FINAL REPORT NUMBER 201UI-MGA-09-03

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

FORD MOTOR COMPANY
2009 Ford Flex
NHTSA No. C90204

MGA RESEARCH CORPORATION
446 Executive Drive
Troy, Michigan 48083

Test Dates: April 28-29, 2009
Report Date: April 30, 2009

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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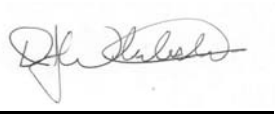
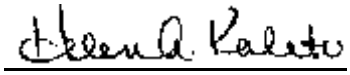
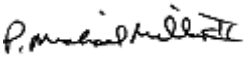
Prepared By: 

Donald J. Whiteside, Project Engineer



Helen A. Kaleto, Project Manager

Approved By: 

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4. Title and Subtitle Final Report of FMVSS 201 Compliance Testing of a 2009 Ford Flex, NHTSA No. C90204		5. Report Date April 30, 2009	
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15. Supplementary Notes			
16. Abstract A compliance test series was conducted on the subject 2009 Ford Flex, NHTSA No. C90204, 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 April 28-29, 2009. Test failures identified were as follows: None The data recorded indicates that the 2009 Ford Flex tested appears to comply with the upper interior requirements of FMVSS 201.			
17. Key Words Compliance Testing Safety Engineering FMVSS 201UI 2009 Ford Flex		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 2009 Ford Flex, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact - Upper Interior Head Impact Protection.

Tests were conducted on April 28-29, 2009 on a 2009 Ford Flex, manufactured by Ford Motor Co.

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 July 1, 2005.

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 July 1, 2005.

2.0 COMPLIANCE TEST DATA SUMMARY

The 2009 Ford Flex, was equipped with A, B, O (Other), and rear-pillars, an adjustable seat belt anchorage on each B-pillar, a fixed seat belt anchorage on each O and rear pillar, grab handles located on the side rail above the front passenger door and on the side rail above the rear driver and passenger doors, and an overhead console 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:

AP1	OP2	FH2	UR3@BPR
BP2	RP2	UR1@SR2	UR4@SR3-1
OP1	FH1	UR2@SR2	UR5@SR3-3

The 2009 Ford Flex, 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: 2009 Ford Flex

VEH. NHTSA NO.: C90204 VIN: 2FMDK51C09BA11234 COLOR: Dark Blue

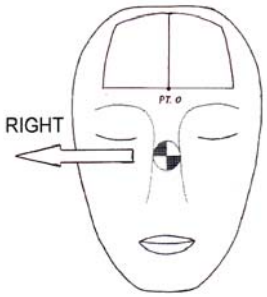
VEH. BUILD DATE: July, 2008 TEST DATES: April 28-29, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, 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
AP1	Right	154	28	18.9	351	245	36	22 Left
BP2	Right	90	3	23.8	618	598	9	1 Left
OP1	Left	270	5	24.0	789	825	13	11 Left
OP2	Right	90	1	24.0	661	655	15	11 Right
RP2	Right	15	-5	24.0	564	527	27	5 Left
FH1	Left	180	50	24.0	575	541	19	1 Left
FH2	Right	180	44	24.0	489	428	14	10 Left
UR1@SR2	Right	90	39	24.0	949	1037	34	4 Left
UR2@SR2	Left	270	50	24.1	650	641	18	6 Left
UR3@BPR	Left	270	50	24.0	553	512	27	4 Left
UR4@SR3-1	Right	90	50	24.0	755	780	31	8 Left
UR5@SR3-3	Right	90	50	23.9	416	330	34	10 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.

RP2 Right: Dislodged trim panel.

FH1 Left: Windshield broke after FMH chin rotation.

FH2 Right: Overhead console opened during impact; windshield broke after FMH chin rotation.

UR2 Left: Rear right roof vent popped out.

REMARKS:

The targets listed were impacted in the following order:

Left: FH1, UR2@SR2, UR3@BPR, OP1

Right: AP1, RP2, OP2, UR5@SR3-3, UR4@SR3-1, UR1@SR2, BP2, FH2

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: April 29, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-2

GENERAL TEST AND VEHICLE PARAMETER DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Ford Flex

VEH. NHTSA NO.: C90204 VIN: 2FMDK51C09BA11234 COLOR: Dark Blue

VEH. BUILD DATE: July, 2008 TEST DATES: April 28-29, 2009

TEST LABORATORY: MGA Research Corporation

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

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

SUNROOF INFORMATION:

Installed: _____Yes __X__ No

Operation: _____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: February 12, 2009; Odometer Reading 196 miles

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: Ford Motor Co.

Date of Manufacture: July, 2008; VIN: 2FMDK51C09BA11234

GVWR: 2708 kg; GAWR FRONT: 1311 kg;

GAWR REAR: 1420 kg;

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load:

FRONT: 240 kPa REAR: 240 kPa

Recommended Tire Size: P235/60R18

Recommended Cold Tire Pressure:

FRONT: 240 kPa REAR: 240 kPa

Size of Tire on Test Vehicle: P235/60R18

Type of Spare Tire: T155/70D17; Space Saver: X; Standard__

VEHICLE CAPACITY DATA:

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

Number of Occupants: Front 2; Rear 5; TOTAL 7

VEHICLE CAPACITY WEIGHT:

Vehicle Capacity Weight (VCW) = 526 kg

No. of Occupants x 68 kg = 476 kg

Rated Cargo/Luggage Weight (RCLW) = 50 kg (difference)

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

Right Front =	545.0 kg	Right Rear =	454.5 kg
Left Front =	588.0 kg	Left Rear =	434.5 kg
TOTAL FRONT =	1133.0 kg	TOTAL REAR =	889.0 kg
% Total Weight =	56.0 %	% Total Weight =	44.0 %

TOTAL DELIVERED WEIGHT = 2022.0 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight = 2022.0 kg

Max. Test Cargo/Luggage Weight = 50.0 kg

Target Test Weight = 2072.0 kg

WEIGHT OF TEST VEHICLE FULLY LOADED:

Right Front =	540.0 kg	Right Rear =	484.5 kg
Left Front =	581.0 kg	Left Rear =	466.5 kg
TOTAL FRONT =	1121.0 kg	TOTAL REAR =	951.0 kg
% Total Weight =	54.1 %	% Total Weight =	45.9 %

TOTAL TEST WEIGHT = 2072.0 kg

Weight of ballast secured in vehicle's cargo area = 50.0 kg

TEST VEHICLE ATTITUDE:

AS DELIVERED:
Right Front 797 mm; Left Front 795 mm;
Right Rear 828 mm; Left Rear 827 mm;
Pitch Angle at Right Door Sill = 0.2 Rear is higher
Pitch Angle at Left Door Sill = 0.2 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.2 Right is higher

FULLY LOADED:
Right Front 796 mm; Left Front 792 mm;
Right Rear 817 mm; Left Rear 820 mm;
Pitch Angle at Right Door Sill = 0.6 Rear is higher
Pitch Angle at Left Door Sill = 0.3 Rear is higher
Roll Angle at Front Bumper = 0.2 Right is higher
Roll Angle at Rear Bumper = 0.0

AS TARGETED:
Right Front 1048 mm; Left Front 1047 mm;
Right Rear 1068 mm; Left Rear 1066 mm;
Pitch Angle at Right Door Sill = 0.2 Rear is higher
Pitch Angle at Left Door Sill = 0.2 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

AS TESTED ON RIGHT SIDE:

Pitch Angle at Right Door Sill =	0.2 Rear is higher
Pitch Angle at Left Door Sill =	0.2 Rear is higher
Roll Angle at Front Bumper =	0.2 Right is higher
Roll Angle at Rear Bumper =	0.1 Right is higher

AS TESTED ON LEFT SIDE:

Pitch Angle at Right Door Sill =	0.3 Rear is higher
Pitch Angle at Left Door Sill =	0.2 Rear is higher
Roll Angle at Front Bumper =	0.2 Right is higher
Roll Angle at Rear Bumper =	0.0

VEHICLE WHEELBASE = 2986 mm

REMARKS: The seat travel distance was measured to be 276 mm for the driver front seat and 238 mm for the passenger front seat.

