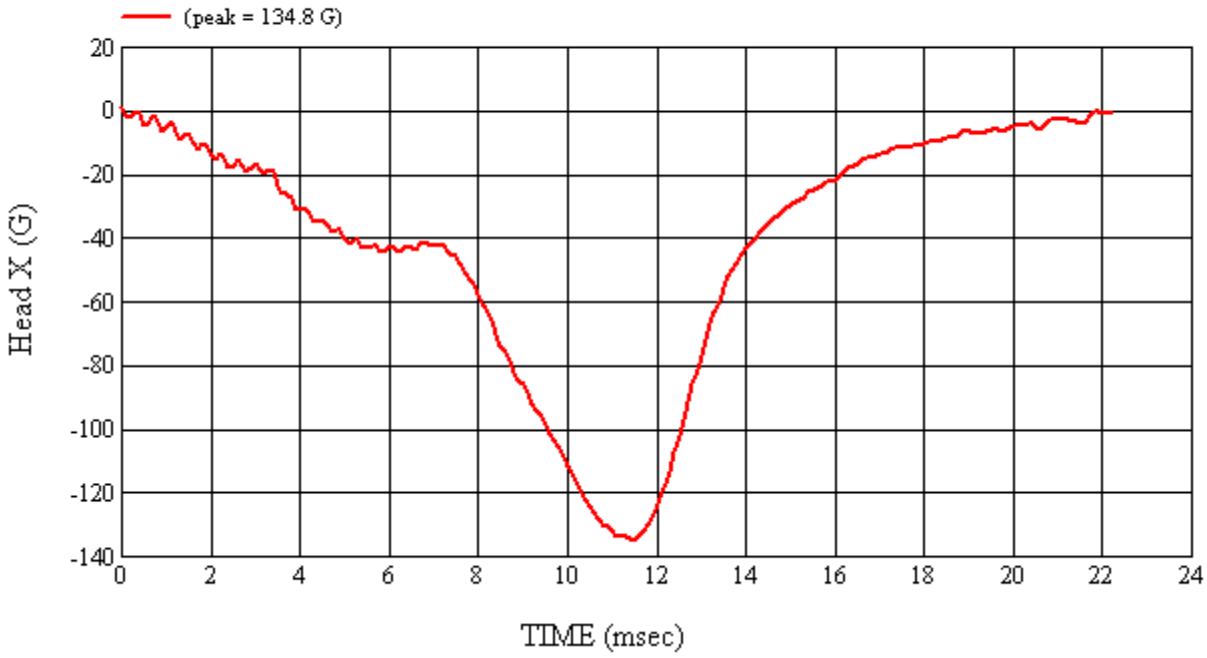
Recorded By: _____ Approved By*: _____ Date: 5/5/2010

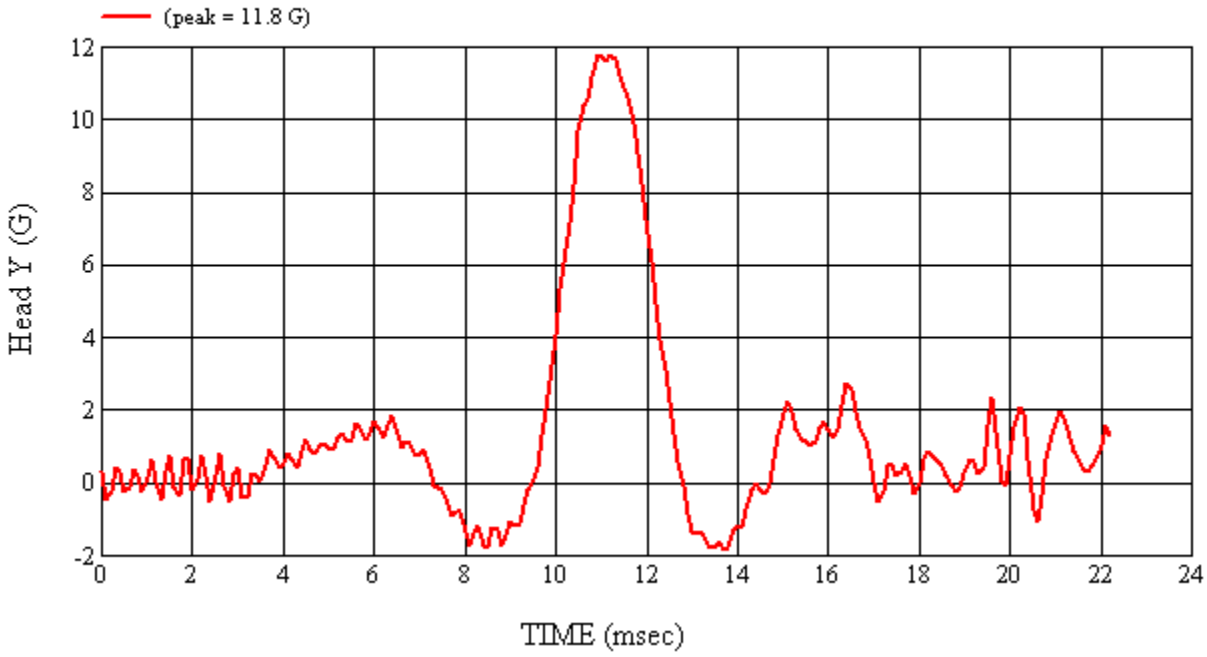
*Only necessary for NHTSA (Government) Compliance testing.

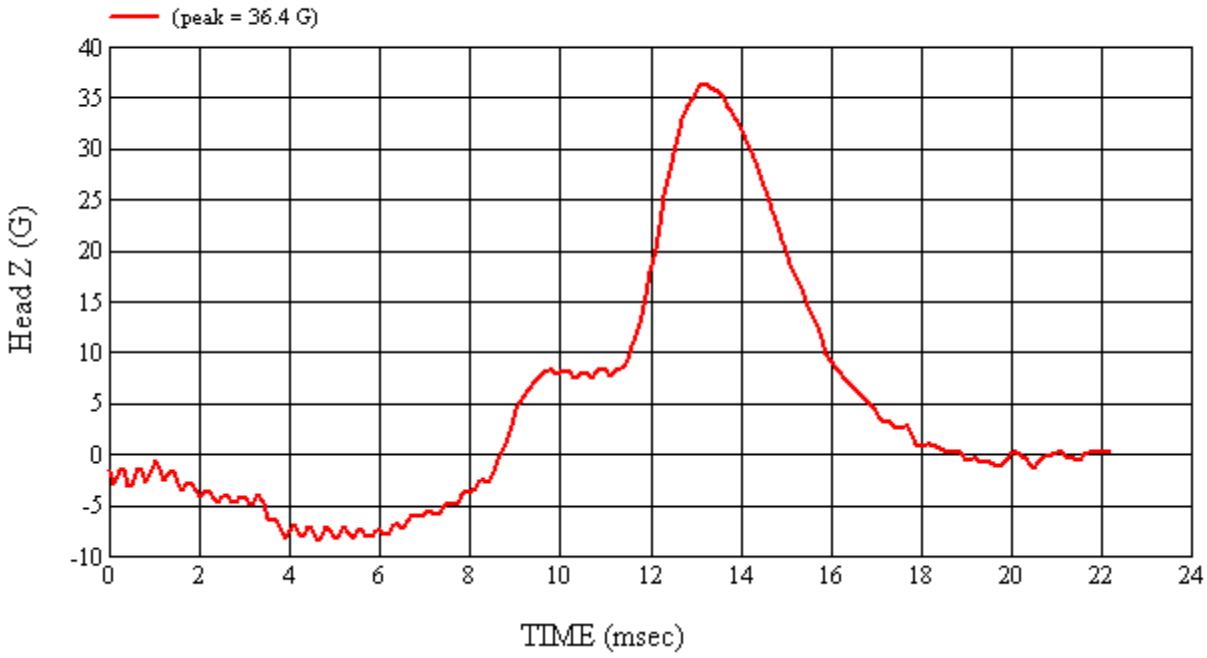
MGA Test #: U10106 Target Location: UR4, Left Side Test Date: 5/5/2010

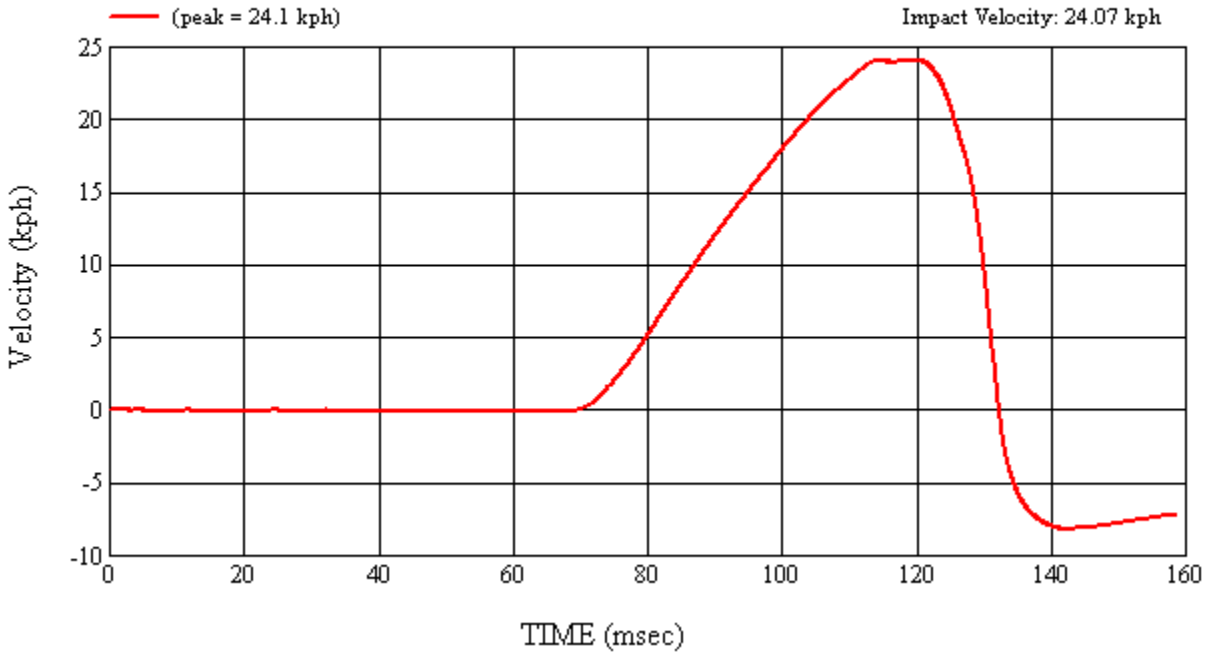




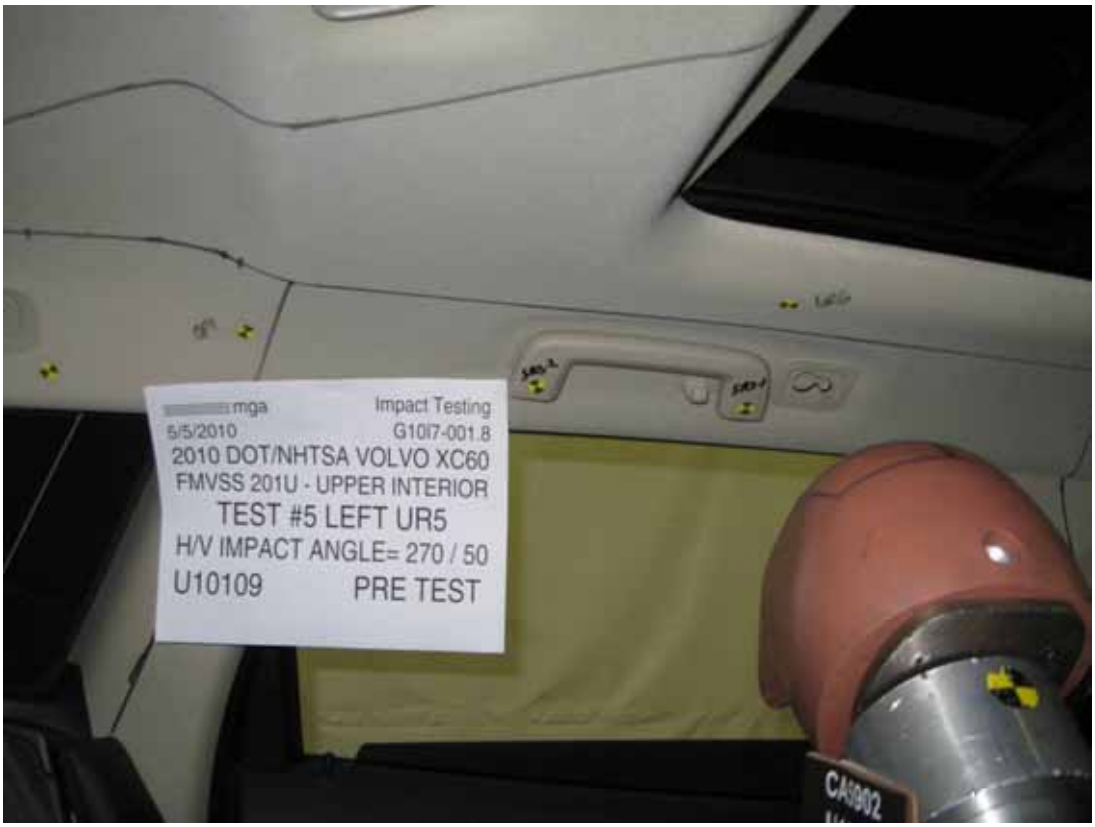

(peak = 134.8 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 11.8 G)
Head Y (G)
12
10
8
6
4
2
0
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 36.4 G)
Head Z (G)
40
35
30
25
20
15
10
5
0
-5
-10
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 24.1 kph)
Impact Velocity: 24.07 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
TIME (msec)


mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #5 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U10109
PRE TEST


mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #5 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U10109
PRE TEST


mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #5 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U10109
POST TEST


mga
5/5/2010
Impact Testing
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #5 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U10109
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#5

Target (Vehicle Side): UR5Left

Temperature:23.8C

MGA Test Reference No.:U10109

Humidity:47.2%

Approach Horizontal Angles:270º

Time of Test:2:17:02 PM

Approach Vertical Angles:50º

FMH Serial No:[037]

Additional Description: At SR3-1

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
571	536	8.9	23.8	19	1 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-116.9	1.04	1.05
Y	6	J14103	94.2	0.83	0.84
Z	7	J35800	98.2	0.91	0.93

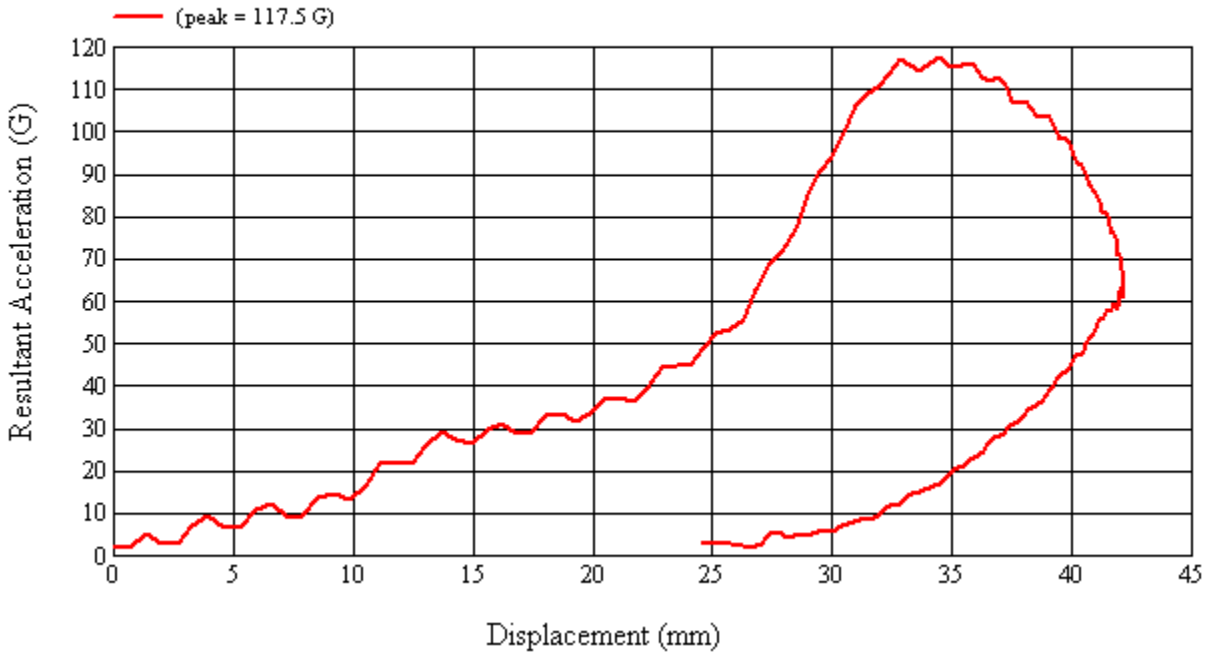
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

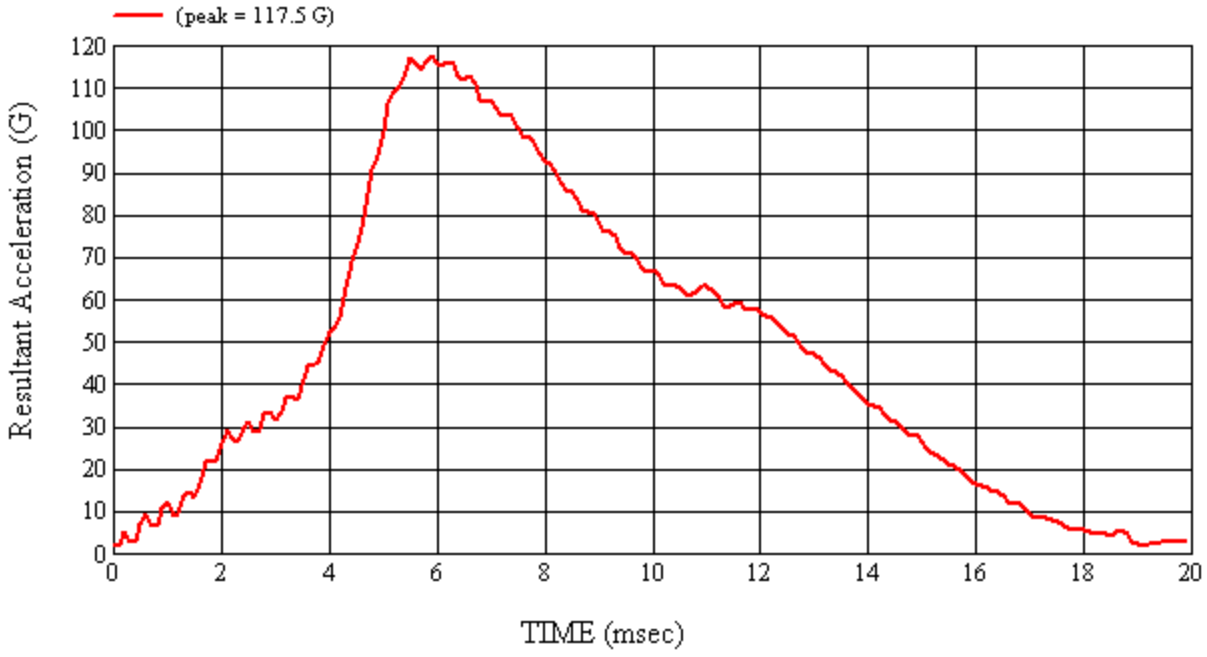
Headliner deformation, grab handle compression

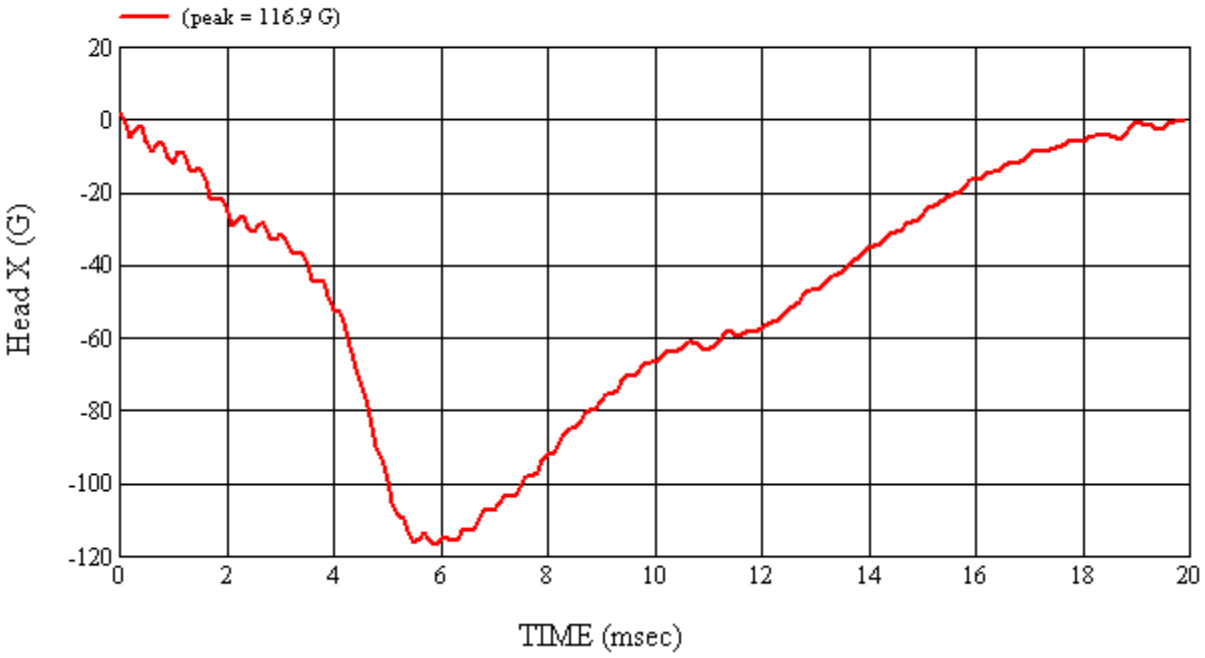
Recorded By: _____ Approved By*: _____ Date: 5/5/2010

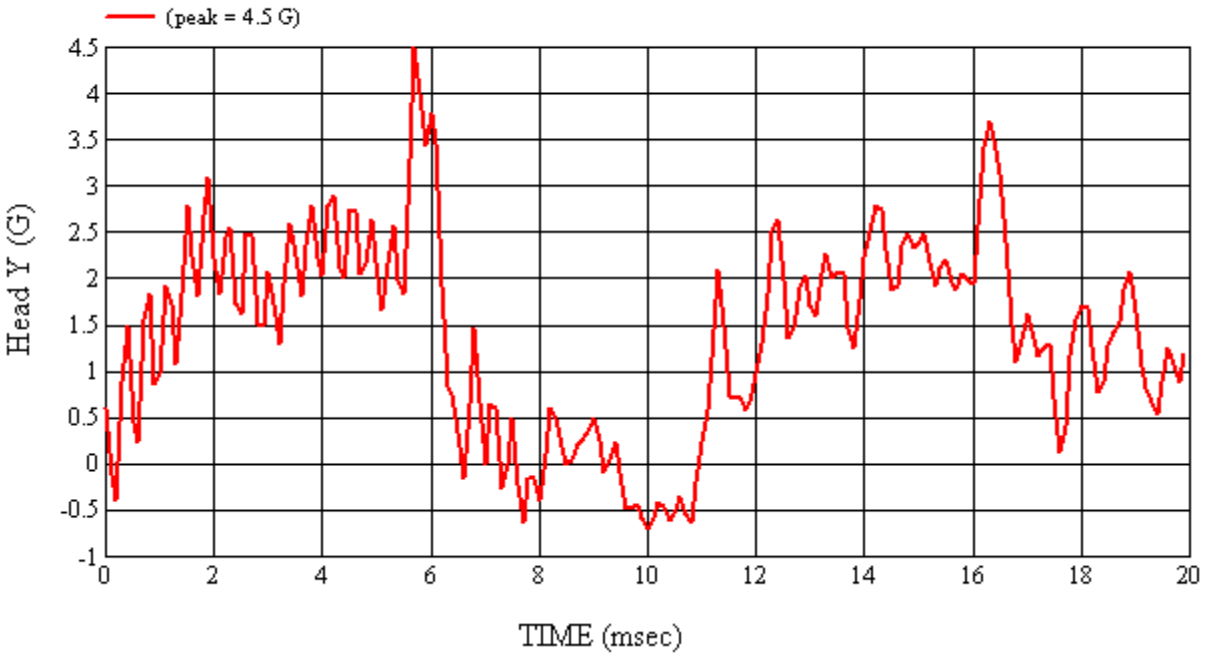
*Only necessary for NHTSA (Government) Compliance testing.

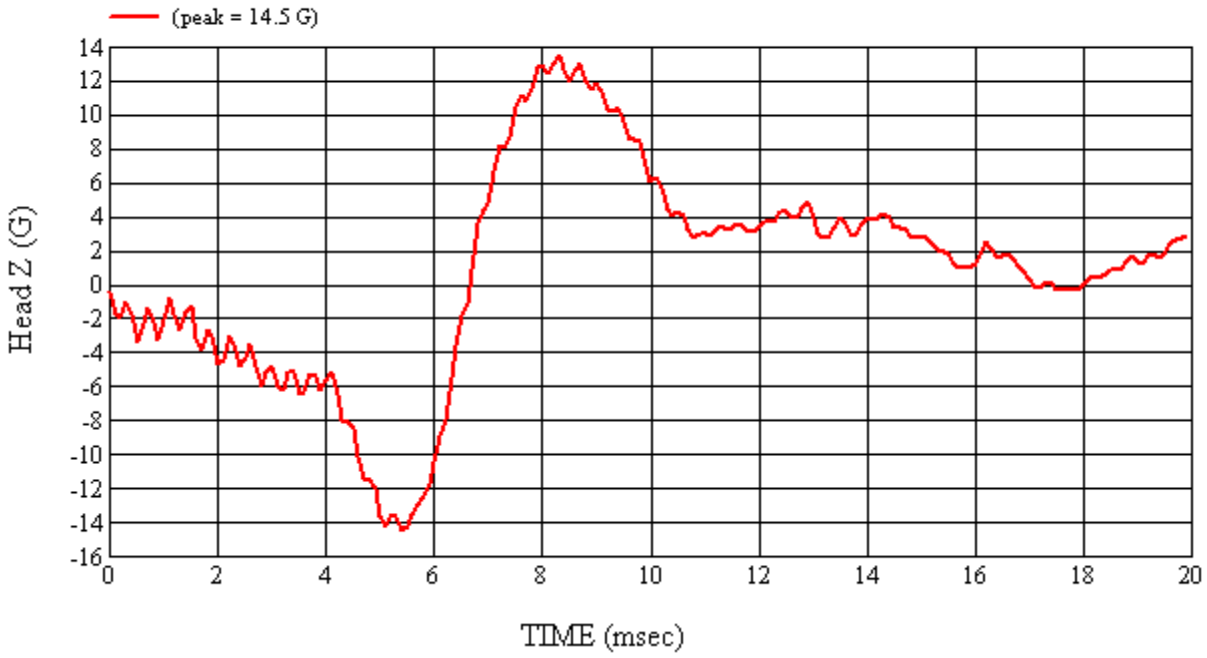
MGA Test #: U10109 Target Location: UR5, Left Side Test Date: 5/5/2010

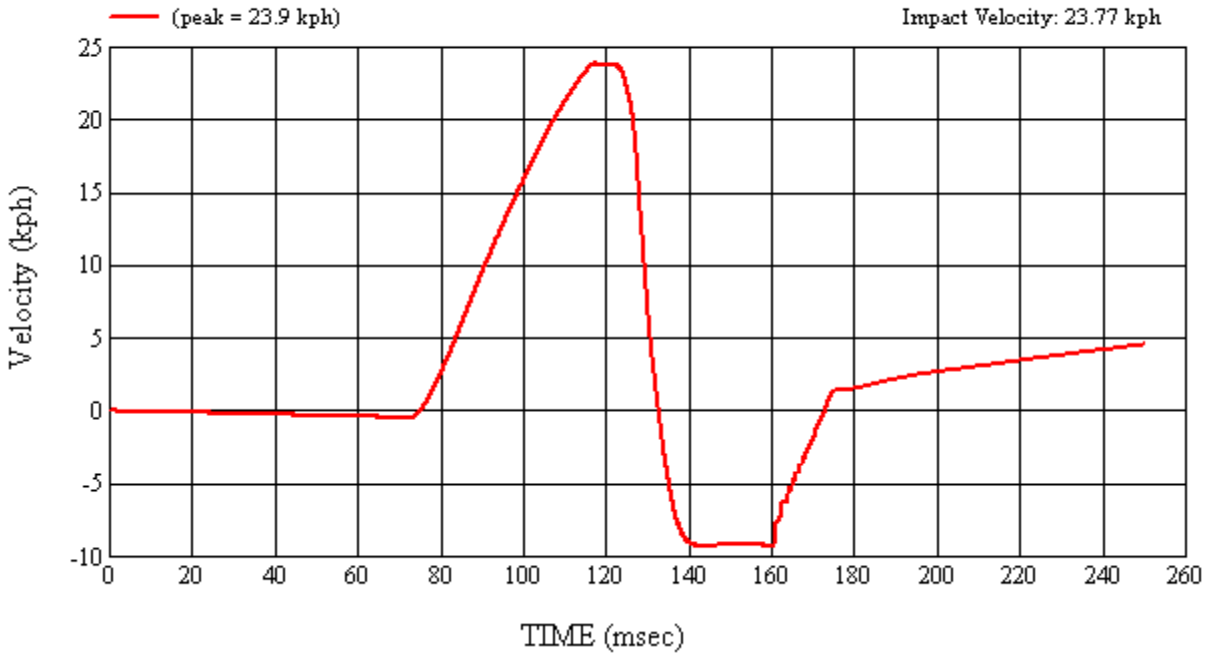


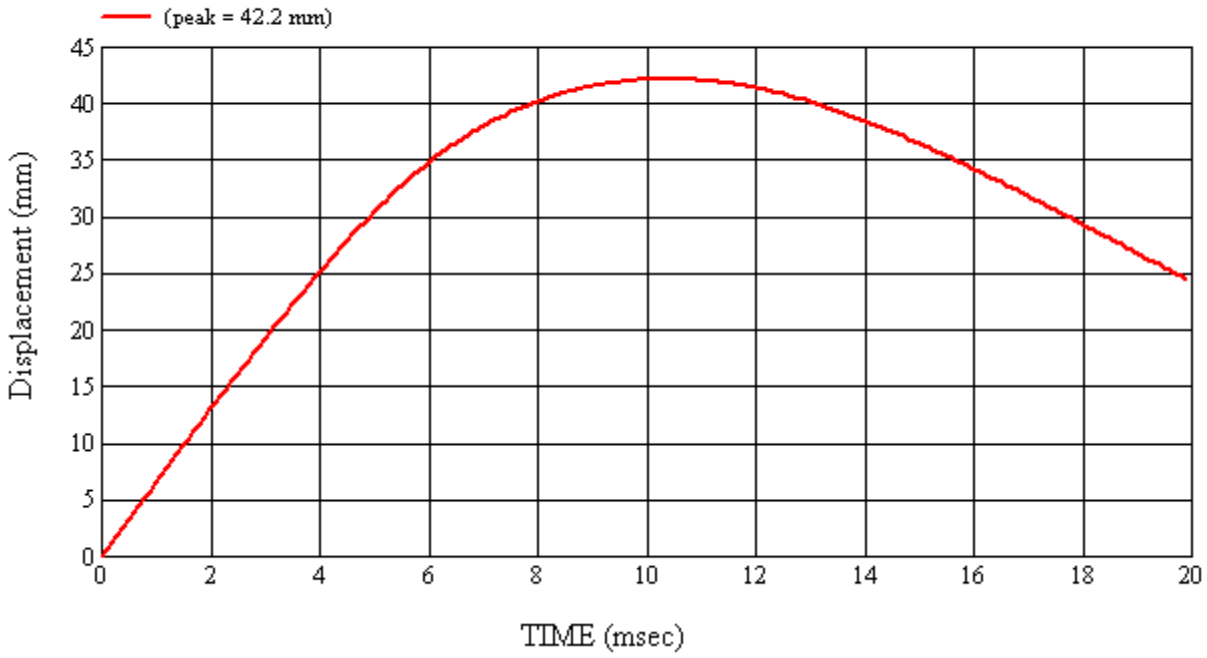



(peak = 116.9 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

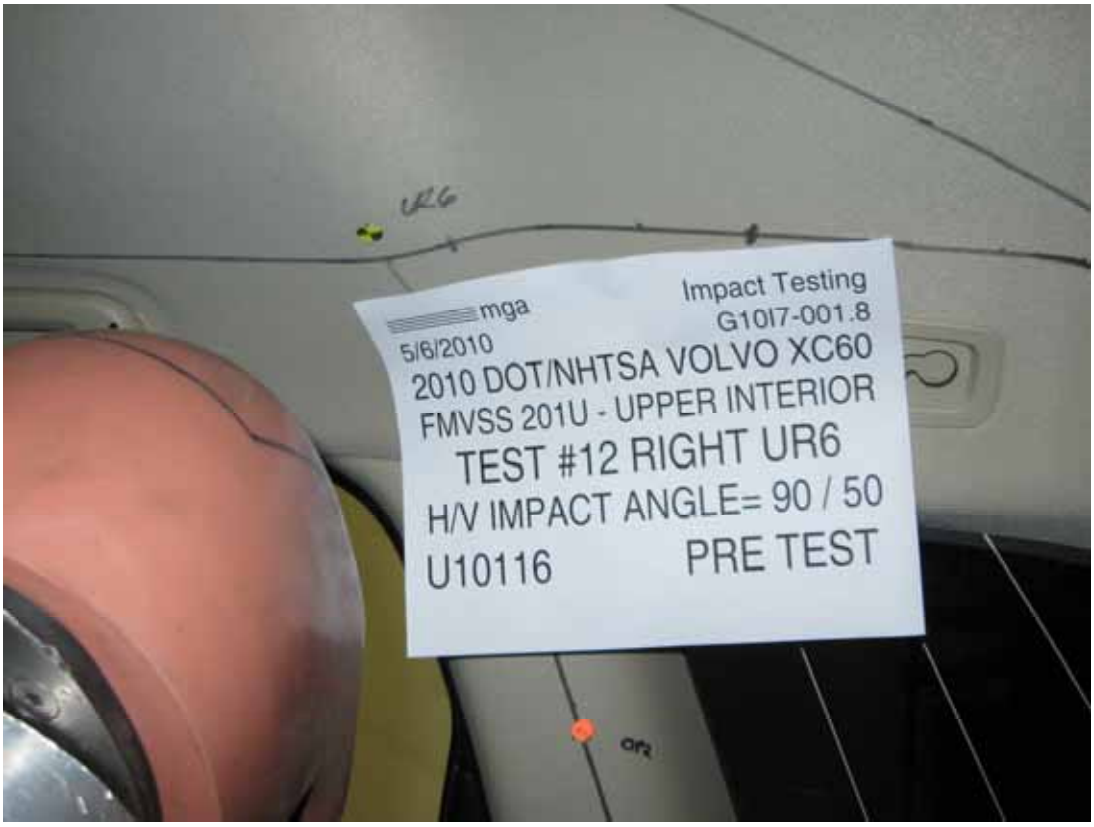

(peak = 4.5 G)
Head Y (G)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 14.5 G)
Head Z (G)
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 23.9 kph)
Impact Velocity: 23.77 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 42.2 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U10116
PRE TEST


UR6
mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U10116
PRE TEST


CA5902
U10116
RIGHT UR6
H/V 90/50
mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U10116
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U10116
POST TEST


mga
Impact Testing
5/6/2010
G10I7-001.8
2010 DOT/NHTSA VOLVO XC60
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U10116
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G10I7-001.8 VEHICLE YR/MAKE/MODEL:2010/DOT/NHTSA/Volvo XC60

GENERAL TEST PARAMETERS:

Test Number:#12

Target (Vehicle Side): UR6Right

Temperature:22.5C

MGA Test Reference No.:U10116

Humidity:38.0%

Approach Horizontal Angles:90º

Time of Test:3:05:25 PM

Approach Vertical Angles:50º

FMH Serial No:[038]

Additional Description:At OP

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
787	823	4.2	23.7	19	4 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.5	1.05	1.05
Y	6	J36197	109.5	0.83	0.84
Z	7	J36353	99.5	0.92	0.93