RECORDED BY: Donald J. Whiteside DATE: April 23, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-3

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Ford Flex

VEH. NHTSA NO.: C90204 VIN: 2FMDK51C09BA11234 COLOR: Dark Blue

VEH. BUILD DATE: July, 2008 TEST DATES: April 28-29, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, 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 203.4º	L 248.9º
	R 105º-165º	R 113.9º	R 154.5º
B-PILLAR	L 195º-345º	L 198.0º	L 291.6º
	R 15º-165º	R 67.8º	R 160.1º

AS DETERMINED USING THE PROCEDURES SPECIFIED IN S8.13.4.1

REMARKS:

RECORDED BY: Donald J. Whiteside DATE: April 23, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-4

VERTICAL IMPACT ANGLE RANGES

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Ford Flex

VEH. NHTSA NO.: C90204 VIN: 2FMDK51C09BA11234 COLOR: Dark Blue

VEH. BUILD DATE: July, 2008 TEST DATES: April 28-29, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, 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 45º
		R 0º-50º	R 0º	R 44º
SIDE RAIL	SR1	L 0º-50º	L 0º	L 37º
		R 0º-50º	R 0º	R 38º
	SR2A	L 0º-50º	L 0º	L 37º
		R 0º-50º	R 0º	R 39º
	SR2B	L 0º-50º	L 0º	L 37º
		R 0º-50º	R 0º	R 40º
	SR3-1	L 0º-50º	L 0º	L 43º
		R 0º-50º	R 0º	R 42º
	SR3-2	L 0º-50º	L 0º	L 42º
		R 0º-50º	R 0º	R 45º
	SR3-3	L 0º-50º	L 0º	L 20º
		R 0º-50º	R 0º	R 33º

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
REAR HEADER	RH	L 0º-50º	L 0º	L 26º
		R 0º-50º	R 0º	R 26º
A-PILLAR	AP1	L -5º-50º	L -5º	L 30º
		R -5º-50º	R -5º	R 28º
	AP2	L -5º-50º	L -5º	L 38º
		R -5º-50º	R -5º	R 38º
	AP3	L -5º-50º	L -5º	L 38º
		R -5º-50º	R -5º	R 37º
B-PILLAR	BP1	L -10º-50º	L -10º	L 1º
		R -10º-50º	R -10º	R 1º
	BP2*	L 0º-50º	L 0º	L 3º
		R 0º-50º	R 0º	R 3º
	BP3*	L 0º-50º	L 0º	L 3º
		R 0º-50º	R 0º	R 3º
	BP4	L -10º-50º	L -10º	L -8º
		R -10º-50º	R -10º	R -8º
OTHER-PILLAR	OP1*	L -10º-50º	L -10º	L 5º
		R -10º-50º	R -10º	R 2º
	OP2	L -10º-50º	L -10º	L -5º
		R -10º-50º	R -10º	R 1º
REAR PILLAR	RP1	L -10º-50º	L -10º	L 38º
		R -10º-50º	R -10º	R 38º
	RP2*	L -10º-50º	L -10º	L -5º
		R -10º-50º	R -10º	R -5º
UPPER ROOF 1		0º-50º	0º	39º
UPPER ROOF 2		0º-50º	0º	50º
UPPER ROOF 3		0º-50º	0º	50º

	VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
UPPER ROOF 4	0º-50º	0º	50º
UPPER ROOF 5	0º-50º	0º	50º
UPPER ROOF 6	0º-50º	0º	44º

As determined using the Procedures specified in S8.13.4.2.

*Target BP2 and BP3 are seat belt anchorage locations.
Target OP1 and RP2 are seat belt anchorage locations treated as pillar targets with respect to horizontal and vertical angle ranges of Table 1, approach angle limits.

RECORDED BY: Donald J. Whiteside DATE: April 23, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-5

TARGET MEASUREMENTS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Ford Flex

VEH. NHTSA NO.: C90204 VIN: 2FMDK51C09BA11234 COLOR: Dark Blue

VEH. BUILD DATE: July, 2008 TEST DATES: April 28-29, 2009

TEST LABORATORY: MGA Research Corporation

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

Measurement	Description	Left Side	Right Side
M	Seat Fore/Aft Travel (Front seats)	276 mm	238 mm
Tº	Horizontal < {CG-F1 (Left Seat) to (Right A-Pillar)}	111.1º	--
A1º	360º - Tº	248.9º	--
Wº	Horizontal < {CG-2 (Left Seat) to (Left A-Pillar)}	203.4º	--
A2º	A2º = Wº	203.4º	--
Uº	Horizontal < {CG-2 (Left Seat) to (Left B-Pillar)}	291.6º	--
B1º	B1º = Uº	291.6º	--
Vº	Horizontal < {CG-R (Left Seat) to (Left B-Pillar)}	198.0º	--
B2º	B2º = Vº	198.0º	--
Wº (right)	Horizontal < {CG-F2 (Right Seat) to (Right A-Pillar)}	--	154.5º
A1º (right)	A1º (right) = Wº (right)	--	154.5º
T º (right)	Horizontal < {CG-F1 (Right Seat) to (Left A-Pillar)}	--	246.1º
A2º (right)	360º-Tº (right)	--	113.9º
V º (right)	Horizontal < {CG-R (Right Seat) to (Right B-Pillar)}	--	160.1º
B1º (right)	B1º (right) = Vº (right)	--	160.1º
U º (right)	Horizontal < {CG-F2 (Right Seat) to (Right B-Pillar)}	--	67.8º
B2º (right)	B2º (right) = Uº (right)	--	67.8º
J	A-Pillar {(Plane 3) – (Plane 5)}	324.8 mm	326.4 mm
J/2	J ÷ 2	162.4 mm	163.2 mm
D1	Upper Roof {(Plane A) – (Plane B)}	2924.0 mm	
D1/2	D1 ÷ 2	1462.0 mm	
D2	Upper Roof {(Plane C) – (Plane D)}	1385.2 mm	

Measurement	Description	Left Side	Right Side
D2/2	D2 ÷ 2	692.6 mm	
.35D1	.35 x D1	1023.4 mm	
.35D2	.35 x D2	484.8 mm	
N	B-Pillar {(BPR) – (lowest point on daylight opening forward of B-Pillar)}	449.8 mm	446.8 mm
N/2	B-Pillar {(BP3) – (lowest point on daylight opening forward of B-Pillar)}	224.9 mm	223.4 mm
N/4	B-Pillar {(BP4) – (lowest point on daylight opening forward of B-Pillar)}	112.5 mm	111.7 mm
Q	O-Pillar (Plane 13 – Plane 14)	425.1 mm	454.2 mm
Q/2	Q / 2	212.6 mm	227.1 mm
D	R-Pillar (Point 7 – Point M)	1159.0 mm	1140.0 mm
3D/7	3*D / 7	496.7 mm	488.6 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	3314.4	-372.2	1335.3	3313.4	384.7	1335.8
2nd Row	4298.5	-393.0	1284.5	4297.4	405.5	1285.0
3rd Row	5095.9	-245.9	1351.9	5095.2	258.4	1352.2

SgRP Locations (vehicle coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	3311.7	-378.2	1333.0	3311.7	378.2	1333.0
2nd Row	4295.9	-399.0	1278.1	4295.9	399.0	1278.1
3rd Row	5094.2	-252.0	1342.6	5094.2	252.0	1342.6

CG Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
CGF1	3198.4	-372.2	1995.3	3235.4	384.7	1995.8
CGF2	3474.4	-372.2	1995.3	3473.4	384.7	1995.8
CGR – 2nd Row	4458.5	-393.0	1944.5	4457.4	405.5	1945.0
CGR - 3rd Row	5255.9	-245.9	2011.9	5255.2	258.4	2012.2

REFERENCE FOR VEHICLE COORDINATE SYSTEM (measured in millimeters):

Driver door striker upper hole (x, y, z) = 3514.18, -810.89, 1485.94

Driver front outboard seat anchor hole (x, y, z) = 2934.22, -582.15, 1025.90

Passenger front outboard seat anchor hole (x, y, z) = 2934.22, 582.04, 1025.90

REMARKS:

RECORDED BY: Donald J. Whiteside DATE: April 23, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-6

SUMMARY OF TARGETING RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Ford Flex

VEH. NHTSA NO.: C90204 VIN: 2FMDK51C09BA11234 COLOR: Dark Blue

VEH. BUILD DATE: July, 2008 TEST DATES: April 28-29, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, 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	2980.5	-639.6	2102.6	204	30	No	--	No
AP2	2861.3	-654.2	2015.1	204	38	No	--	No
AP3	2759.4	-674.2	1941.1	204	38	No	--	No
A-Pillar Right Side								
AP1	2978.3	640.6	2105.0	154	28	No	--	Yes
AP2	2859.9	653.4	2017.2	154	38	No	--	No
AP3	2761.9	673.8	1944.5	154	37	No	--	No
B-Pillar Left Side								
BP1	3585.5	-580.5	2198.4	--	--	Yes	--	--
REL	3588.3	-594.6	2187.9	270	1	--	1	No
BP2	3570.1	-647.4	1883.7	270	3	No	--	No
BP3	3571.0	-641.6	1974.3	--	--	Yes	--	No
REL	3568.5	-638.7	1924.9	270	3	--	2	No
BP4	3647.5	-684.8	1862.2	198	-8	No	--	No
B-Pillar Right Side								
BP1	3585.8	587.5	2195.9	--	--	Yes	--	--
REL	3575.3	603.8	2182.4	90	1	--	1	No
BP2	3568.2	652.0	1881.2	90	3	No	--	Yes
BP3	3568.2	645.3	1973.7	--	--	Yes	--	--
REL	3556.5	646.5	1922.6	90	3	--	2	No