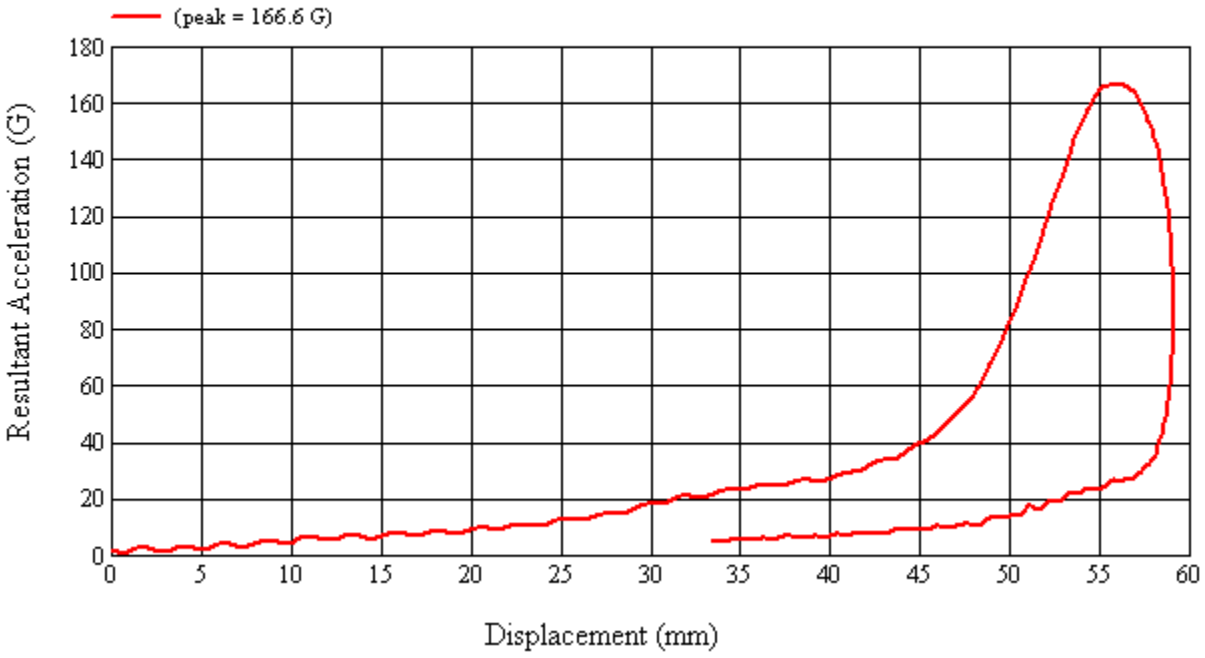
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

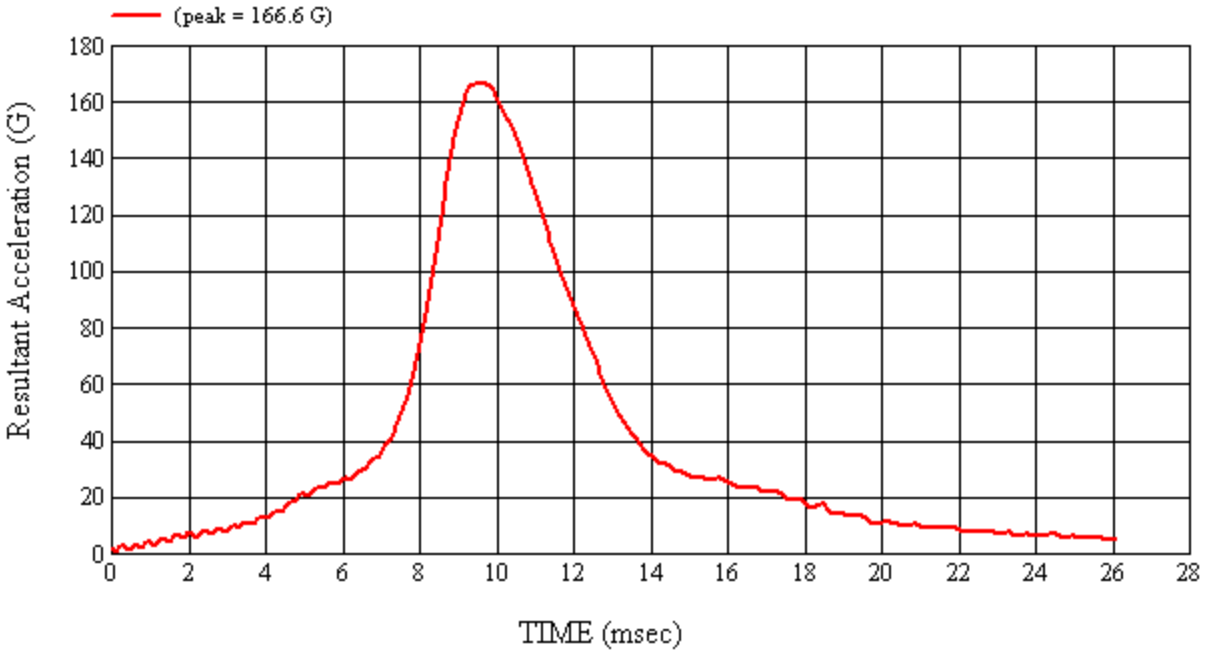
No visible damage

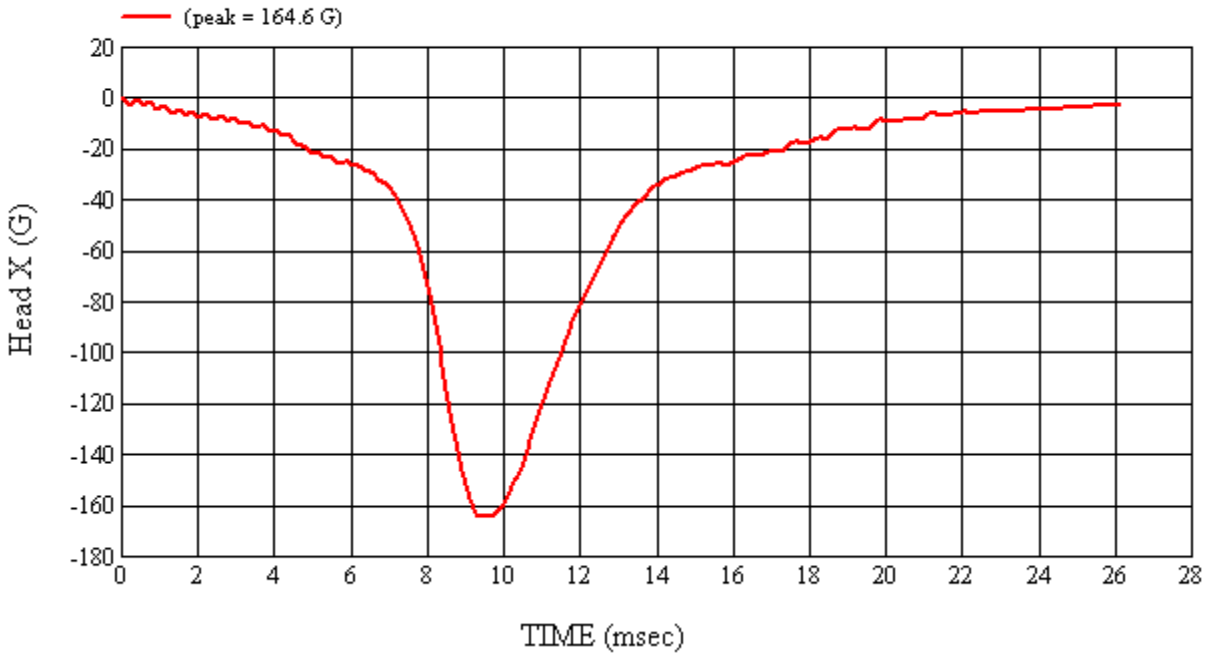
Recorded By: _____ Approved By*: _____ Date: 5/6/2010

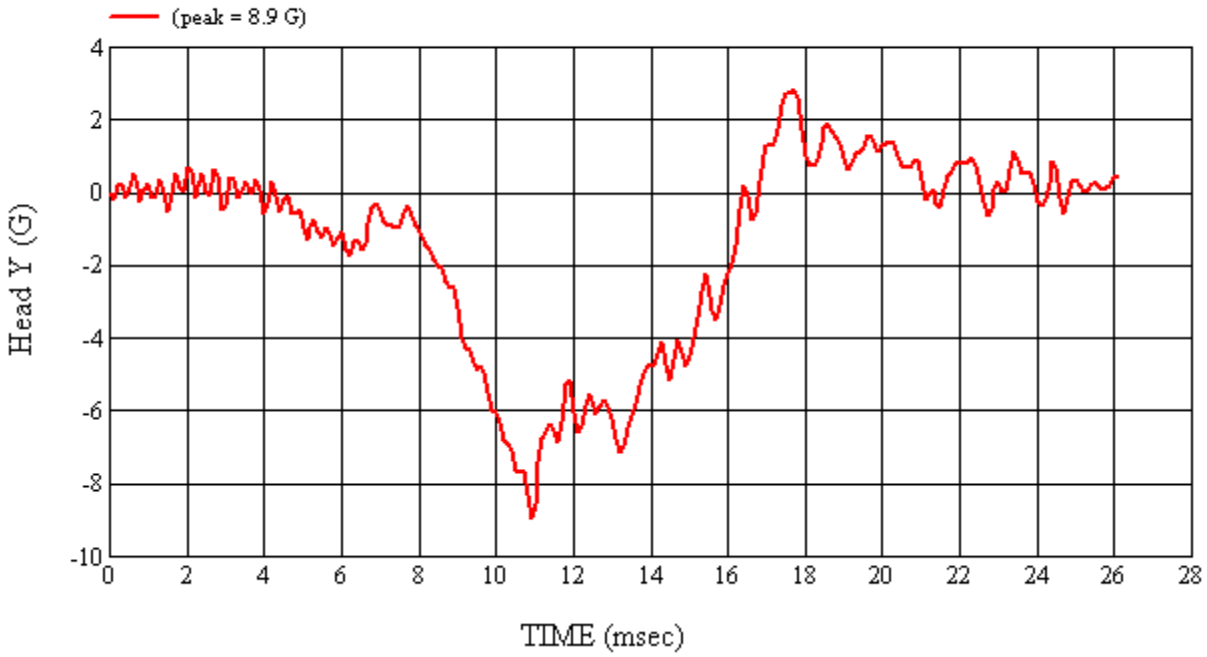
*Only necessary for NHTSA (Government) Compliance testing.

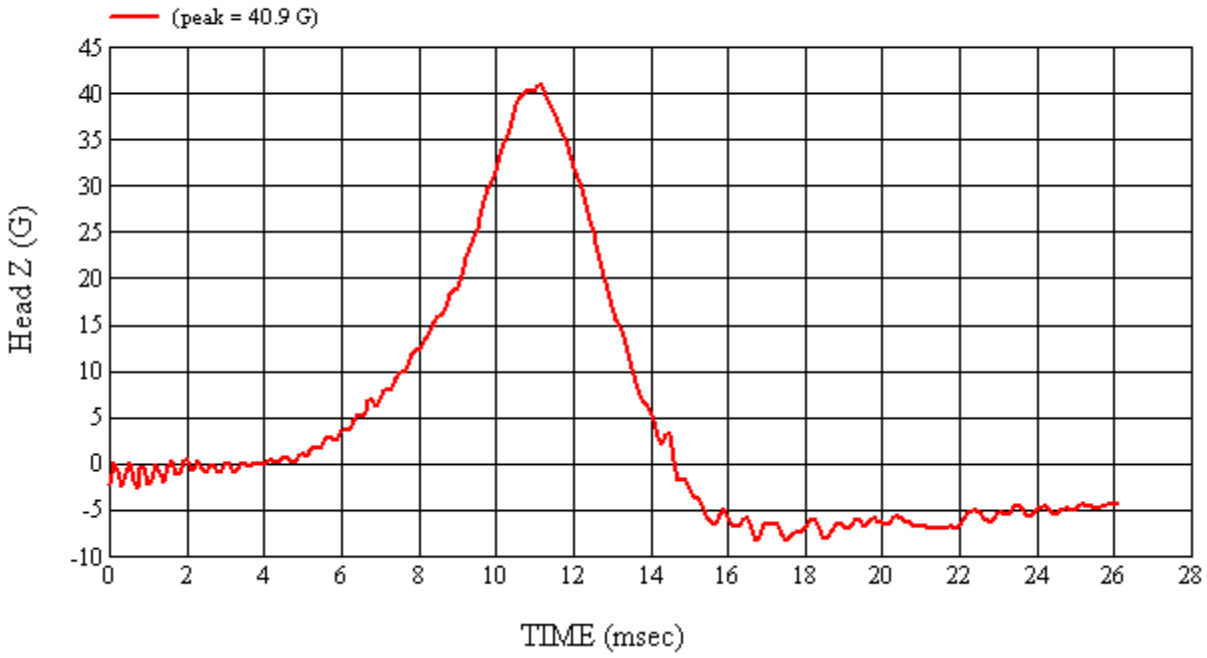
MGA Test #: U10116 Target Location: UR6, Right Side Test Date: 5/6/2010

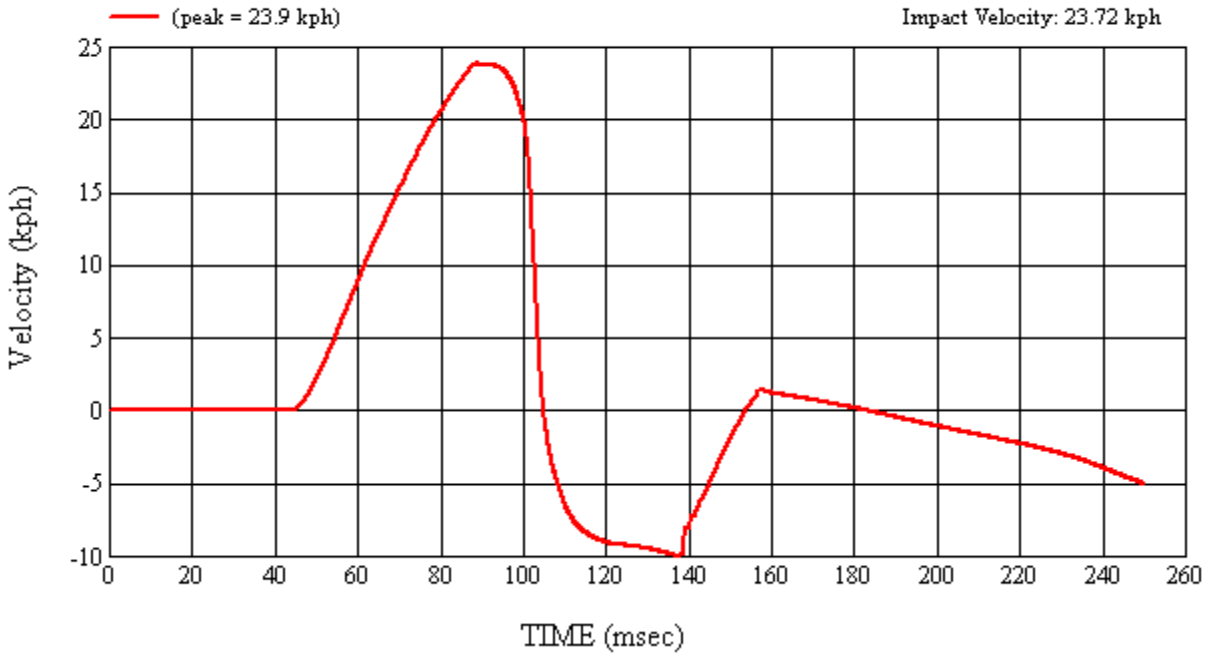


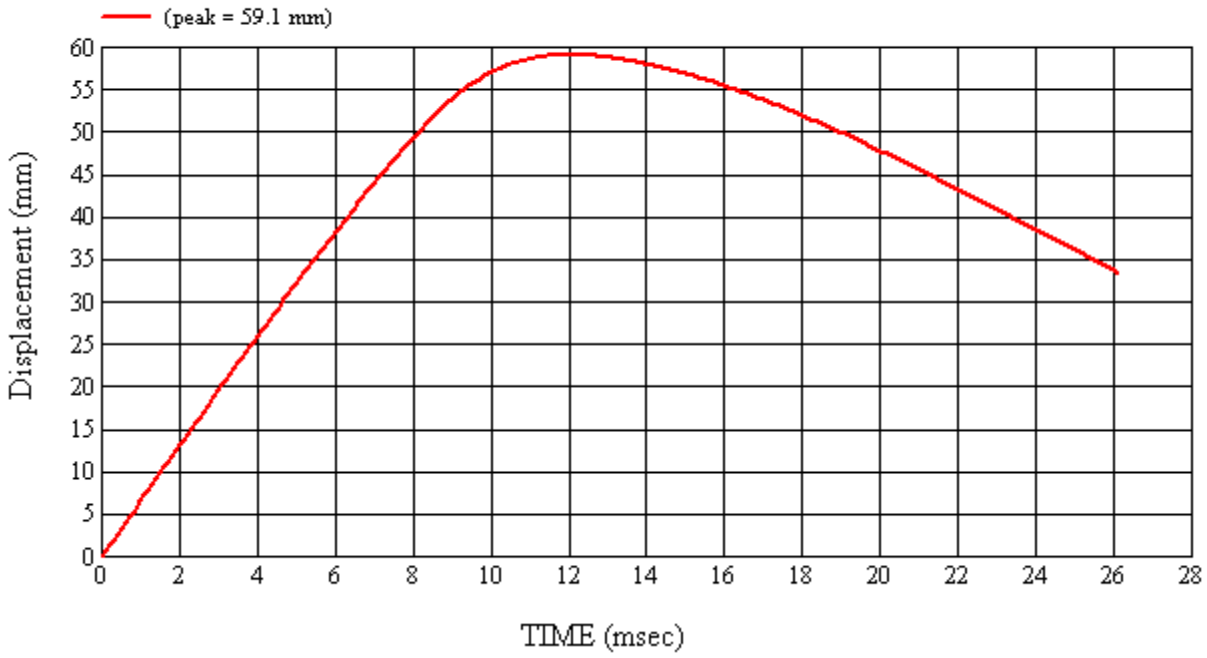



(peak = 164.6 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)


(peak = 8.9 G)
Head Y (G)
4
2
0
-2
-4
-6
-8
-10
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)


(peak = 40.9 G)
Head Z (G)
45
40
35
30
25
20
15
10
5
0
-5
-10
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)


(peak = 23.9 kph)
Impact Velocity: 23.72 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 59.1 mm)
Displacement (mm)
60
55
50
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

The following section lists the test equipment for the compliance test series. Items marked with an asterisk are calibrated by an external lab. An additional summary table is given for the pre and post-test calibration data for the Free Motion Headforms. The temperature trace to confirm testing was conducted between 66ºF and 78ºF (19ºC – 26ºC) is included in Appendix A. Calibration certificates can be found in Appendix B.