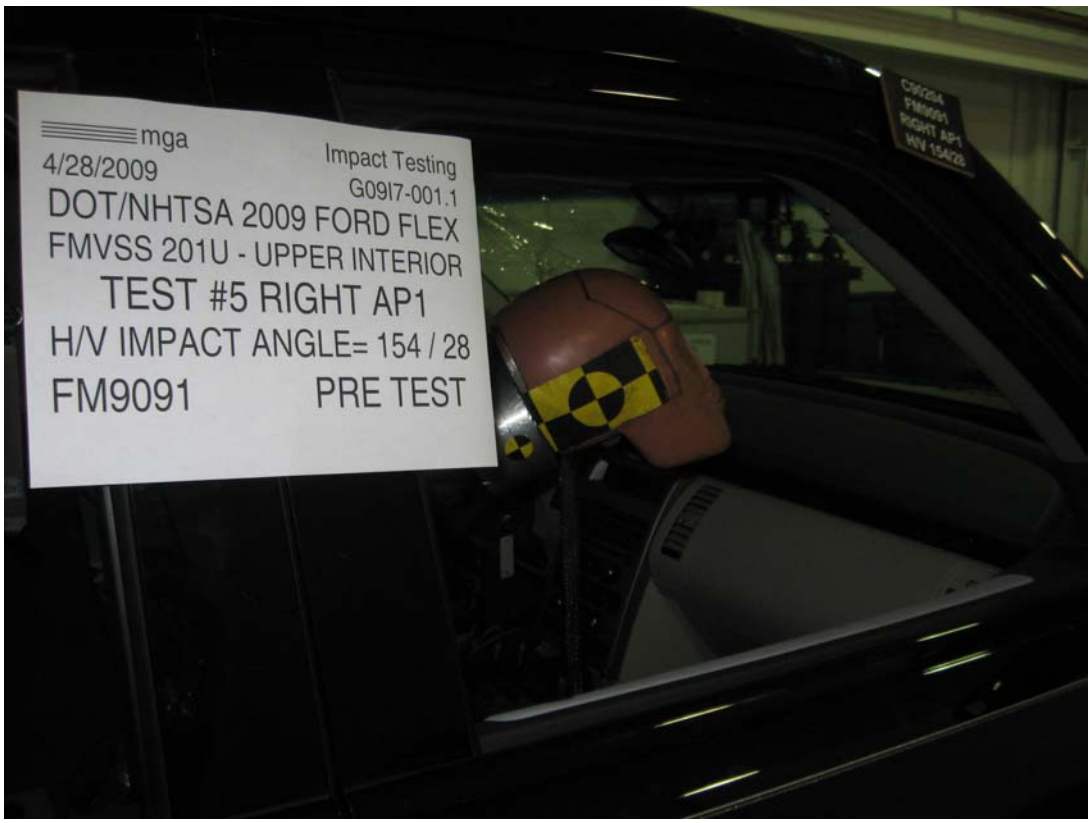
SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
BP4	3646.6	685.5	1861.7	160	-8	No	--	No
Other Pillar Left Side								
OP1	4634.2	-647.6	1947.8	270	5	No	--	Yes
OP2	4724.1	-636.6	1978.7	270	-5	No	--	No
Other Pillar Right Side								
OP1	4639.1	659.2	1941.0	90	2	No	--	No
OP2	4724.0	653.3	1987.4	--	--	Yes	--	--
REL	4651.0	659.7	1934.3	90	1	--	4	Yes
Rear Pillar Left Side								
RP1	5433.4	-580.4	2162.3	--	--	Yes	--	--
REL	5391.1	-567.4	2168.4	345	38	--	2	No
RP2	5531.6	-607.0	2048.3	345	-5	No	--	No
Rear Pillar Right Side								
RP1	5417.7	582.1	2145.5	--	--	Yes	--	--
REL	5395.1	561.6	2165.9	15	38	--	1	No
RP2	5531.3	625.8	2032.2	15	-5	No	--	Yes
Front Header Left Side								
FH1	2871.7	-554.0	2175.4	--	--	Yes	--	--
REL	2834.4	-548.0	2143.2	180	50	--	2	Yes
FH2	2841.9	-405.6	2160.1	180	45	No	--	No
Front Header Right Side								
FH1	2865.9	562.2	2177.9	--	--	Yes	--	--
REL	2830.0	558.9	2144.0	180	50	--	2	No
FH2	2839.9	417.7	2160.9	180	44	No	--	Yes
Side Rail Left Side								
SR1	3130.3	-580.8	2187.6	270	37	No	--	No
SR2A	3281.0	-578.1	2195.5	270	37	No	--	No
SR2B	3286.4	-579.6	2193.5	270	37	No	--	No
SR3-1	4063.0	-541.7	2215.5	270	43	No	--	No

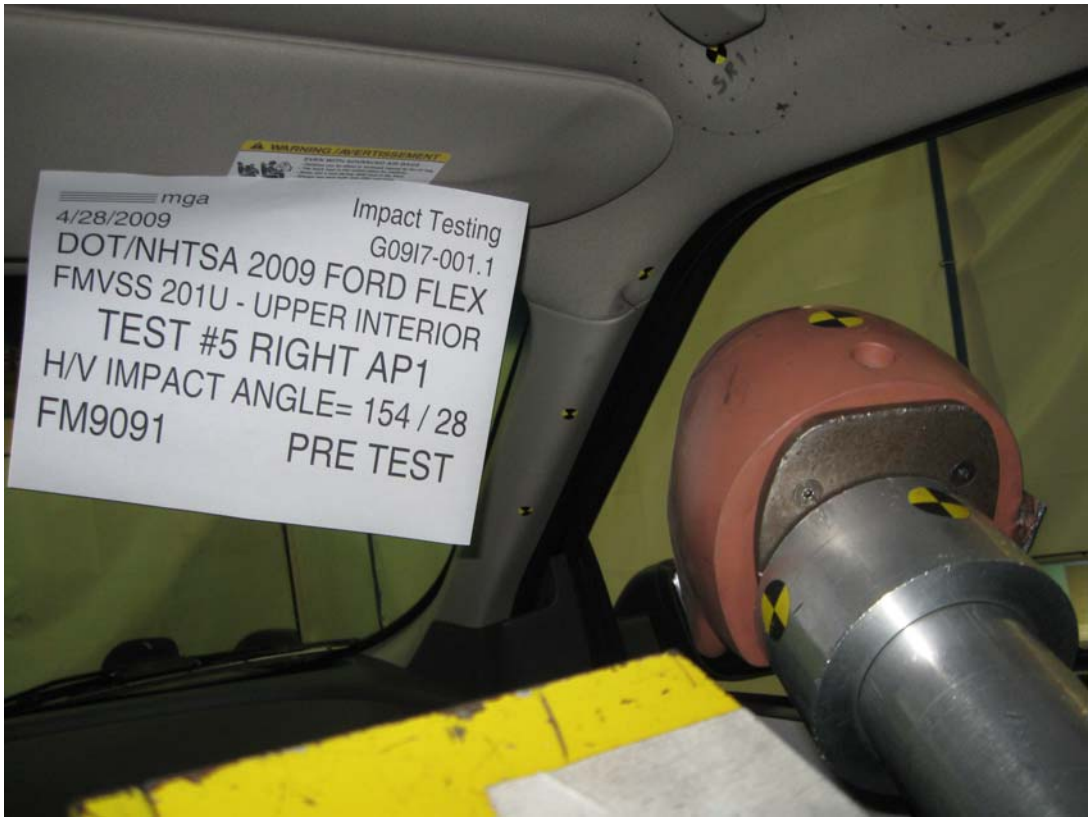
SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
SR3-2	4213.1	-542.8	2217.5	270	42	No	--	No
SR3-3	4857.0	-529.1	2206.3	--	--	Yes	--	--
REL	4831.4	-539.7	2165.7	270	20	--	2	No
Side Rail Right Side								
SR1	3128.0	590.0	2200.4	--	--	Yes	--	--
REL	3139.0	608.8	2164.5	90	38	--	2	No
SR2A	3278.6	592.5	2197.8	--	--	Yes	--	--
REL	3271.7	615.5	2164.3	90	39	--	2	No
SR2B	3285.6	592.1	2199.0	--	--	Yes	--	--
REL	3301.9	613.5	2168.3	90	40	--	2	No
SR3-1	4058.1	545.1	2214.7	90	42	No	--	No
SR3-2	4211.4	546.4	2214.8	90	45	No	--	No
SR3-3	4859.2	553.9	2228.2	--	--	Yes	--	--
REL	4849.6	567.6	2216.8	90	33	--	1	No
Rear Header Left Side								
RH	5406.9	-258.1	2242.8	0	26	No	--	No
Rear Header Right Side								
RH	5410.9	246.6	2240.2	0	26	No	--	No
Upper Roof Left Side								
UR2@SR2	3297.2	-462.3	2245.4	270	50	No	--	Yes
UR3@BPR	3610.7	-462.1	2211.3	270	50	No	--	Yes
UR6@Rear UR Zone	5181.8	-464.8	2274.5	270	44	No	--	No
Upper Roof Right Side								
UR1@SR2	3323.8	458.1	2255.4	90	39	No	--	Yes
UR4@SR3-1	4068.3	459.1	2217.8	90	50	No	--	Yes
UR5@SR3-3	4840.8	447.1	2241.2	90	50	No	--	Yes