TABLE 4-1 LIST OF ITEMS USED

ITEM	MANUFACTURER NAME	MDEL #	FUNCTION OF ITEM	ACCURACY	CAL. INTERNAL
Head Drop Tower (includes test frame and DAS)	MGA Research Corp.	MGA-100-DC	FMH Calibration	N/A	N/A
Accelerometers	Endevco	7264-2000	Acceleration Data	±0.5%	6 months
FMVSS 201U Test Frame (includes the propulsion control system, actuator, test frame, and DAS)	MGA Research Corp.	MGA-100-FMH	Test System	N/A	N/A
Free Motion Headforms	UTAMA UTAMA UTAMA	035 037 038	Test Device	N/A	Pre and Post-Test Series
High Speed Video	Vision Research	Miro Ex4	Record Event	N/A	N/A
*FARO™	Faro Technologies	S08059801273	Targeting	0.1 mm	Annual
Measuring Devices: - Tape Measure - Plumb Bobs - Digital Inclinometer	 Stanley N/A Mitutoyo	 TPM928 -- MGA00048	 Measurement Targeting FMH setup Horizontal Measurement	 1 mm N/A 0.5°	Annual
*Temperature Recorder	Dickson	MGA00152	Record Temperature and Humidity	± 1°C ± 1% RH	Annual
* Scale	Detecto	MGA00783	Weigh FMH Head	± 0.01 lb	Annual
*Vehicle Scale	Sterling Scale Co.	26032389	Weighing Vehicle	± .5 kg	Annual

Each headform was calibrated by an engineer after the headform had soaked in an environment of 66ºF to 78ºF (19ºC to 26ºC) for a period of at least four hours.

Each headform was found to comply with the performance criteria under Part 572L for pre and post-test calibrations. That is, the peak resultant acceleration was between 225 and 275 G's, the peak lateral acceleration was less than 15 G's, the headform weighed between 9.9 and 10.1 lbs., the pulse was determined to be unimodal, and there was no major damage to the headform.

TABLE 4-2 FMH CALIBRATION SUMMARY

FMH Serial #		Headform Calibration Date	Weight (lbs)	Temp (ºC)	% Humidity	Peak Resultant Acceleration (G's)	Peak Lateral Acceleration (G's)	Unimodal
Pre	#035	5/4/2010	9.90	23.3	40.9	253.0	9.7	Yes
Post	#035	5/7/2010	9.90	22.6	44.9	259.7	9.6	Yes
Pre	#037	5/4/2010	9.96	23.2	40.8	247.0	4.7	Yes
Post	#037	5/7/2010	9.96	22.5	45.4	257.2	2.3	Yes
Pre	#038	5/4/2010	9.90	23.0	41.2	260.5	14.0	Yes
Post	#038	5/7/2010	9.90	22.5	45.5	257.4	11.7	Yes

4-1 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

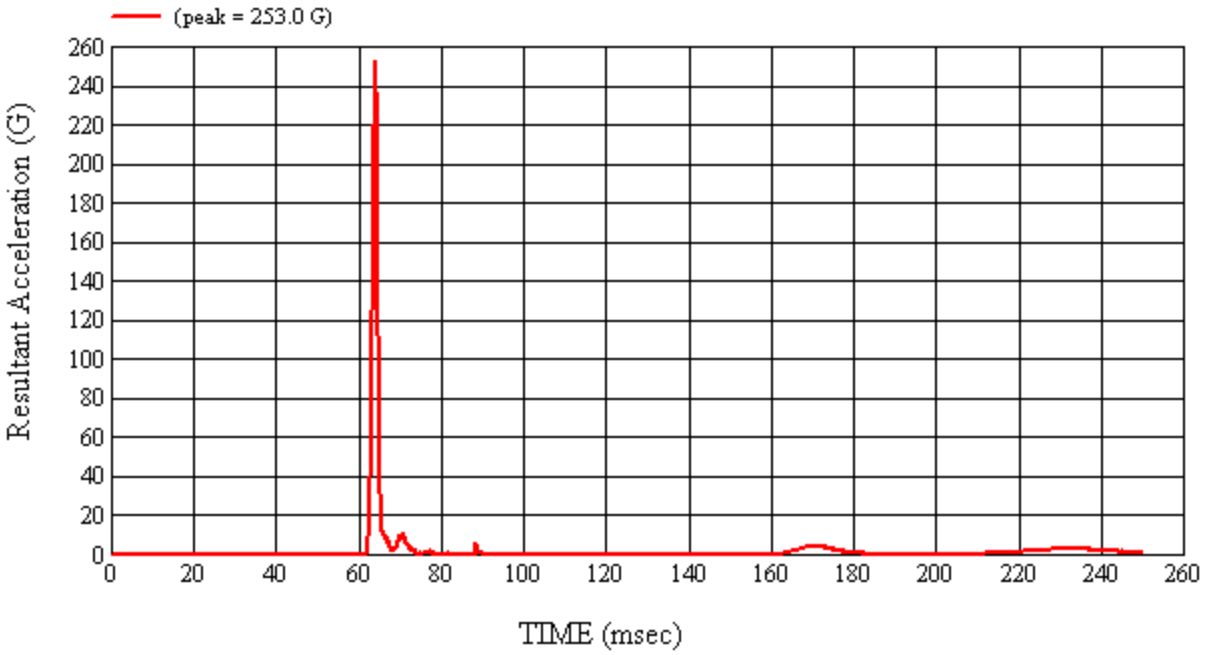
HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 5/4/2010 CALIBRATION TIME: 3:55:05 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	23.3
Relative Humidity	10% to 70%	40.9
Peak Resultant Acceleration	225 G's to 275 G's	253.0
Peak Lateral Acceleration	15 G's Maximum	9.7
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J35919	02/17/10	08/17/10
2	ENDEVCO	7264-2000	J22664	02/17/10	08/17/10
3	ENDEVCO	7264-2000	J35924	02/17/10	08/17/10

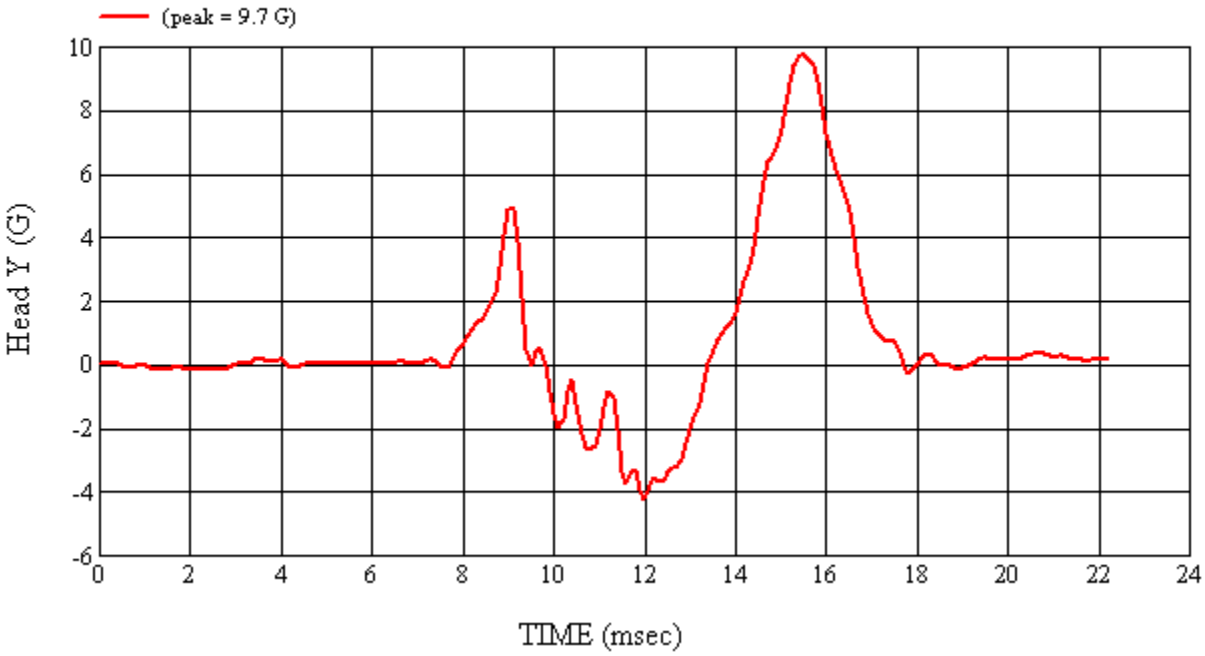
REMARKS:

RECORDED BY: _____ DATE: 5/4/2010

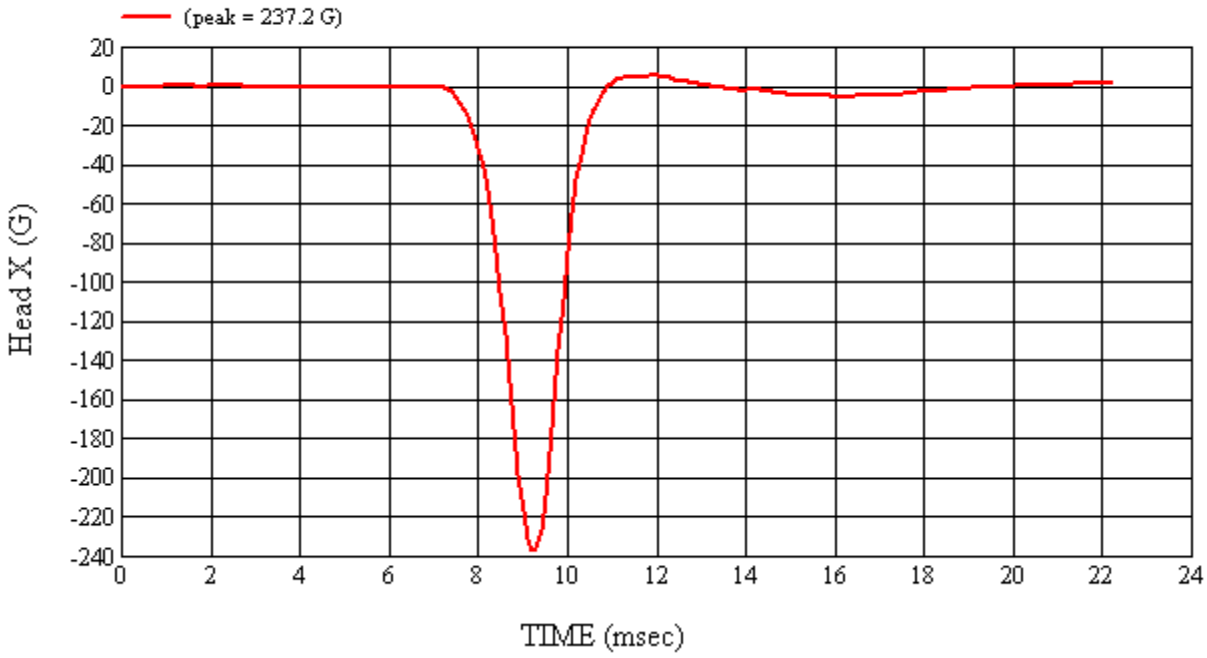
APPROVED BY: _____



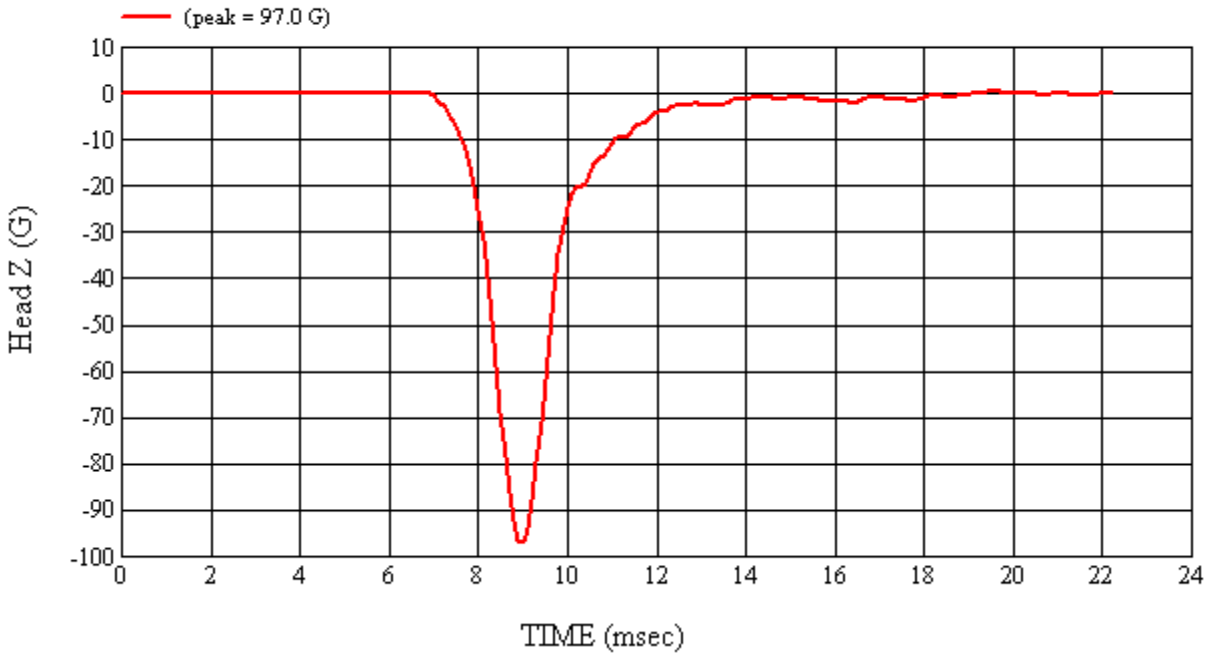
Head 035 (Pre) Calibration #H35014



Head 035 (Pre) Calibration #H35014



Head 035 (Pre) Calibration #H35014



Head 035 (Pre) Calibration #H35014

4-2 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

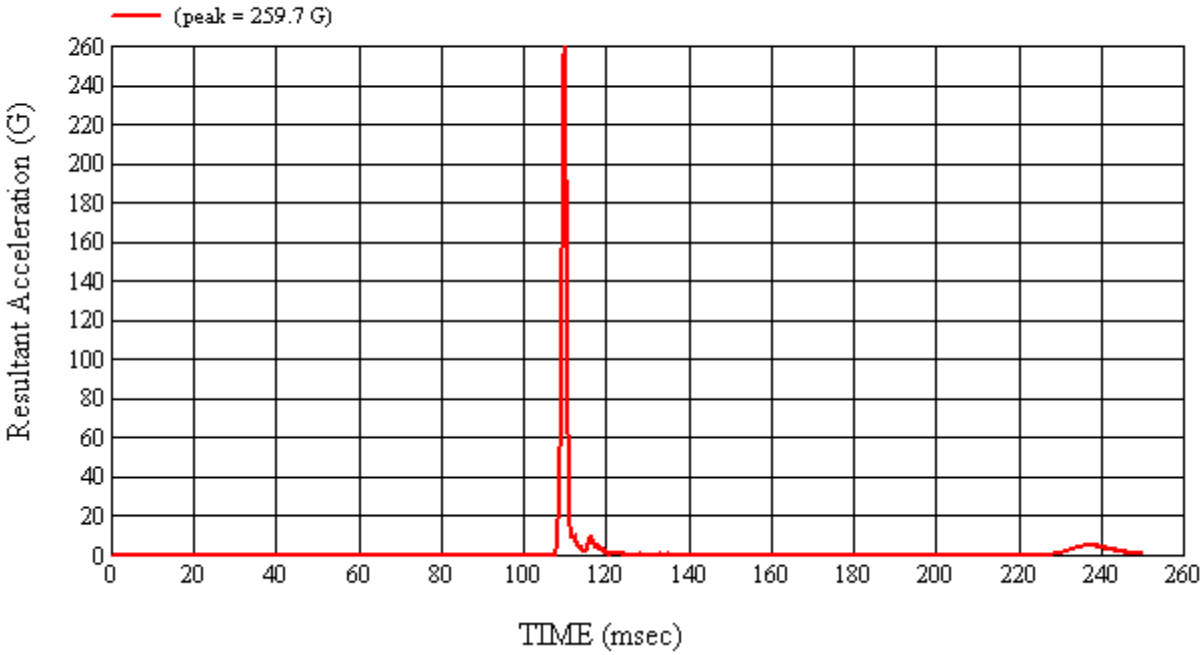
HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 5/7/2010 CALIBRATION TIME: 3:06:11 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.6
Relative Humidity	10% to 70%	44.9
Peak Resultant Acceleration	225 G's to 275 G's	259.7
Peak Lateral Acceleration	15 G's Maximum	9.6
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J35919	02/17/10	08/17/10
2	ENDEVCO	7264-2000	J22664	02/17/10	08/17/10
3	ENDEVCO	7264-2000	J35924	02/17/10	08/17/10

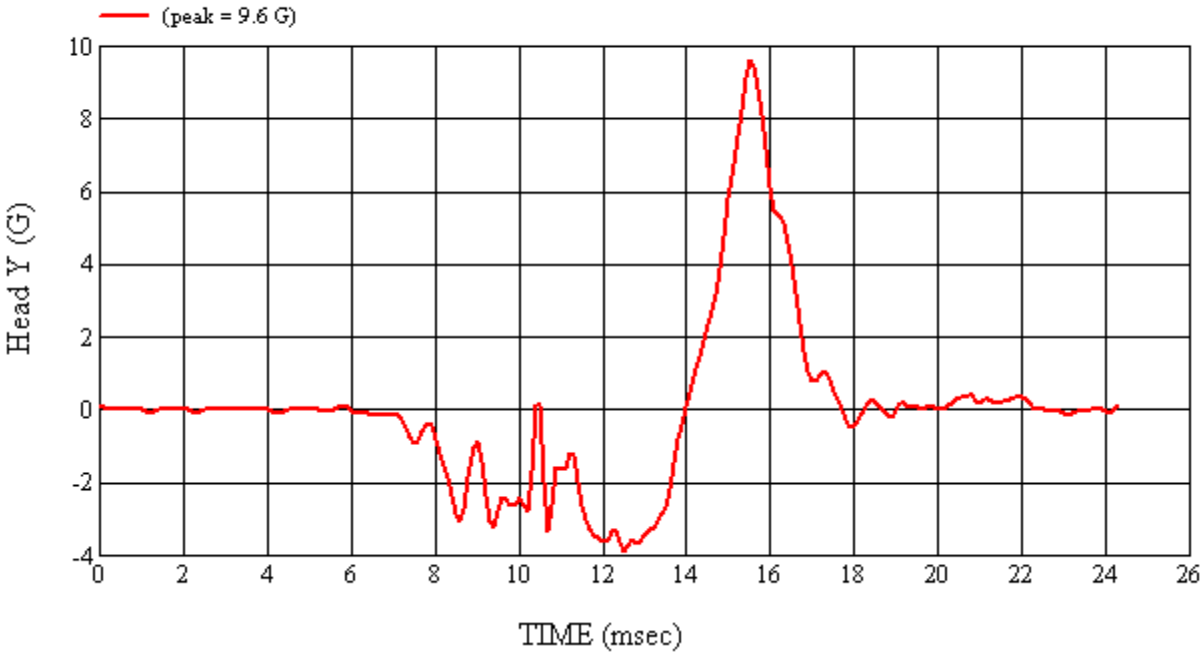
REMARKS:

RECORDED BY: _____ DATE: 5/7/2010

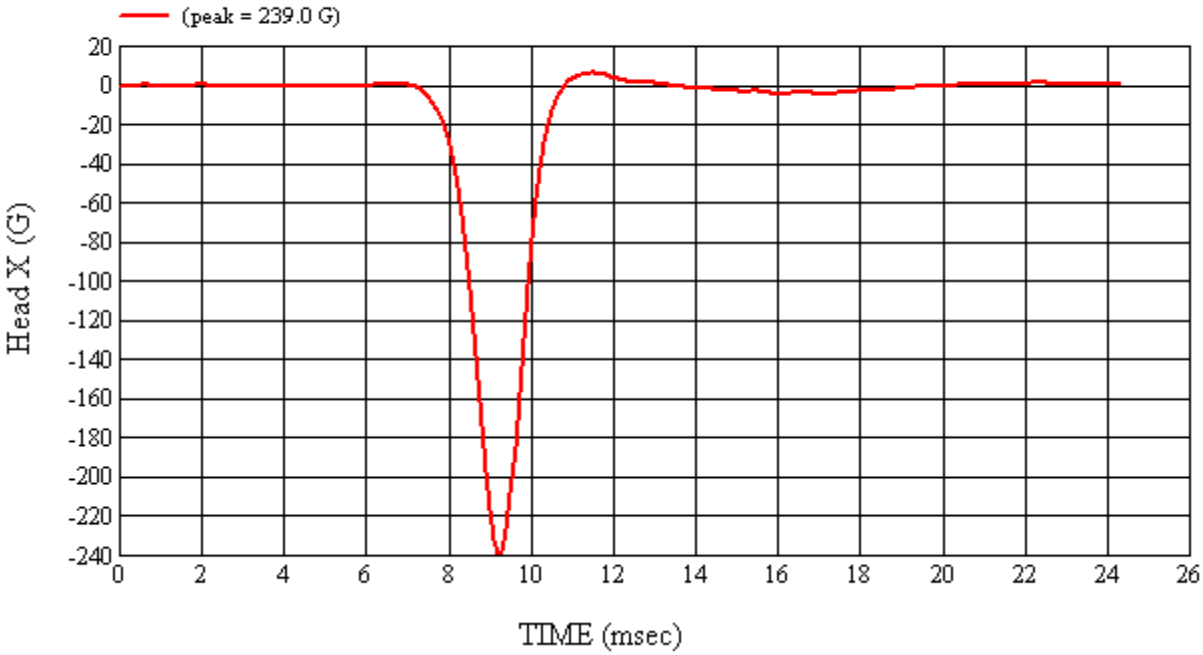
APPROVED BY: _____



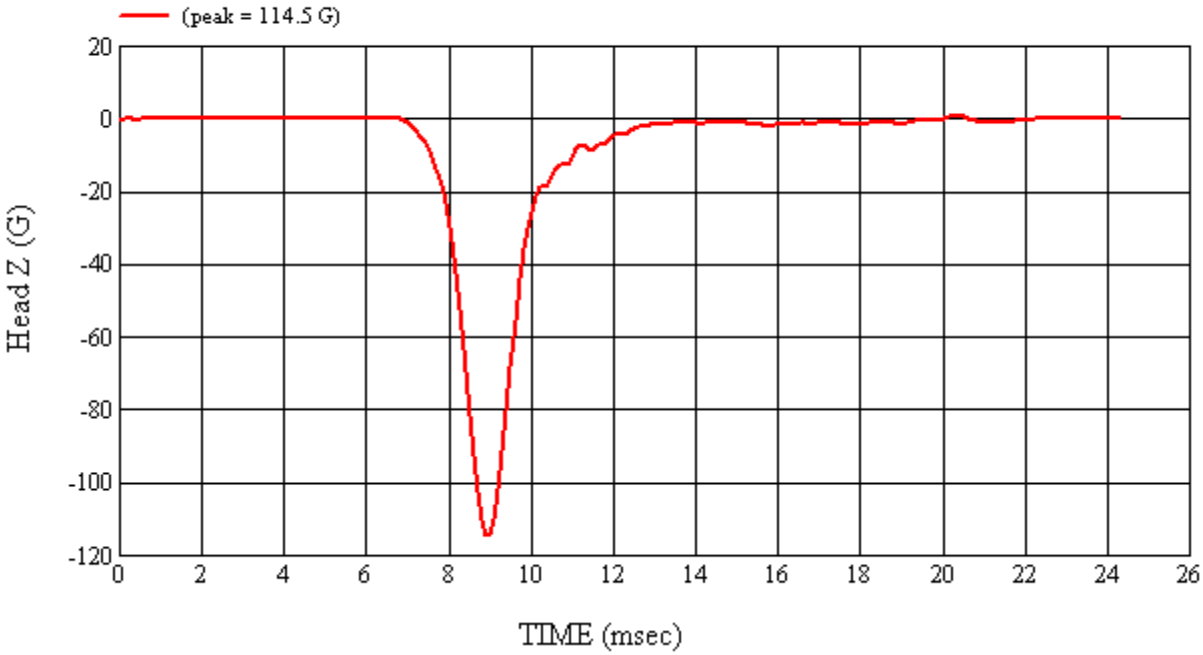
Head 035 (Post) Calibration #H35011



Head 035 (Post) Calibration #H35011



Head 035 (Post) Calibration #H35011



Head 035 (Post) Calibration #H35011

4-3 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

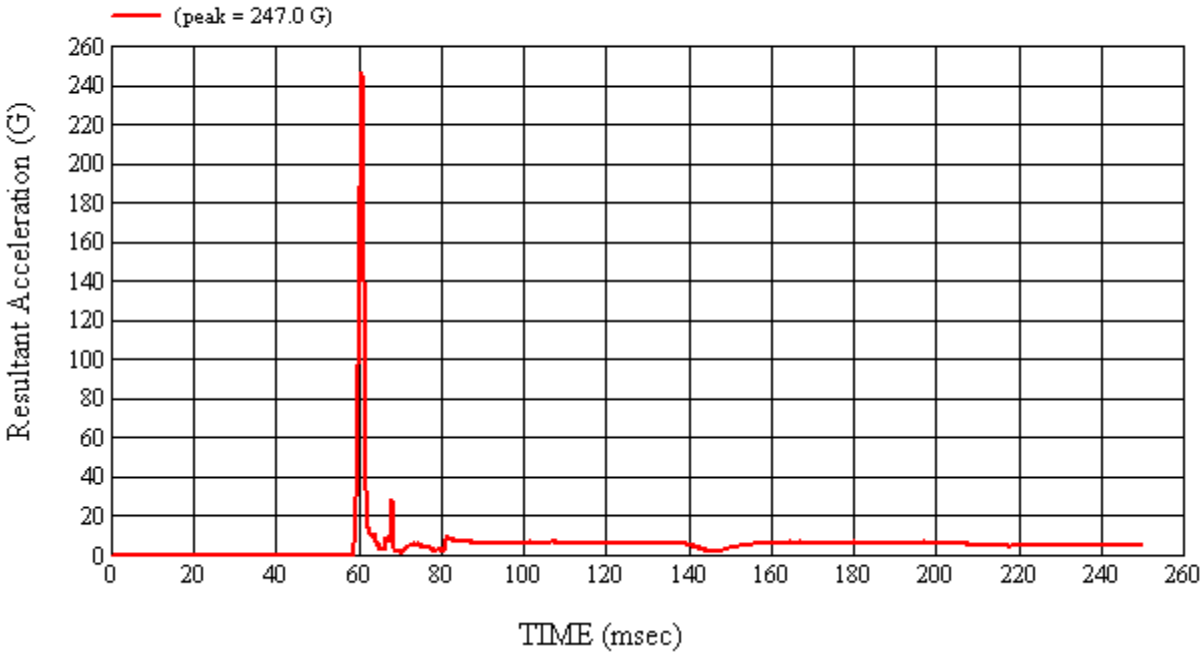
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 5/4/2010 CALIBRATION TIME: 3:25:11 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	23.2
Relative Humidity	10% to 70%	40.8
Peak Resultant Acceleration	225 G's to 275 G's	247.0
Peak Lateral Acceleration	15 G's Maximum	4.7
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	AHTB2	02/17/10	08/17/10
2	ENDEVCO	7264-2000	J14103	02/17/10	08/17/10
3	ENDEVCO	7264-2000	J35800	02/17/10	08/17/10

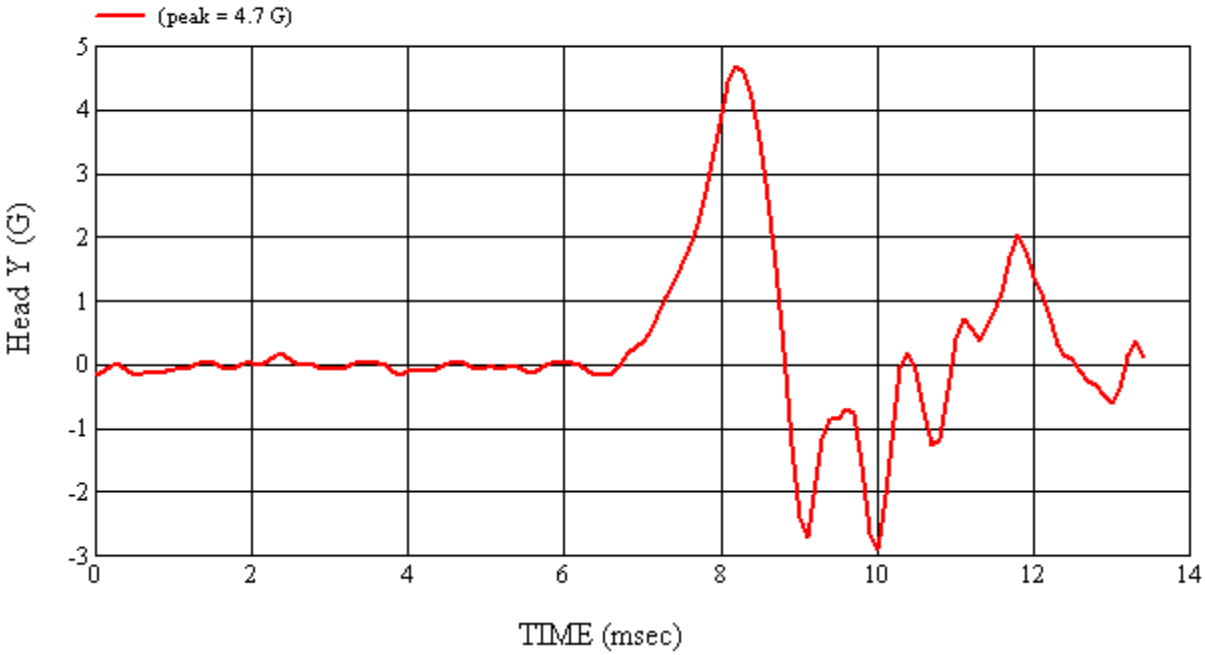
REMARKS:

RECORDED BY:  DATE: 5/4/2010

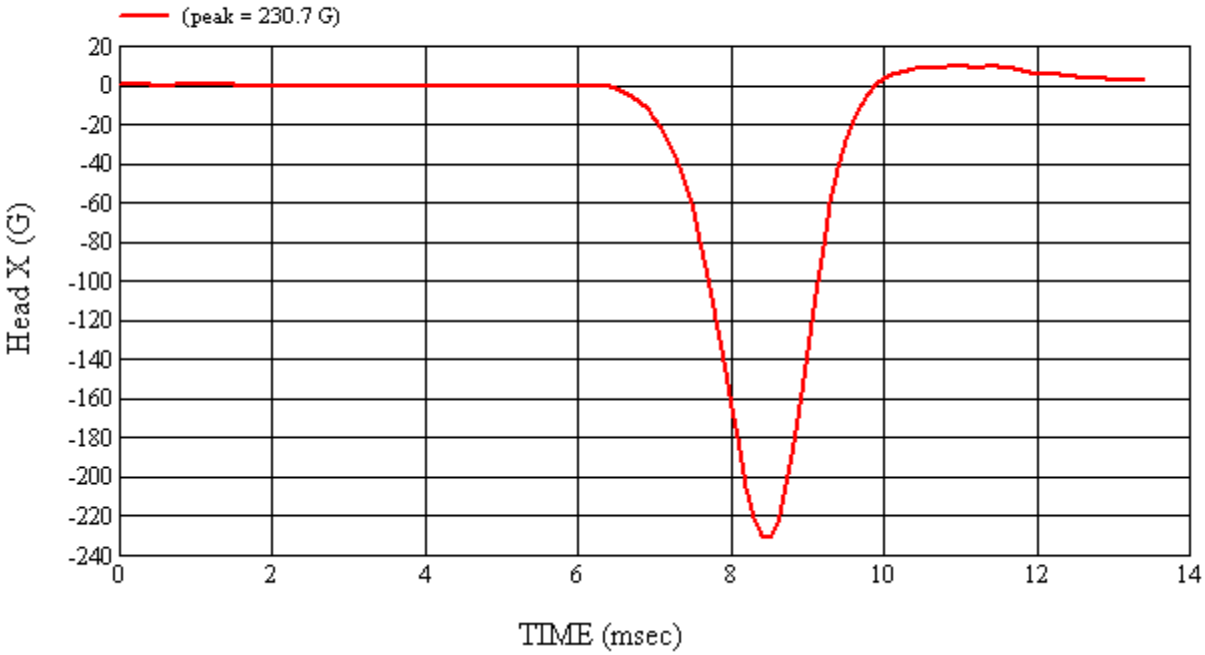
APPROVED BY: 



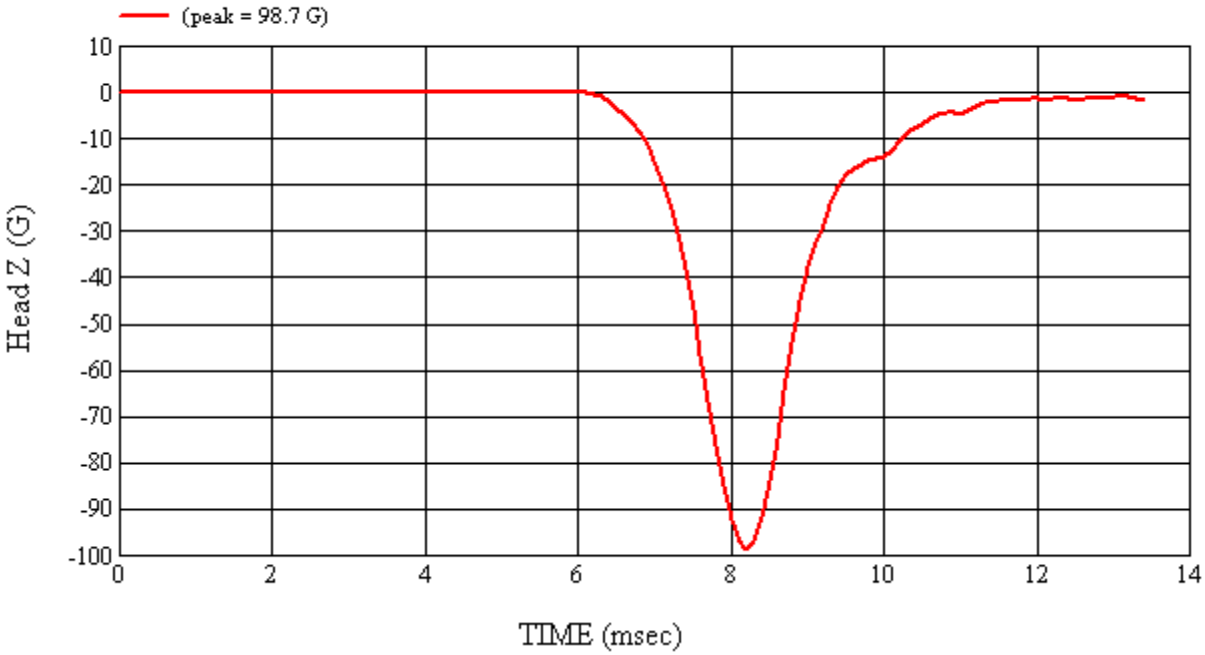
Head 037 (Pre) Calibration #H37014



Head 037 (Pre) Calibration #H37014



Head 037 (Pre) Calibration #H37014



Head 037 (Pre) Calibration #H37014

4-4 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

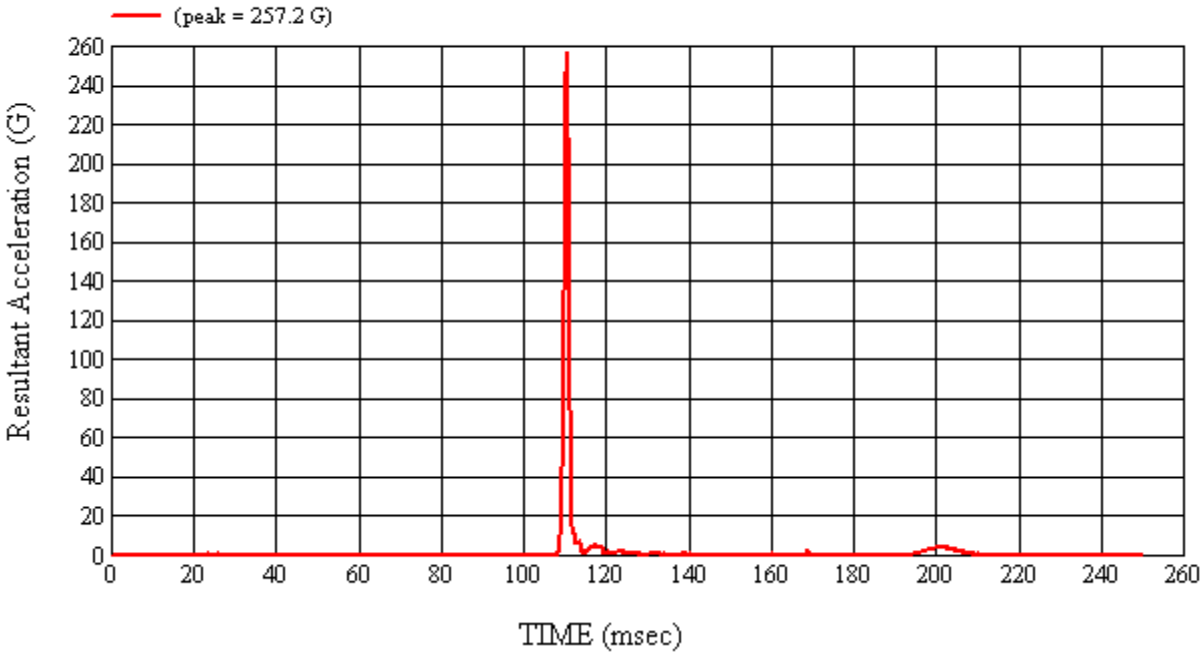
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 5/7/2010 CALIBRATION TIME: 3:19:46 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	22.5
Relative Humidity	10% to 70%	45.4
Peak Resultant Acceleration	225 G's to 275 G's	257.2
Peak Lateral Acceleration	15 G's Maximum	2.3
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	AHTB2	02/17/10	08/17/10
2	ENDEVCO	7264-2000	J14103	02/17/10	08/17/10
3	ENDEVCO	7264-2000	J35800	02/17/10	08/17/10