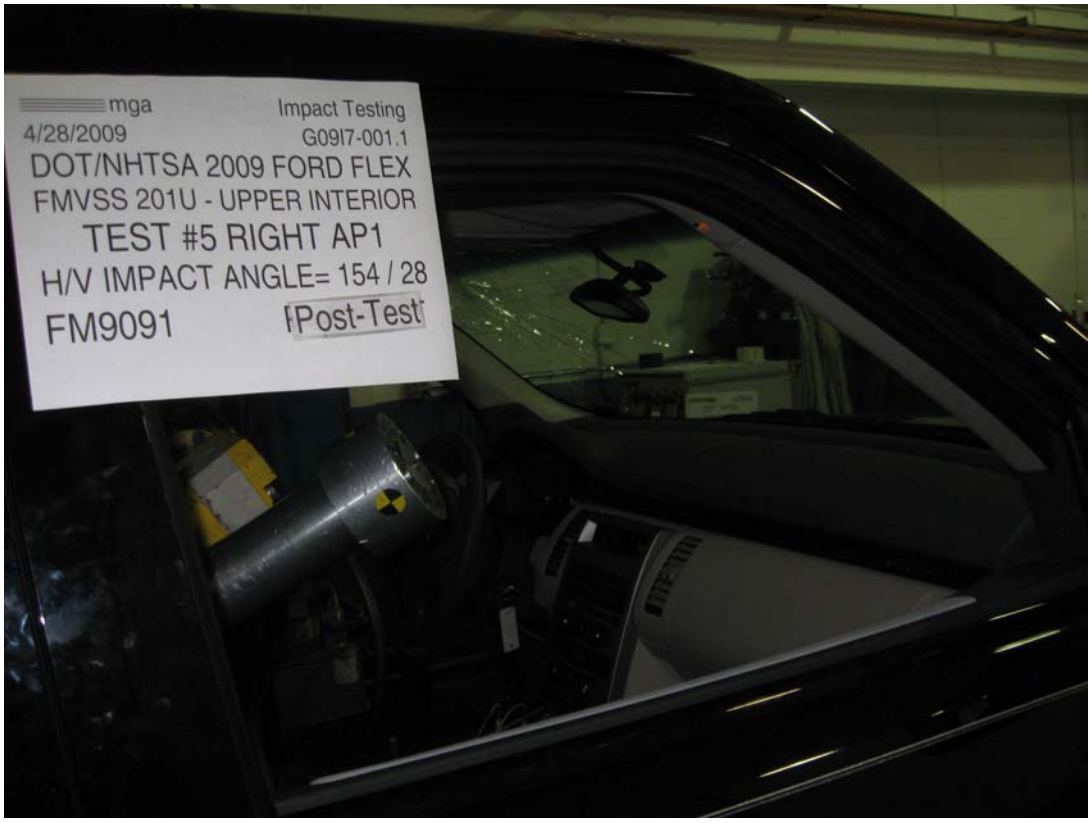
As determined using the Procedures specified in S10.1-10.13.

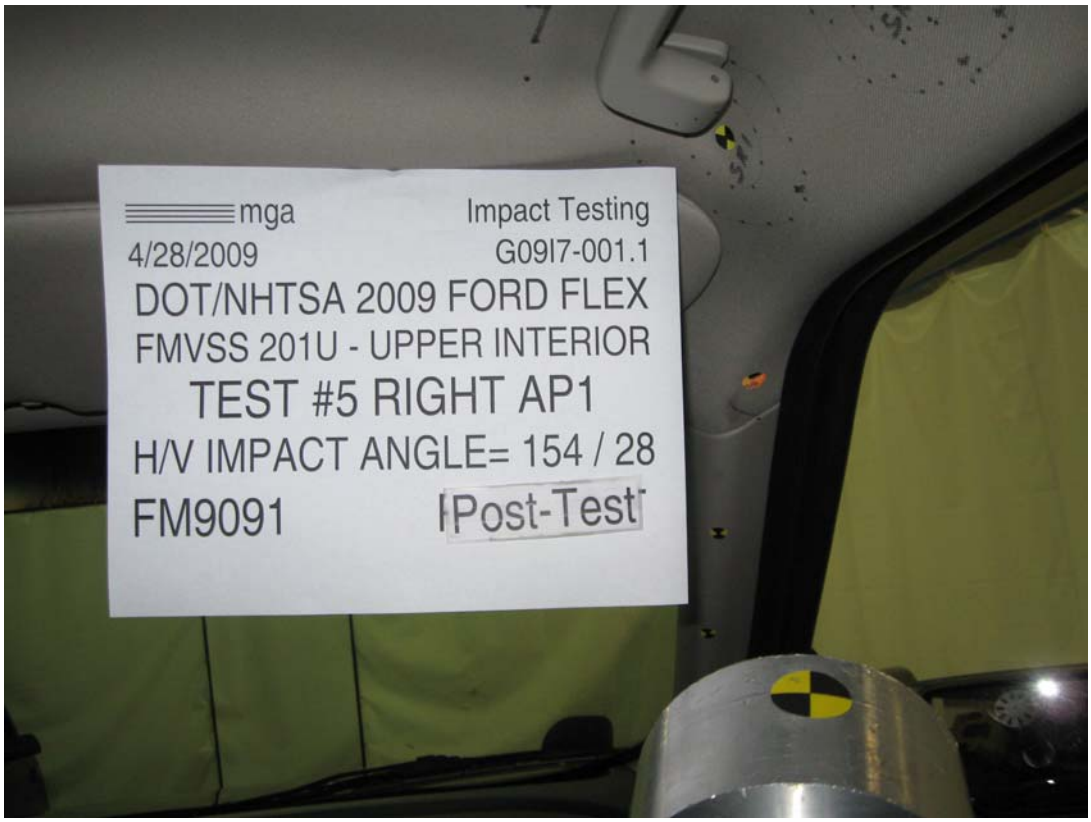
RECORDED BY: Donald J. Whiteside DATE: April 23, 2009 APPROVED BY: Helen A. Kaleto

3.0 TEST DATA (Including Acceleration and Velocity Plots)






mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT AP1
H/V IMPACT ANGLE= 154 / 28
FM9091
Post-Test


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT AP1
H/V IMPACT ANGLE= 154 / 28
FM9091
Post-Test


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT AP1
H/V IMPACT ANGLE= 154 / 28
FM9091
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#5

Target (Vehicle Side): AP1Right

Temperature:21.6C

MGA Test Reference No.:FM9091

Humidity:53.1%

Approach Horizontal Angles:154º

Time of Test:3:58:31 PM

Approach Vertical Angles:28º

FMH Serial No:[037]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
351	245	4.5	18.9	36	22 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.94	0.94

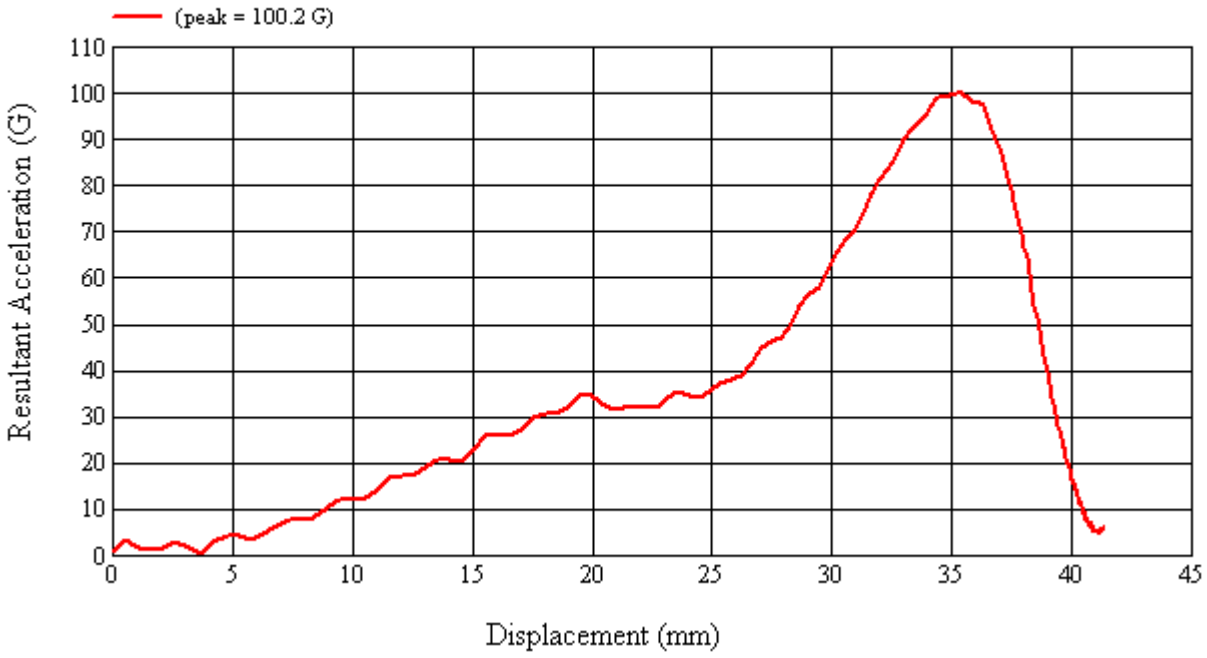
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