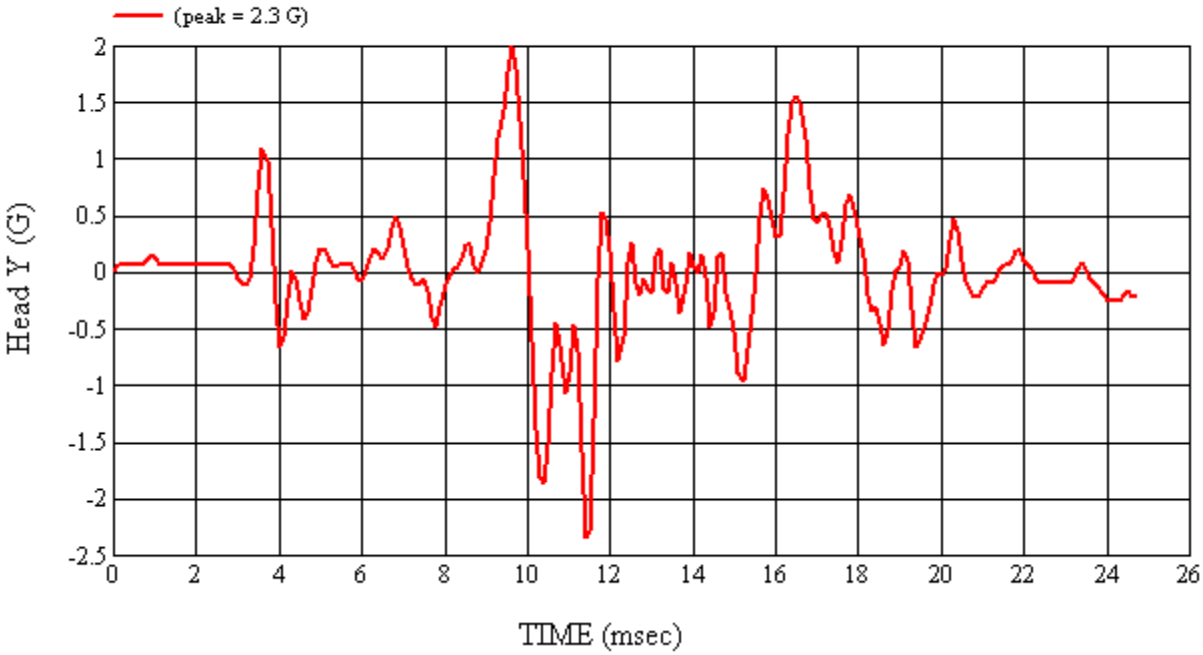
REMARKS:

RECORDED BY: _____ DATE: __5/7/2010____

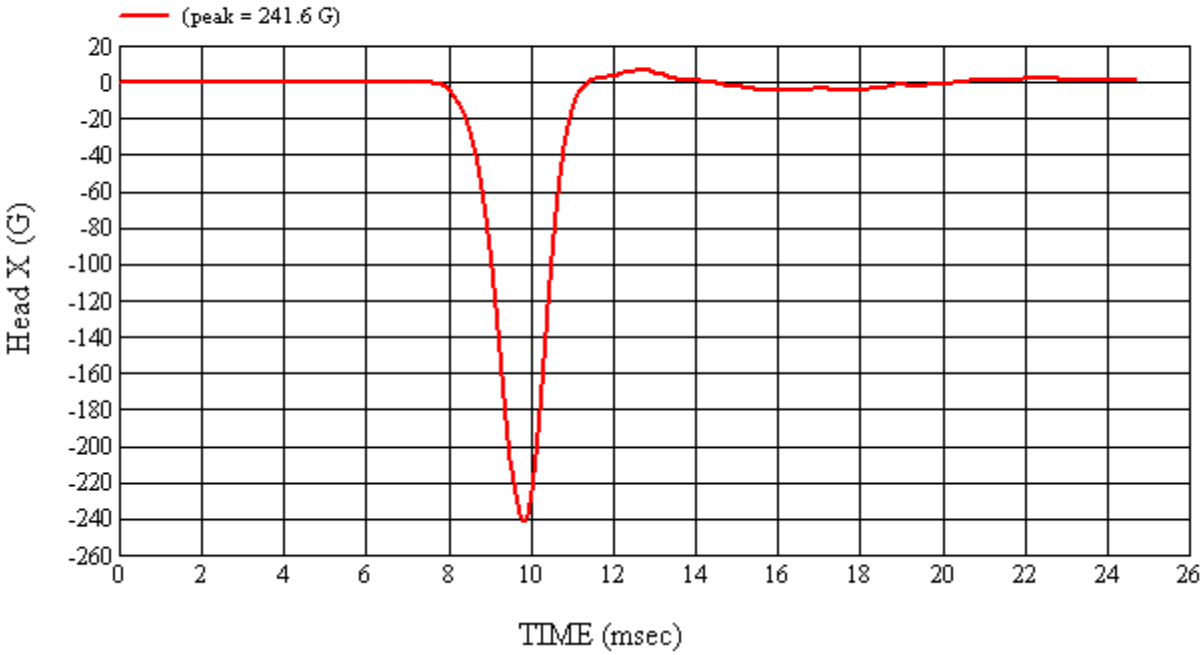
APPROVED BY: _____



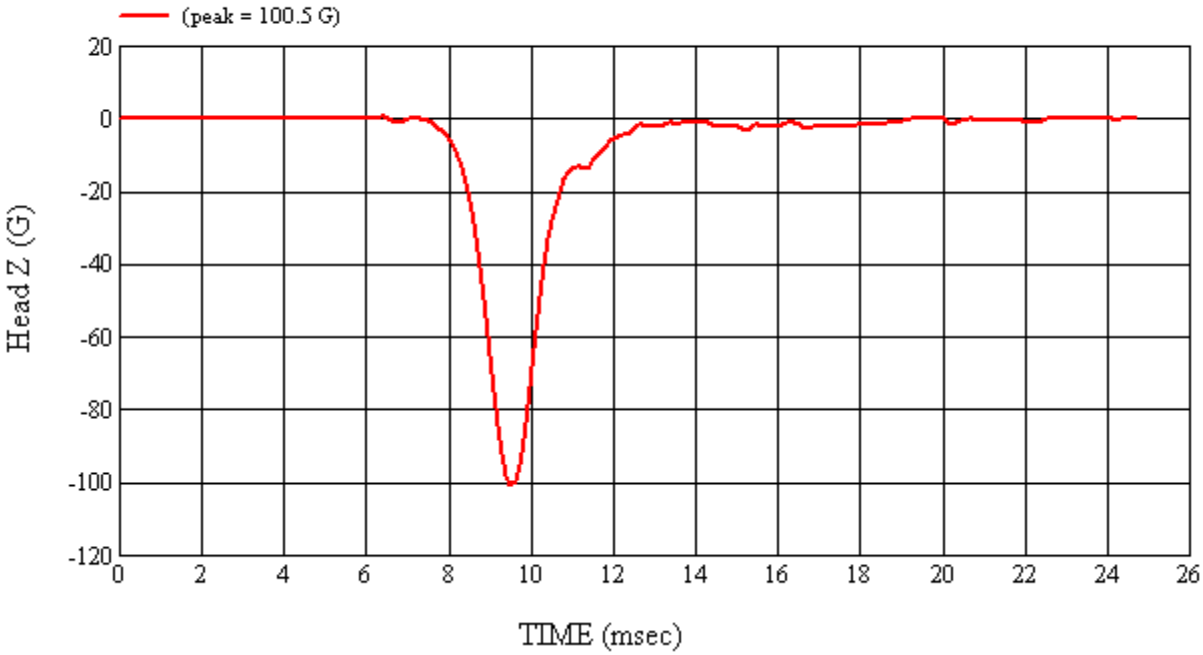
Head 037 (Post) Calibration #H37011



Head 037 (Post) Calibration #H37011



Head 037 (Post) Calibration #H37011



Head 037 (Post) Calibration #H37011

4-5 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

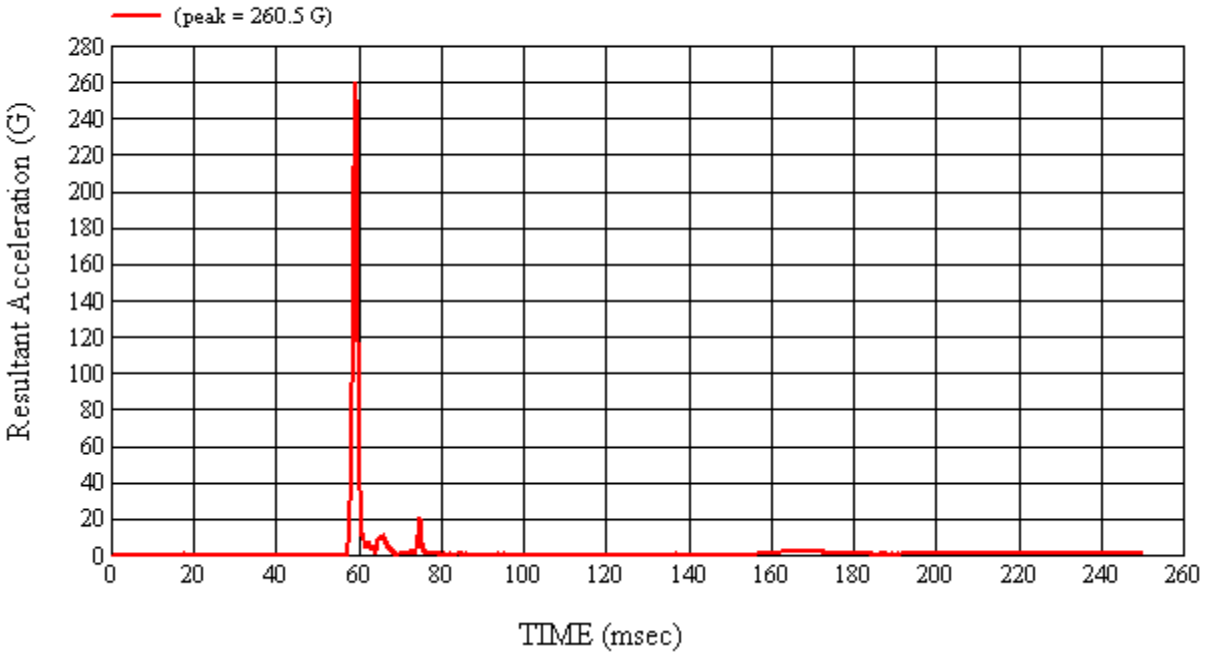
HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 5/4/2010 CALIBRATION TIME: 3:07:38 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	23.0
Relative Humidity	10% to 70%	41.2
Peak Resultant Acceleration	225 G's to 275 G's	260.5
Peak Lateral Acceleration	15 G's Maximum	14.0
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J22700	03/12/10	09/12/10
2	ENDEVCO	7264-2000	J36197	03/12/10	09/12/10
3	ENDEVCO	7264-2000	J36353	03/12/10	09/12/10

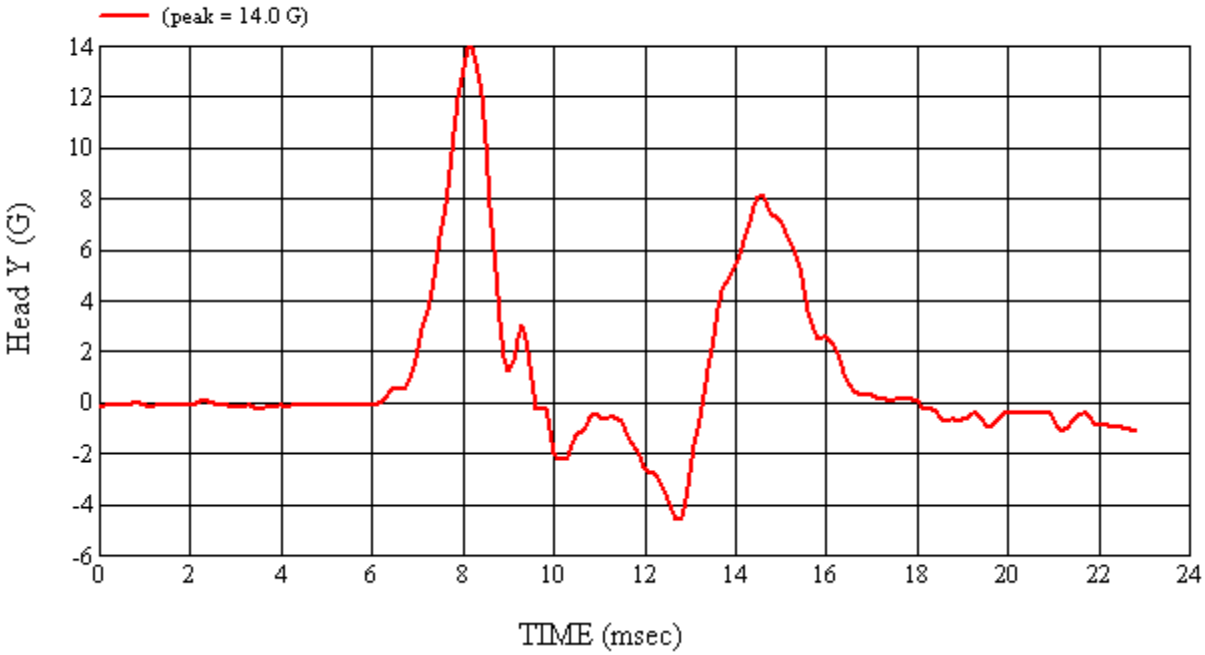
REMARKS:

RECORDED BY: _____ DATE: __5/4/2010____

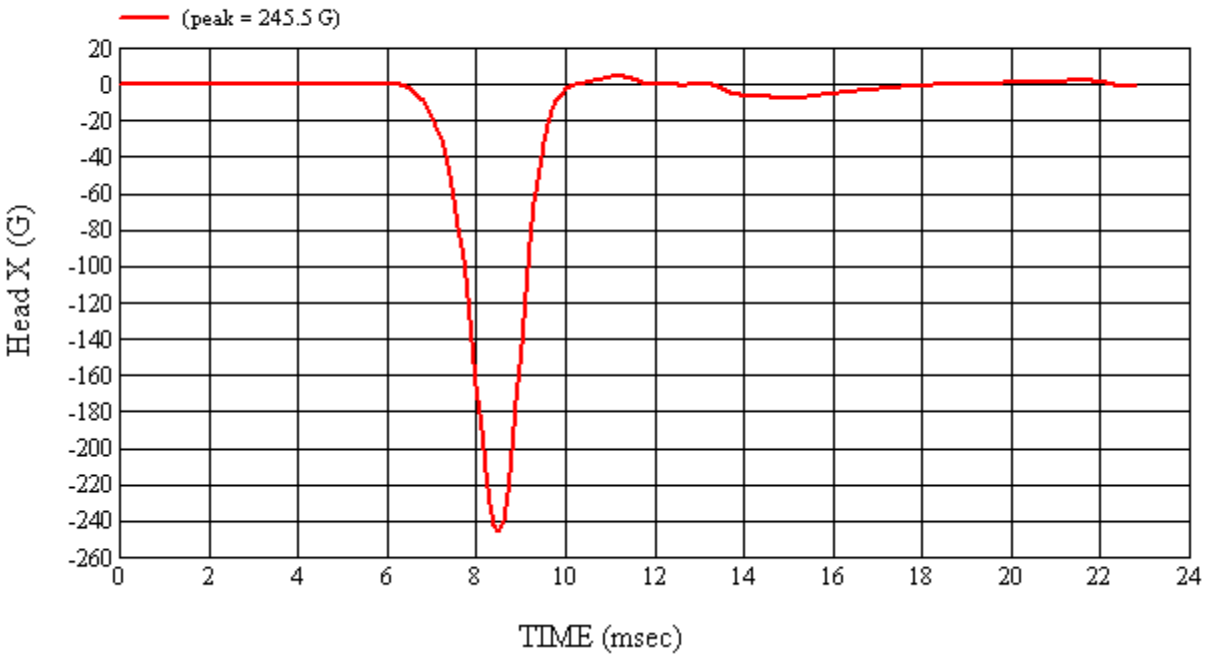
APPROVED BY: _____



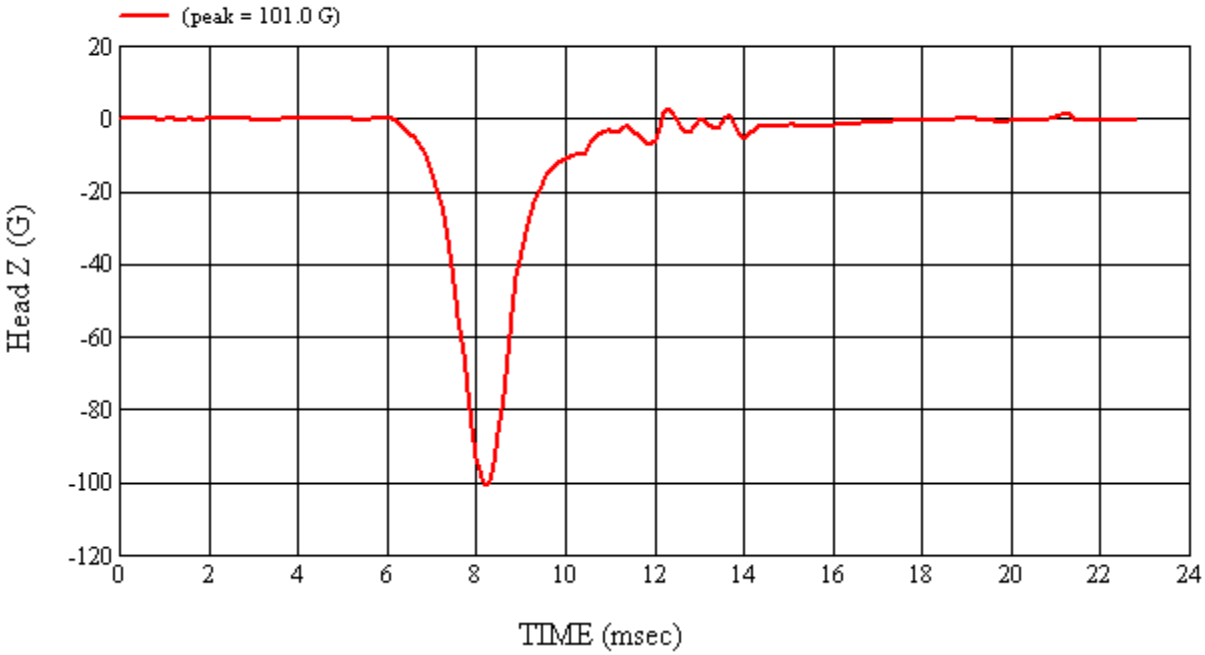
Head 038 (Pre) Calibration #H38013



Head 038 (Pre) Calibration #H38013



Head 038 (Pre) Calibration #H38013



Head 038 (Pre) Calibration #H38013

4-6 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 5/7/2010 CALIBRATION TIME: 3:48:25 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.5
Relative Humidity	10% to 70%	45.5
Peak Resultant Acceleration	225 G's to 275 G's	257.4
Peak Lateral Acceleration	15 G's Maximum	11.7
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION

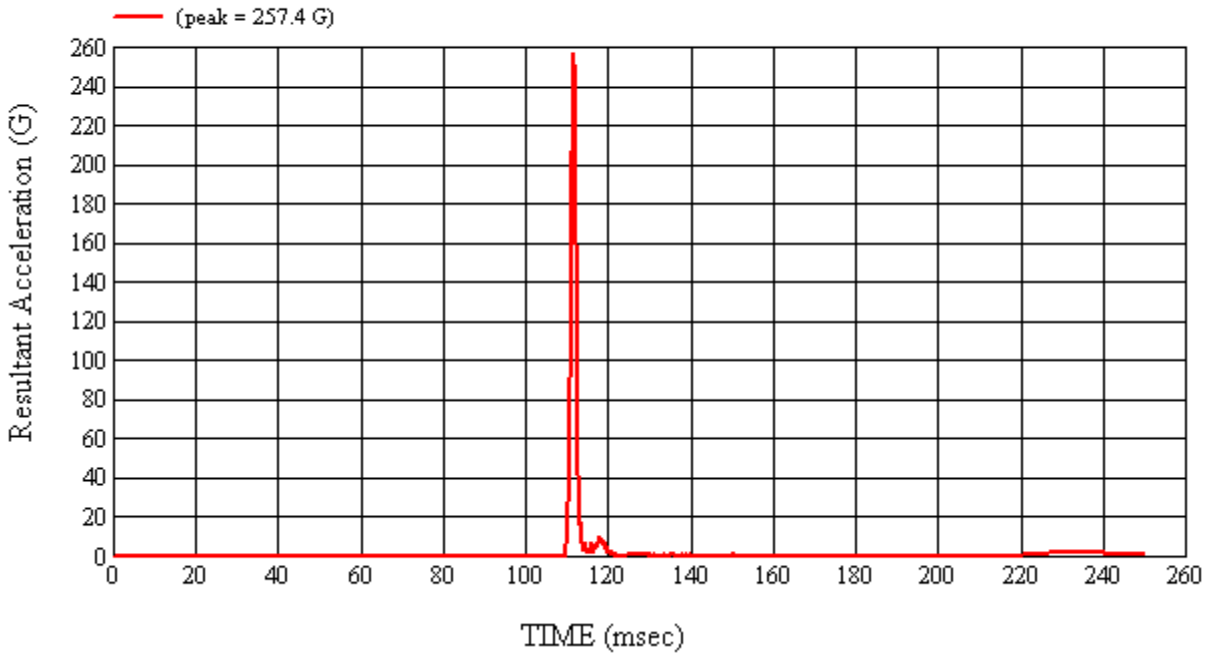
HEAD ACCELEROMETERS

Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22700	03/12/10	09/12/10
2	ENDEVCO	7264-2000	J36197	03/12/10	09/12/10
3	ENDEVCO	7264-2000	J36353	03/12/10	09/12/10

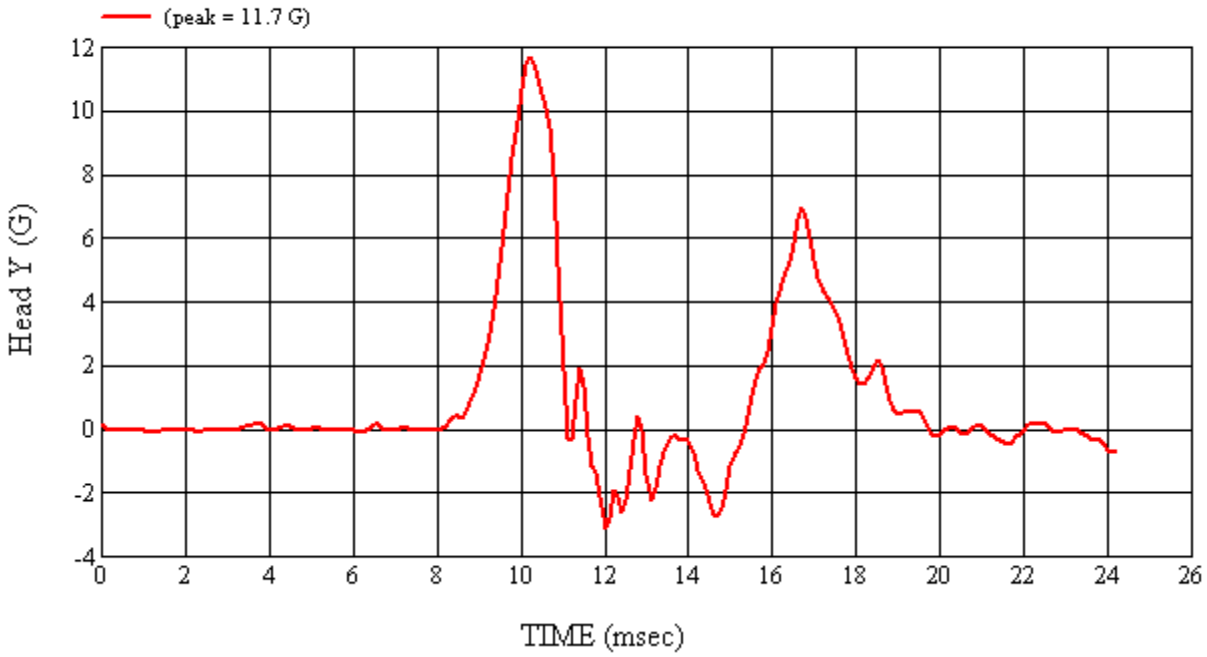
REMARKS:

RECORDED BY:  DATE: 5/7/2010

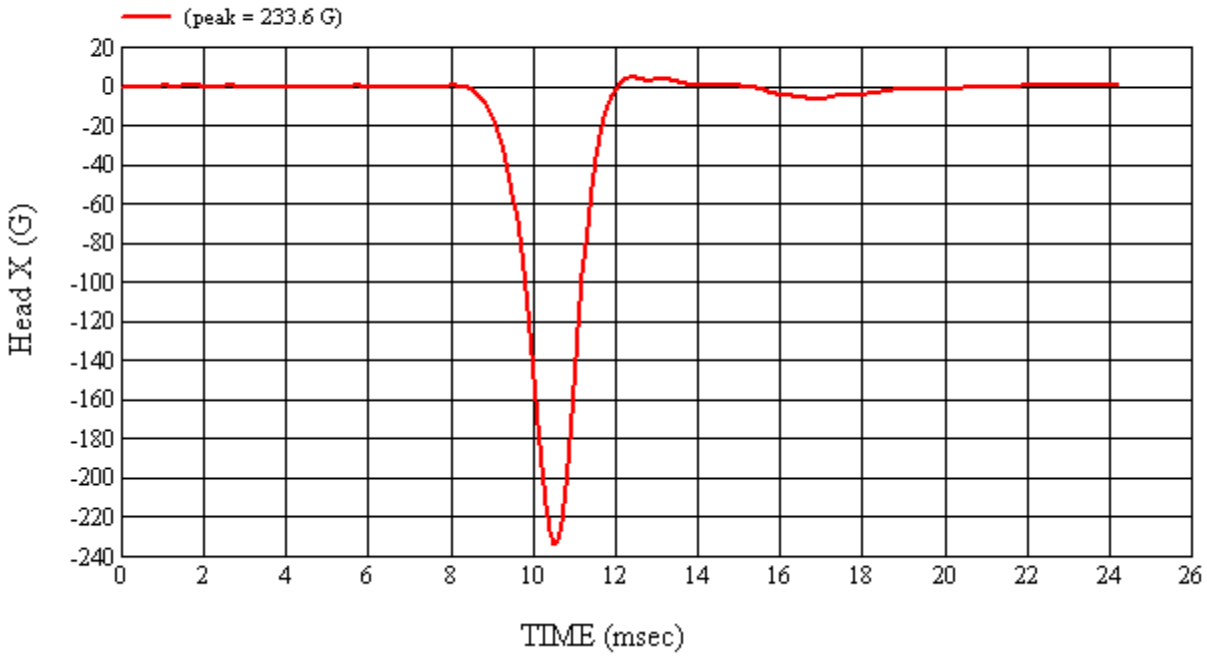
APPROVED BY: 



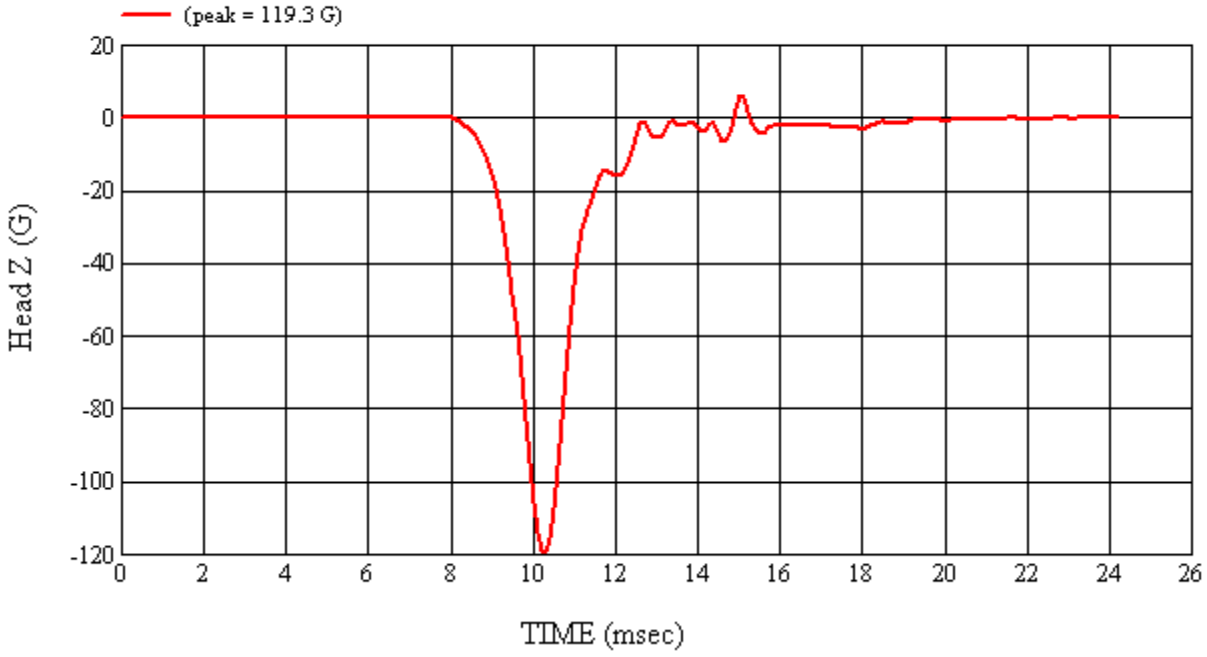
Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010

5.0 PHOTOGRAPHS

As Delivered – Left Side View

As Delivered – Right Side View

As Delivered – ¾ Front View From Left Side

As Delivered – ¾ Rear View From Right Side

As Delivered – Vehicle's Certification Label

As Delivered – Vehicle's Tire Information Label

Pre-Test Component Photographs


05/04/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Pre-Test Components
G10I7-001.8


05/04/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Pre-Test Components
G10I7-001.8


05/04/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Pre-Test Components
G10I7-001.8


05/04/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Pre-Test Components
G10I7-001.8

Post-Test Component Photographs


05/07/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Post-Test Components
G10I7-001.8


05/07/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Post-Test Components
G10I7-001.8

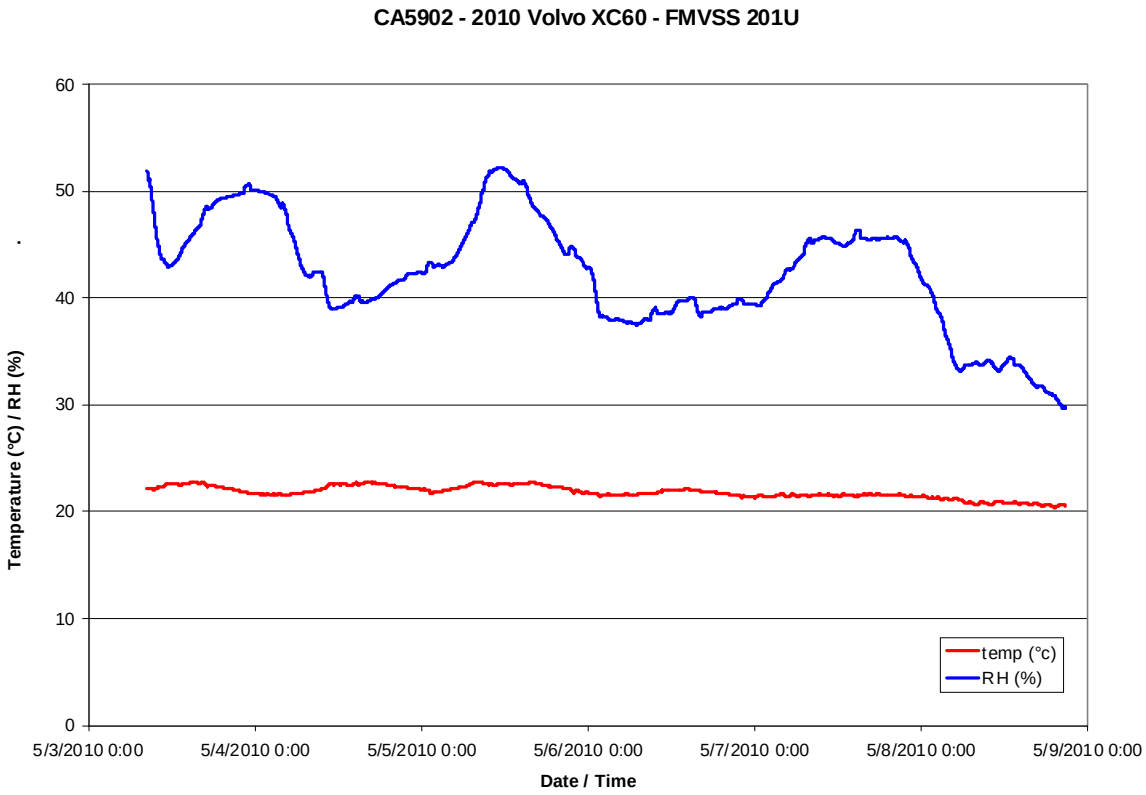

05/07/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Post-Test Components
G10I7-001.8


05/07/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Post-Test Components
G10I7-001.8


05/07/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Post-Test Components
G10I7-001.8


05/07/10
DOT/NHTSA
2010 Volvo XC60
FMVSS 201U
CA5902
Post-Test Components
G10I7-001.8

Appendix A – Temperature Trace



Appendix B – Calibration Certificates

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35919
Capacity/Range: (G's)	2,000

Calibration Date:	2/17/2010
New DLR(Units:G'S) 100K SHUNT [1]	96.3
Linearity: [2]	0.99974
New vs Old Sensitivit (% Difference)	0.8
Temperature:	70 °F
Humidity:	25 %
Sensitivity (mV/V/G):	0.025792
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J22664
Capacity/Range: (G's)	2,000

Calibration Date:	2/17/2010
New DLR(Units:G'S) [1] 100K SHUNT	95.2
Linearity:[2]	0.99973
New vs Old Sensitivit (% Difference)	0.6
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.026097
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A. Kalista

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35924
Capacity/Range: (G's)	2,000