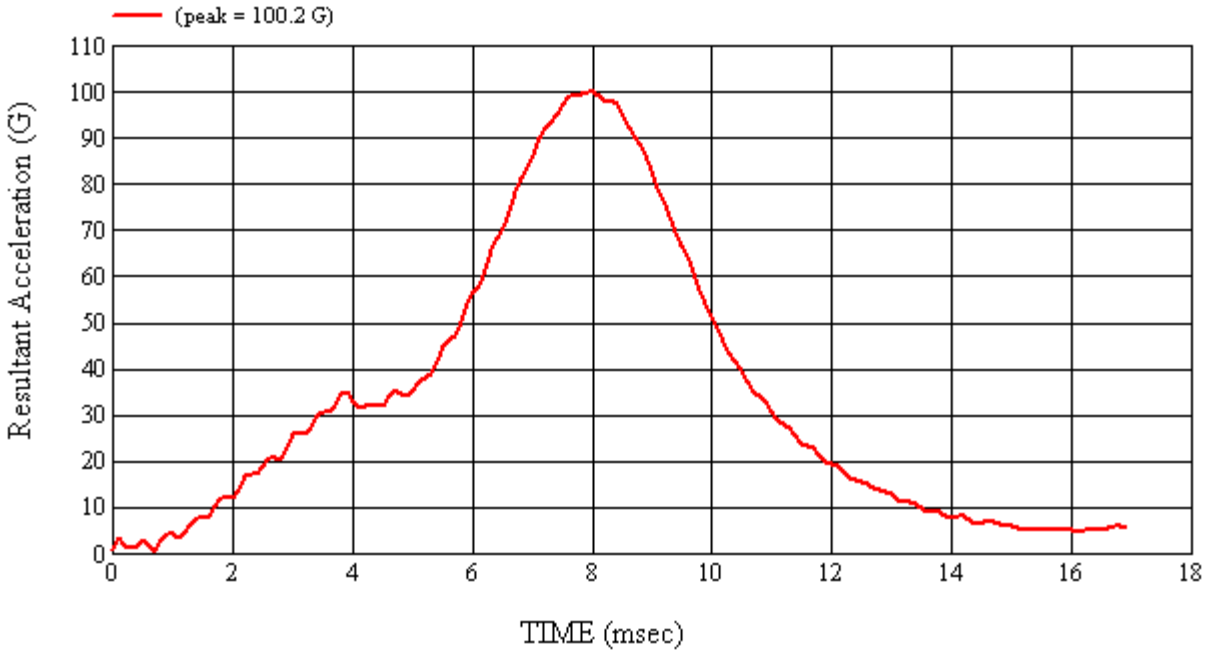
No damage observed

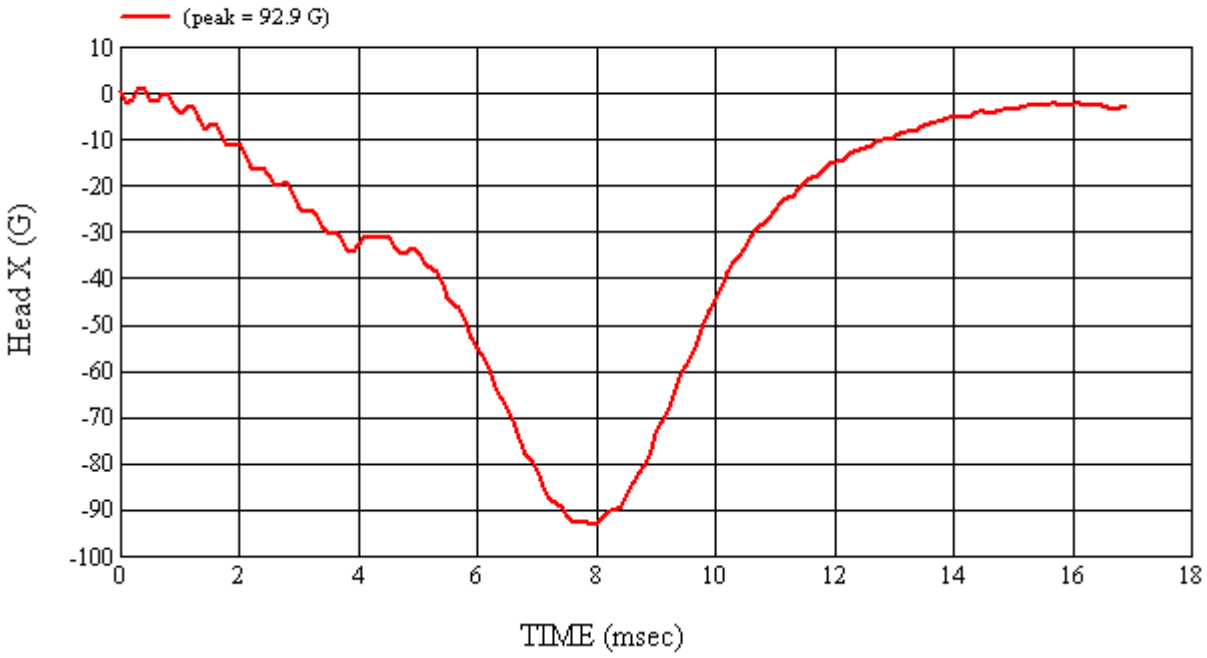
Recorded By:_____ Approved By*: _____ Date: 4/28/2009

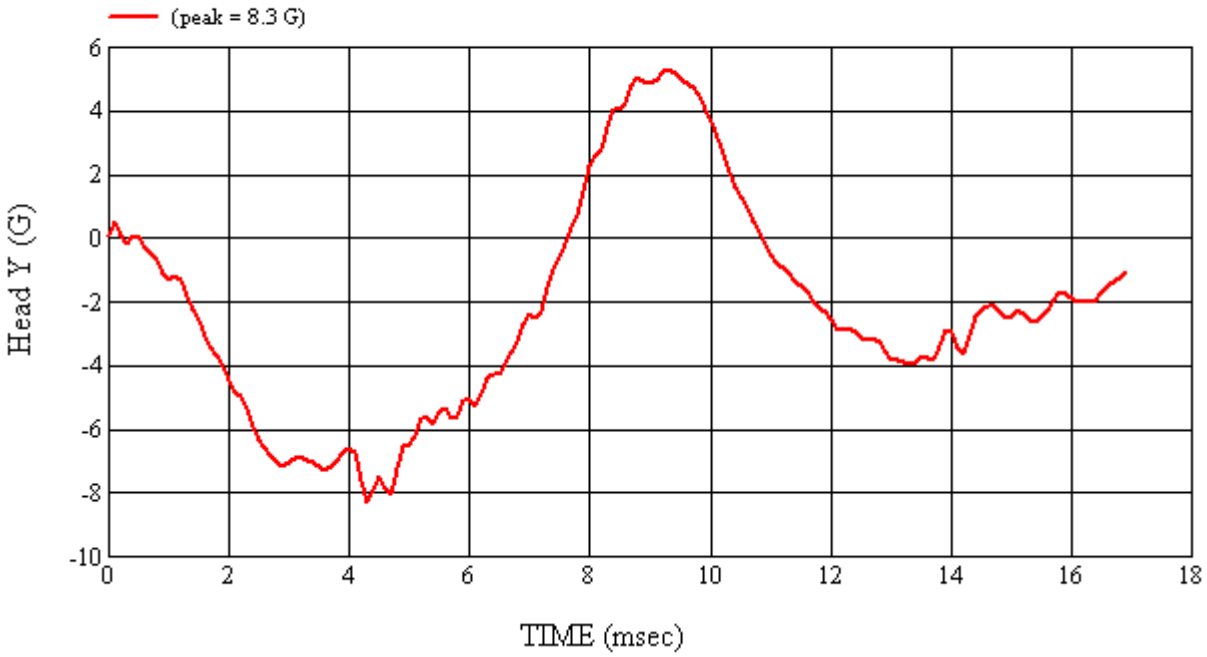
*Only necessary for NHTSA (Government) Compliance testing.

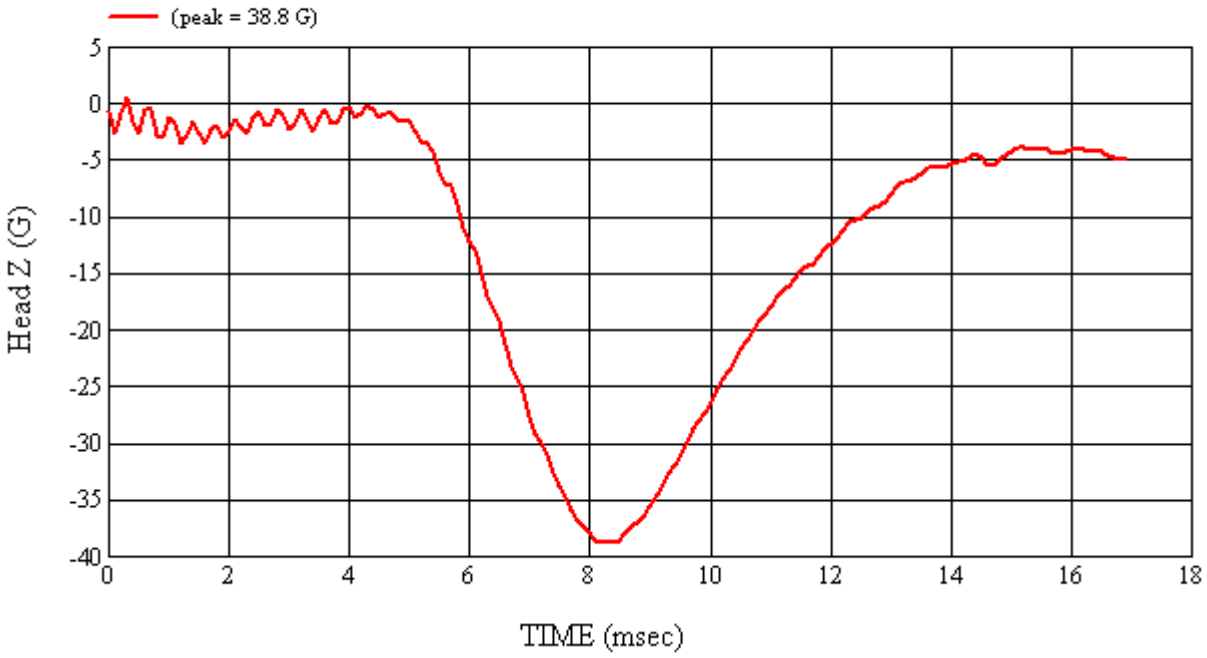
MGA Test #: FM9091 Target Location: AP1, Right Side Test Date: 4/28/2009

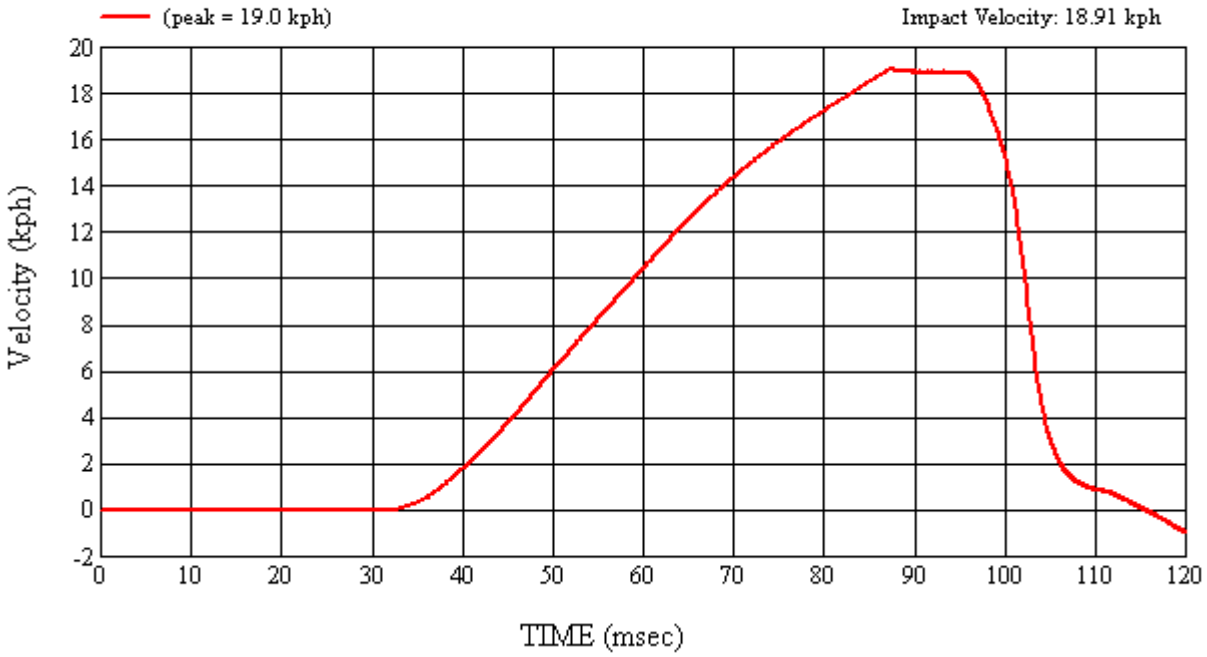


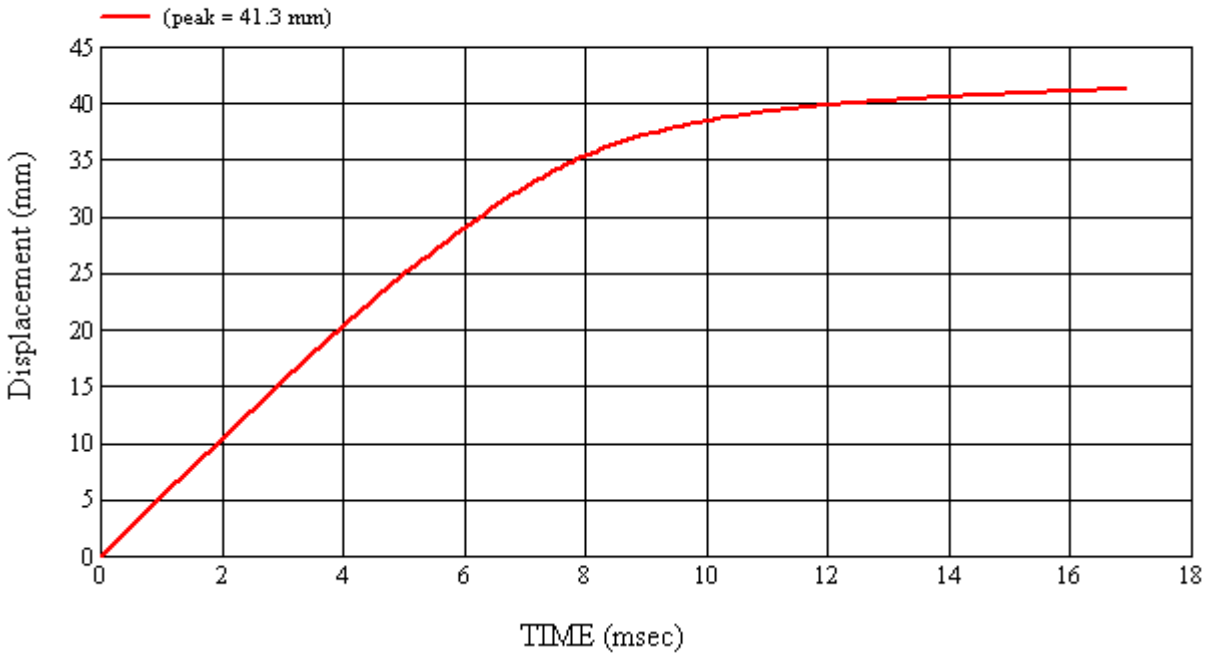



(peak = 92.9 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
2
4
6
8
10
12
14
16
18
TIME (msec)

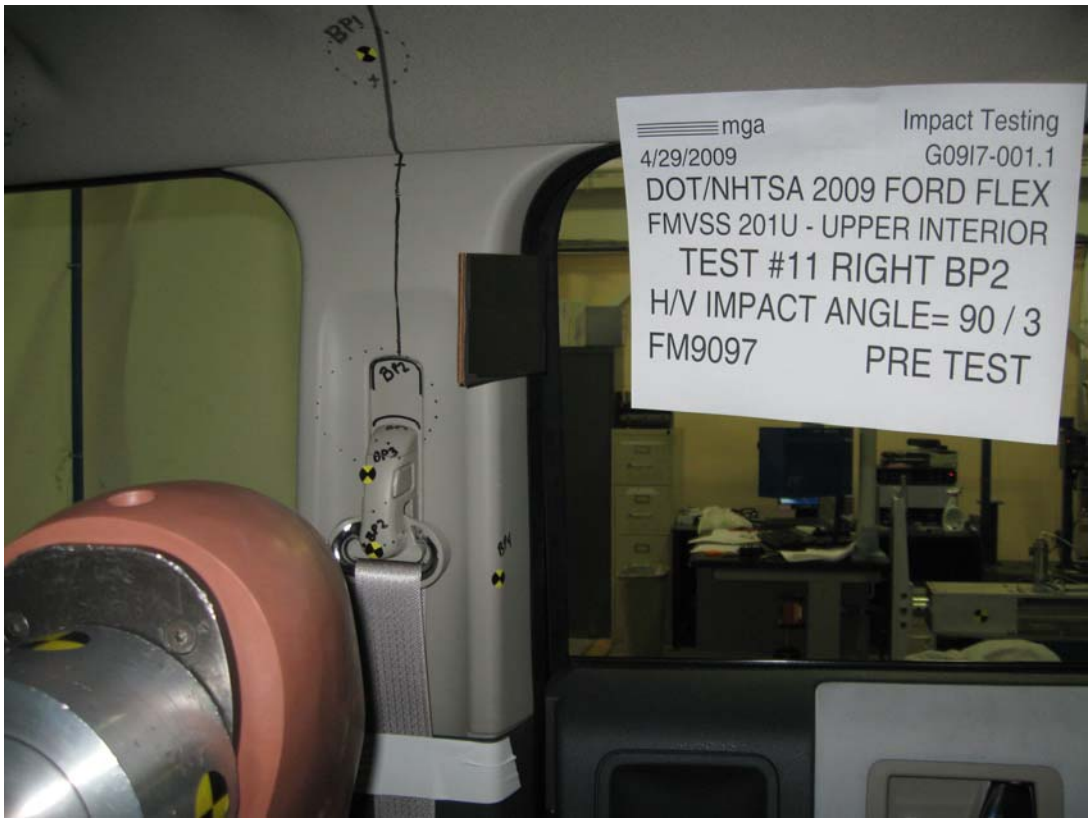

(peak = 8.3 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
-10
0
2
4
6
8
10
12
14
16
18
TIME (msec)


(peak = 38.8 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
TIME (msec)