Calibration Date:	2/17/2010
New DLR(Units:G'S) [1] 100K SHUNT	93.8
Linearity:[2]	0.99915
New vs Old Sensitivit (% Difference)	-0.1
Temperature:	70 °F
Humidity:	25 %
Sensitivity (mV/V/G):	0.026486
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen Q. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	AHTB2
Capacity/Range: (G's)	2,000

Calibration Date:	2/17/2010
New DLR(Units:G'S) 100K SHUNT [1]	116.9
Linearity: [2]	0.99971
New vs Old Sensitivit (% Difference)	0.3
Temperature:	70 °F
Humidity:	25 %
Sensitivity (mV/V/G):	0.021276
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Steven A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J14103
Capacity/Range: (G's)	2,000

Calibration Date:	2/17/2010
New DLR(Units:G'S) 100K SHUNT [1]	94.2
Linearity: [2]	0.99963
New vs Old Sensitivit (% Difference)	0.2
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.026374
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Eileen A. Kalista

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35800
Capacity/Range: (G's)	2,000

Calibration Date:	2/17/2010
New DLR(Units:G'S) [1] 100K SHUNT	98.2
Linearity:[2]	0.99961
New vs Old Sensitivit (% Difference)	0.4
Temperature:	70 °F
Humidity:	25 %
Sensitivity (mV/V/G):	0.02528
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J22700
Capacity/Range: (G's)	2,000

Calibration Date:	3/12/2010
New DLR(Units:G'S) 100K SHUNT [1]	96.5
Linearity: [2]	0.99962
New vs Old Sensitivit (% Difference)	0.7
Temperature:	69 °F
Humidity:	46.9
Sensitivity (mV/V/G):	0.025769
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Helen A. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J36197
Capacity/Range: (G's)	2,000

Calibration Date:	3/12/2010
New DLR(Units:G'S) 100K SHUNT [1]	109.5
Linearity: [2]	0.99976
New vs Old Sensitivit (% Difference)	0.5
Temperature:	69 °F
Humidity:	46.9
Sensitivity (mV/V/G):	0.022699
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	8/21/2009
Calibrated By:	Schober

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J36353
Capacity/Range: (G's)	2,000

Calibration Date:	3/12/2010
New DLR(Units:G'S) 100K SHUNT [1]	99.5
Linearity: [2]	0.99945
New vs Old Sensitivit (% Difference)	0.6
Temperature:	69 °F
Humidity:	46.9
Sensitivity (mV/V/G):	0.024972
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

Certificate of Calibration

Schober Calibration Service, Inc.
28265 Beck Road, Unit C-22
Wixom, MI 48393
Phone: (248) 735-9600 FAX: (248) 735-9646

ACCREDITED
CALIBRATION 1563.01

Certificate Number: 0002580:1249117013

CUSTOMER: MGA Research Corporation
446 Executive Drive
Troy MI 48083
Contact: Thomas Hutter

Calibration Location: **In House**

Equipment Calibrated

Manufacturer:	PCB	Date Received:	07/31/2009
Description:	Accelerometer	Date Calibrated:	08/01/2009
Model Number:	352C03	Calibration Due Date:	08/01/2010
Serial Number:	95980	Calibration Procedure:	CP0003
Asset Number:		Revision:	
Received Status:	Good	Performed By:	Al Schober

Condition as Received: In Tolerance
Condition as Returned: In Tolerance

Notes:

Ambient Calibration Conditions

Ambient Temperature: 22 °C Relative Humidity: 51 % RH Barometric Pressure: mbar

Calibration Equipment Used

Asset Number:	Manufacturer:	Model:	Serial:	Cal Due:
RMS002	PCB	301A03	254	12 Jun 2010
RMS003	PCB	353B04	37067	09 Jun 2010
RMS005	Beran	801A	9506	18 Mar 2010
RMS006	Beran	801B	9701	18 Mar 2010
RMS007	Beran	475	182340	18 Mar 2010

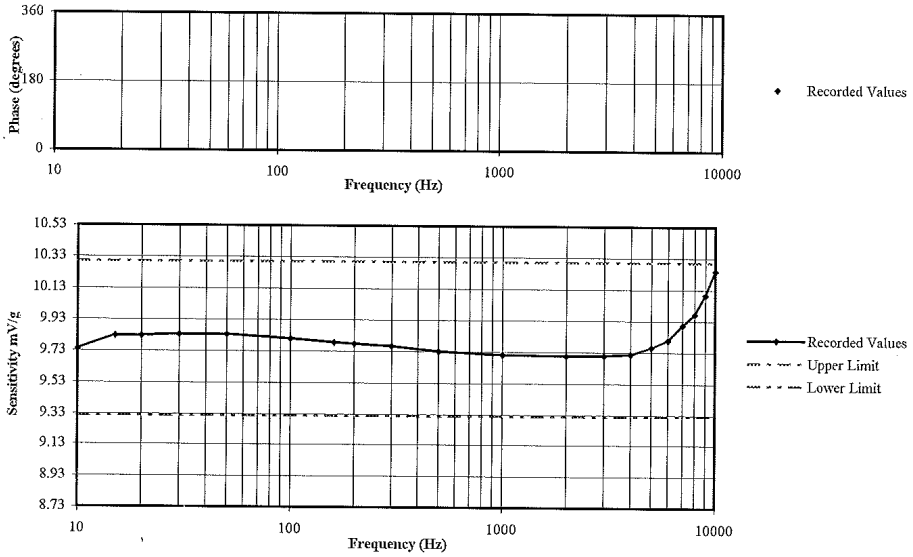
The Uncertainty is estimated using expanded uncertainties and coverage factor (k) of 2, providing a confidence level of approximately 95%.
This calibration is traceable to the international system of units (SI) through standards calibrated by accredited laboratories, or through standards calibrated at NIST. This laboratory meets the requirements of ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994. This certificate shall not be reproduced, except in full, without prior written approval by Schober Calibration Service.
Calibration interval determined by the customer. When determining the calibration interval, the customer should take into consideration that any number of factors may cause the calibration item to drift out of calibration before the calibration interval has expired.
The results herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

Approved By: Quality Manager Date: 8-21-09

Serial Number: 95980 **Date: 8/1/09**

Specifications: Nominal Sensitivity: 10mV/g±5%
Frequency Reponse: 10 to 10000Hz ±5%

Results: Measured Nominal Sensitivity: 9.812 mV/g at 100 Hz 1 g Peak
Test Profile: 10Hz - 10000Hz



Frequency Hz	Sensitivity mV/g	Phase Deg	Frequency Hz	Sensitivity mV/g	Phase Deg	Frequency Hz	Sensitivity mV/g	Phase Deg
10	9.74	-178.3°	300	9.76	-179.0°	7000	9.90	-178.9°
15	9.83	-178.5°	500	9.73	-179.1°	8000	9.97	-178.9°
20[1]	9.83	-178.7°	1000	9.71	-179.0°	9000	10.09	-178.9°
30	9.84	-178.8°	2000	9.70	-179.0°	10000	10.25	-179.0°
50	9.84	-179.0°	3000	9.71	-178.9°	0	0.00	0.0°
100	9.81	-179.0°	4000	9.72	-178.9°	0	0.00	0.0°
160[1]	9.79	-179.0°	5000	9.76	-179.1°	0	0.00	0.0°
200[1]	9.78	-179.0°	6000[1]	9.81	-179.0°	0	0.00	0.0°

[1] These frequencies are not traceable to NIST.

* These measurements are not within manufacturers stated specifications.

Calibration Certificate

Part Description: Silver **Certification Date:** 10/1/2009 (MMDDYYYY) **Serial#:** S08-05-98-01273

Single Point - (Max-Min)/2 Specification: S08-05 .076mm (.0030") **Certificate#:** S0127340087

Volumetric (Max Deviation) Specification: S08-05 +/-.108mm (+/-.0042") **Temperature:** See attached data

Measurement Standards Traceability

Ball Bar Kit	Asset Number: 1039	Calibration Due: 1/1/2010	*SI Traceability: METAS-L20081128MG1
Thermometer	Asset Number: TQ023	Calibration Due: 12/30/2009	*SI Traceability: NVLAP-A8C22083-1
Reference Sphere	Asset Number: TQ1176	Calibration Due: 5/21/2010	*SI Traceability: NIST-821/270114-04

The artifacts above have been calibrated with a device traceable to the International System of Units (SI) through a National Metrological Institute (NMI) or through an ISO17025 Accredited Laboratory.
Measurement uncertainty is 3.9 + 5.9X micrometers, where X = length in meters.
Uncertainty is expressed at approximately a 95% Level of Confidence using k=2.00.

Calibration Results*

3 Single Point Articulation Tests at <=20%, 20%-80% and >=80% range.	PASSED
1 Effective diameter sphere test.	PASSED
20 Volumetric ball bar tests in 4 quadrants and 2 orientations.	PASSED

*Calibration conforms to procedures developed in accordance with ASME B89.4.22-2004. See attached data for measurement results.

Instrument condition as received: Inoperative

Instrument condition outgoing: Within specifications

Technician: Harry Van Horn Date: 10/1/09

FARO Technologies, Inc.
PH1:1-800-736-2771
PH2:407-333-9911
FAX:407-333-8056
L-A-B Cert Number:L1147-1

125 Technology Park
Lake Mary, FL 32746
USA

10/15/09

FARO®

LABORATORY ACCREDITATION BUREAU
ISO/IEC 17025 Accredited

MetroCal Inc.

ACCREDITED
CALIBRATION CERT #0513.01

4700 Barden Court SE, Kentwood MI 49512, Telephone: 616-698-3124, Fax: 616-698-2364, www.metrocal.com

Certificate of Calibration

MGA Research
446 Executive Drive
Troy, MI 48083

Order Number: **67210**
Certificate Number: **100216801**
Page: **1 of 1**

Gauge Number: **MGA00048**
Gauge Desc: **Digital Protractor**
Manufacturer: **Mitutoyo**
Model Number: **Pro 360**
Serial Number: **N/A**

Customer PO: **N/A**
Last Calibration: **12/12/08**
Calibration Date: **2/16/10**
Next Calibration: **2/16/11**

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 Procedure 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 ID# 24281	1/4/10	1/4/11	Cert# 100104801	0.0015°
DoAll Sine Bar ID#1879	1/21/10	1/21/11	Cert# 100121125	0.0015°

Results:

As Found Readings

Units	Nominal	Actual	Deviation
Decimal Deg.	5.00	5.1	0.10
	10.00	10.1	0.10
	20.00	20.0	0.00
Tolerance	30.00	30.1	0.10
± 0.1°	40.00	40.1	0.10

Reference Level Check: Within ± 0.1 degrees

As Left Readings

Nominal	Actual	Deviation
5.00	5.1	0.10
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

Comments: Environmental conditions during calibration: 68 °F, 40% RH.

Issued: 2/16/10

Shannon Shoemaker
Calibration Technician

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

@ 2/22/10

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: GEI
S/N: MGA 00067
Calibration Date: 1/23/09

Subject Tape Measure
Brand: GUSHAIE
S/N: TPM 928
Calibration Date: 5/26/09

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

If all differences are ± 1/32 of an inch (1 mm), then the tape measure is acceptable.
Pass X Fail ____ Maximum Difference = 0

Date: 5/26/09 Performed By: [signature]

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is ± 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.

Certificate of Calibration

Schober Calibration Service, Inc.
2550 Oakley Park Road, Suite #300
Walled Lake, MI 48390
Phone: (248) 926-6000 FAX: (248) 926-6006

ACCREDITED
CALIBRATION 1563.01

Certificate Number: 0001591:1244035380

CUSTOMER: MGA Research Corporation
446 Executive Drive
Troy MI 48083
Contact: Thomas Hutter

Calibration Location: **On-site**

Equipment Calibrated

Manufacturer:	Dickson	Date Received:	06/03/2009
Description:	Temp/Humidity Recorder	Date Calibrated:	06/03/2009
Model Number:	FH125	Calibration Due Date:	06/03/2010
Serial Number:	06163263	Calibration Procedure:	CP0001
Asset Number:	MGA00152	Revision:	
Received Status:	Good	Performed By:	P. Vella

Condition as Received: In Tolerance
Condition as Returned: In Tolerance

Notes:

Ambient Calibration Conditions

Ambient Temperature: 23 °C Relative Humidity: 45 % RH Barometric Pressure: mbar

Calibration Equipment Used

Asset Number:	Manufacturer:	Model:	Serial:	Cal Due:
RMS042	Fluke/Hart	1502A	A6C537	24 Apr 2010
RMS043	Hart Scientific	5614	778109	24 Apr 2010
RMS045	Vaisala	HMP76	C0630009	27 Mar 2010

The Uncertainty is estimated using expanded uncertainties and coverage factor (k) of 2, providing a confidence level of approximately 95%.
This calibration is traceable to the international system of units (SI) through standards calibrated by accredited laboratories, or through standards calibrated at NIST. This laboratory meets the requirements of ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994. This certificate shall not be reproduced, except in full, without prior written approval by Schober Calibration Service.
Calibration interval determined by the customer. When determining the calibration interval, the customer should take into consideration that any number of factors may cause the calibration item to drift out of calibration before the calibration interval has expired.
The results herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

Approved By: Quality Manager Date: 7-29-09

7/29/09

Calibration Data

MFG/MODEL: **Dickson / FH125**

Serial / ID #: **06163263 / MGA00152**

Customer: **MGA Research**

Date Calibrated: **06/03/09**

Certificate No.: **0001591:1244035380**

All calculations and data transfers have been reviewed for accuracy and completeness

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit
Data Logger with Sensor System Tests					
Channel 1					
	-22.8° C	-23.8° C	-23.2° C	-23.2° C	-21.8° C
	23.8° C	22.8° C	24.0° C	24.0° C	24.8° C
	39.6° C	38.6° C	38.8° C	38.8° C	40.6° C
Channel 2 (RH @ 21° C)					
	41.4 %rh	39.4 %rh	42.8 %rh	42.8 %rh	43.4 %rh
	72.4 %rh	70.4 %rh	74.1 %rh	74.1 %rh	74.4 %rh
Calibration Performed By: P. Vella					

Bold Font Indicates Out Of Tolerance Condition.

Temperature Measurement Standard Uncertainty U_{temp}= 0.65°C

Relative Humidity Measurement Standard Uncertainty U_{rh}= 2.22%

MetroCal Inc.
ACCREDITED
CALIBRATION CERT #0513.01
4700 Barden Court SE, Kentwood MI 49512, Telephone: 616-698-3124, Fax: 616-698-2364, www.metrocal.com

Certificate of Calibration

MGA Research
446 Executive Drive
Troy, MI 48083

Order Number: **65274**
Certificate Number: **090814711**
Page: **1 of 1**

Gauge Number: **MGA00783**
Gauge Desc: **0 to 20 lb. X .01 lb. Digital Scale**
Manufacturer: **Detecto**
Model Number: **AP-20**
Serial Number: **E10807-0187**

Customer PO: **A071735**
Last Calibration: **7/24/08**
Calibration Date: **8/14/09**
Next Calibration: **8/14/10**

As Found Condition: **See Results**

As Left Condition: **See Results**

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 Procedure CP042 and relevant sections of the manufacturer's manual. This calibration complies with ISO/IEC 17025 and ANSI/NCSL Z540-1 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)
Weight Set ID# 2463	9/3/08	9/3/10	MI-07-07-8945	+/-0.001% of Load

Results:
Tolerance used: Class III

Units: lbs **TI Division/Increment:** .01 lb.

	As Found				As Left		
Weight Test	**Nominal**	**Indication**	**Deviation**		**Nominal**	**Indication**	**Deviation**
0-25% fs	5.00	5.01	0.01		5.00	5.01	0.01
26-50% fs	10.00	10.02	0.02		10.00	10.02	0.02
51-75% fs	15.00	15.02	0.02		15.00	15.02	0.02
76-100% fs	20.00	20.03	0.03		20.00	20.03	0.03
Shift Test:	Pass			**Shift Test:**	Pass		
Half Load Test:	Pass			**Half Load Test:**	Pass		

Comments: Environmental conditions during calibration: 68 °F, 40 % RH.

Bill Rinzema
Calibration Technician

Issued: 8/17/09

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

@ 8/18/09

Sterling Scale Co., Inc.
20950 Boening St.
Southfield, MI 48075

Certificate of Calibration

F410/12-3
Rev. Date 11/23/05

calibration cert. 1448.01

Customer: M G A ***Cert#*** 09-5841 ***Temp/Humidity:*** 75/35
Location of Calibration: 2839 Elliott Troy, MI 48083
Calibration Date: 7/27/2009 ***Cal Due:*** Jul-10 ***Condition of Item:*** fair
Equipment Make: Intercomp ***Model:*** SWD-Deluxe ***Serial/ID:*** 26032389 ***Capacity:*** 2200lb x 1lb

Applied Test Wt	*Before Adus*	*Tolerance*	*In-Tolerance Y/N*	*After Adjustment*	*In-Tolerance Y/N*	*Unc*
RF 100lb	100lb	1lb	y	100lb	y	.11lb
2000lb	2000lb	2lb	y	2000lb	y	.5lb
LF 100lb	100lb	1lb	y	100lb	y	.11lb
2000lb	2000lb	2lb	y	2000lb	y	.5lb
RR 100lb	100lb	1lb	y	100lb	y	.11lb
2000lb	2000lb	2lb	y	2000lb	y	.5lb
LR 100lb	100lb	1lb	y	100lb	y	.11lb
2000lb	2000lb	2lb	y	2000lb	y	.5lb

shift test
N/A

Platform # Platform #2 Platform #3

☐ Pass ☐ Pass ☐ Pass

☐ Fail ☐ Fail ☐ Fail

Tests performed: ☑ Repeat ☑ Linearit ☐ Sensitivity ☑ Discrimination

Technician COMMENTS/ weights used
Scale pass all test perform on it
Scale have stable zero & weight reading.
Our test weights are on file.

☑ Scale Certified ☐ Scale Rejected

Sterling Scale Service Rep Wayne **Date:** **7/27/2009** 1 of 1

The above item has been calibrated using the relevant EPO or OEM procedures utilizing test weights
Traceable to International Systems of Units (SI), through the Michigan Department of Agriculture.
Test numbers on file. Expanded uncertainty(k=2) confidence level of 95% as reported.
Results relate only to items listed.
The reported uncertainty is valid only for the environment in which it is determined.
Any number of factors may cause the item to drift out of calibration before recommended interval has expired
This report shall not be reproduced, except in full without approval of the laboratory
Tolerances followed are maintenance/acceptance per HB 44 or as detremined by the customer

7/27/09
HAM