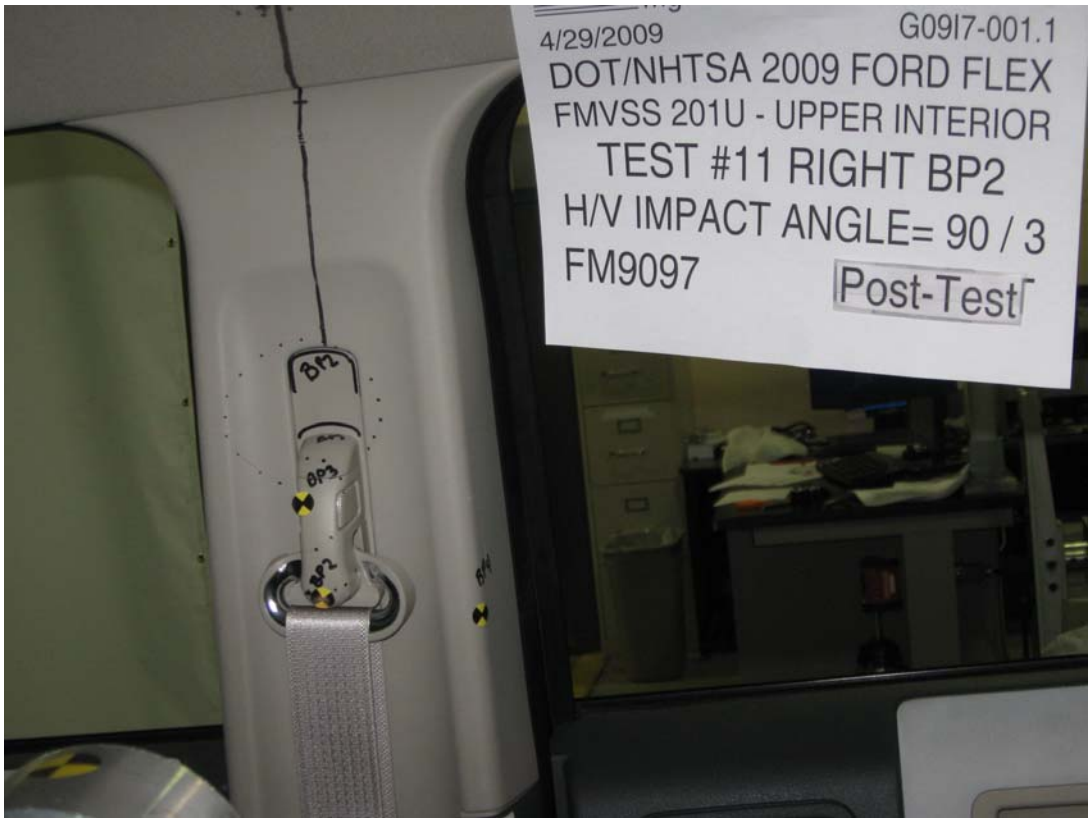

(peak = 19.0 kph)
Impact Velocity: 18.91 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
0
10
20
30
40
50
60
70
80
90
100
110
120
TIME (msec)


(peak = 41.3 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
TIME (msec)


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT BP2
H/V IMPACT ANGLE= 90 / 3
FM9097
PRE TEST


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT BP2
H/V IMPACT ANGLE= 90 / 3
FM9097
PRE TEST


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT BP2
H/V IMPACT ANGLE= 90 / 3
FM9097
Post-Test


4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT BP2
H/V IMPACT ANGLE= 90 / 3
FM9097
Post-Test
BP1
BP3
BP2


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #11 RIGHT BP2
H/V IMPACT ANGLE= 90 / 3
FM9097
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#11

Target (Vehicle Side): BP2Right

Temperature:21.2C

MGA Test Reference No.:FM9097

Humidity:41.0%

Approach Horizontal Angles:90º

Time of Test:2:25:37 PM

Approach Vertical Angles:3º

FMH Serial No:[038]

Additional Description:Anchor in mid position

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
618	598	6.5	23.8	9	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	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.94	0.94

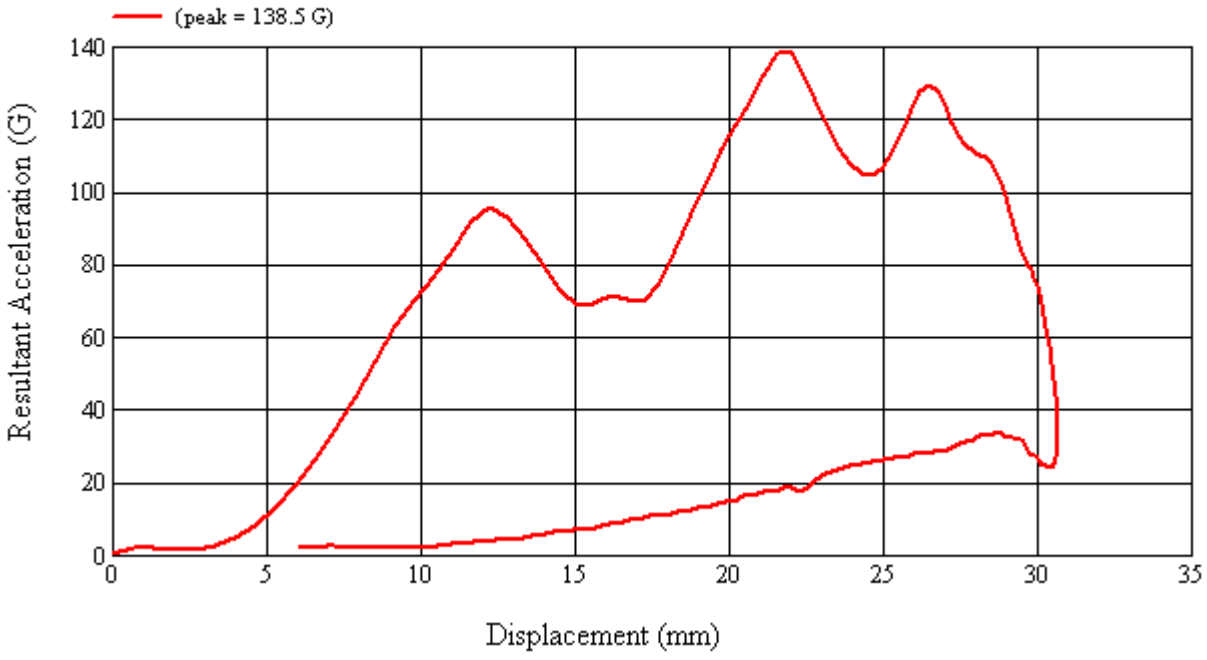
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

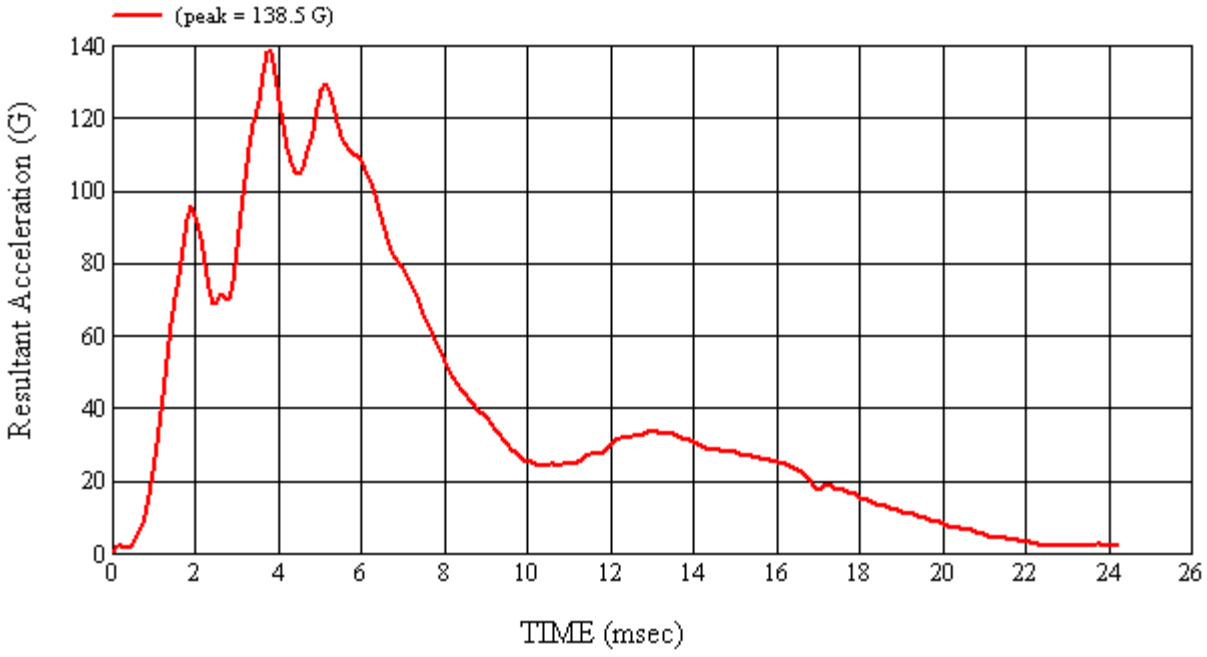
No damage observed

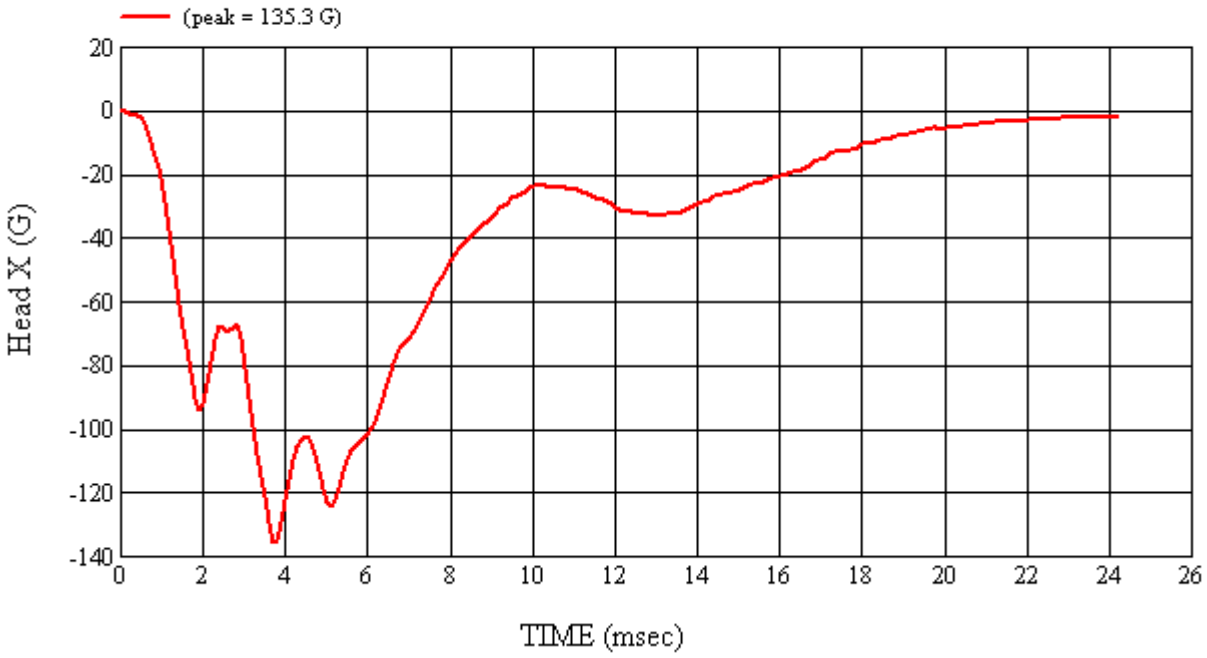
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

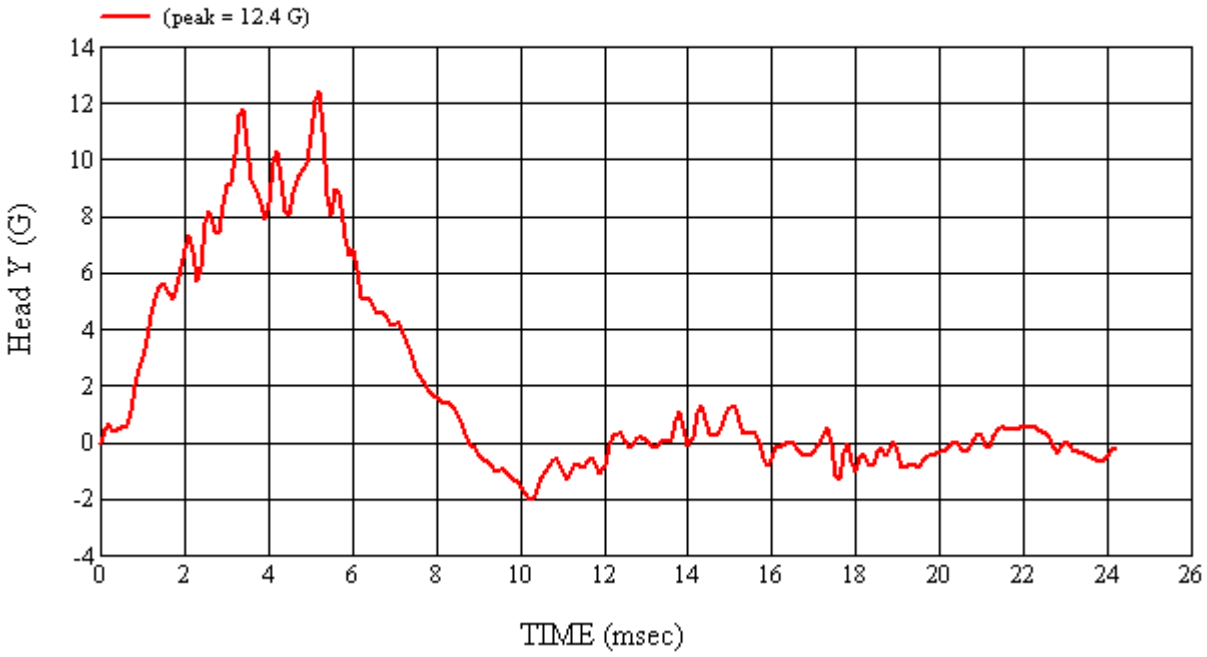
*Only necessary for NHTSA (Government) Compliance testing.

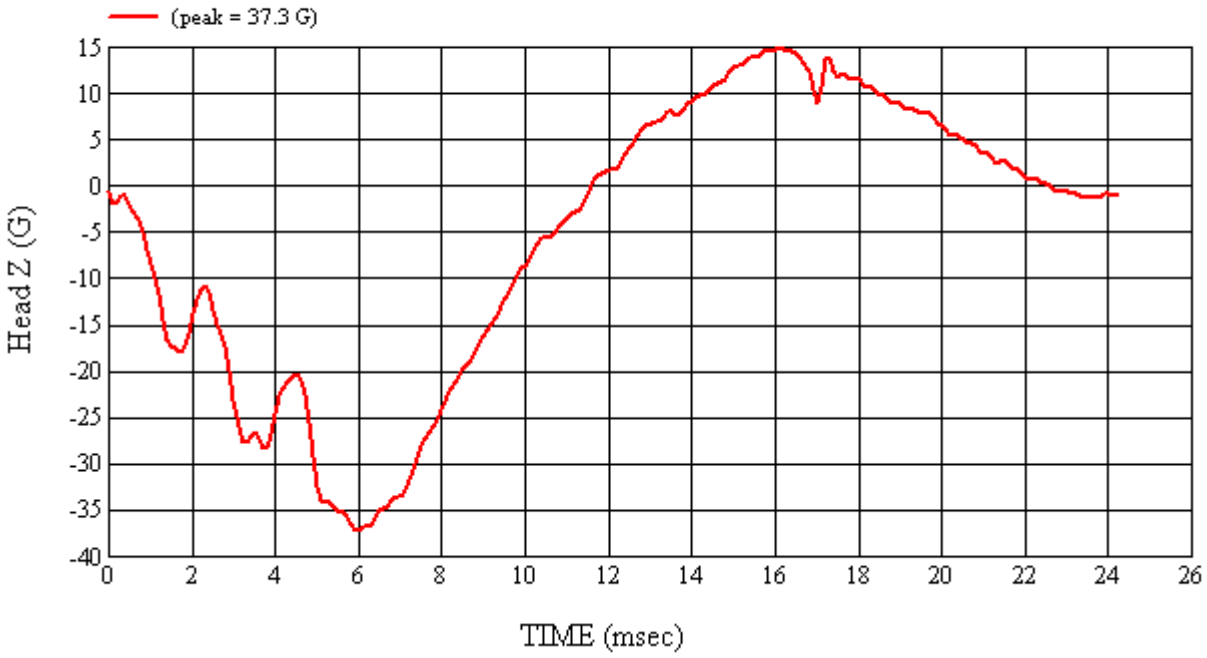
MGA Test #: FM9097 Target Location: BP2, Right Side Test Date: 4/29/2009

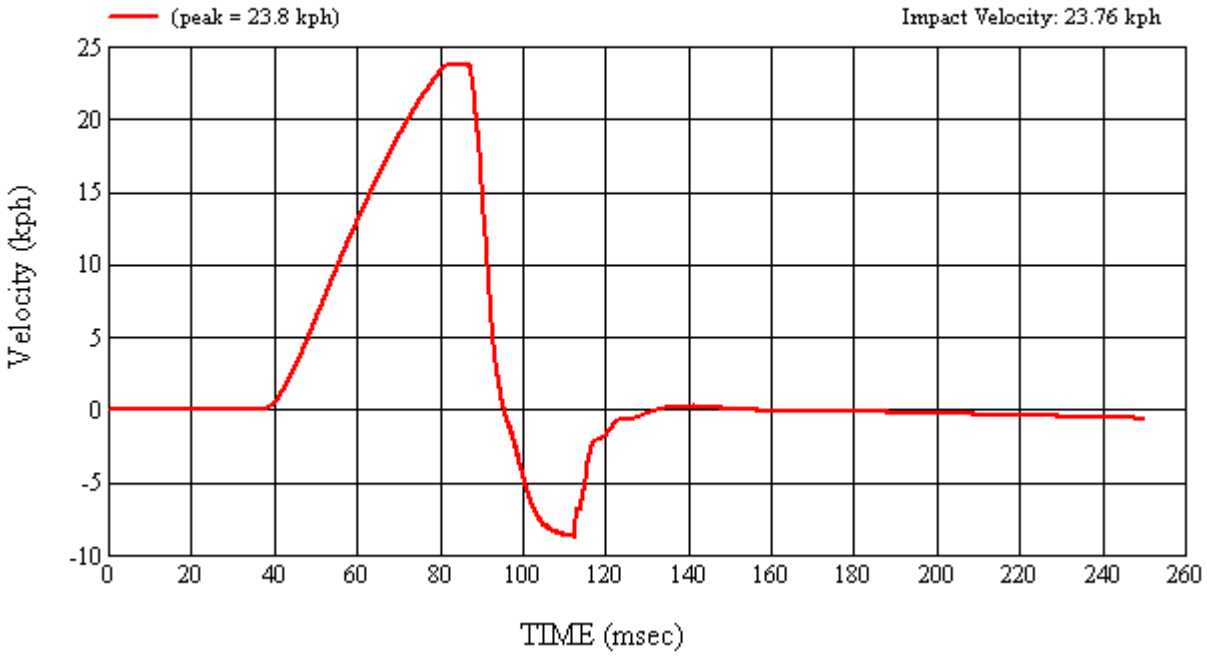


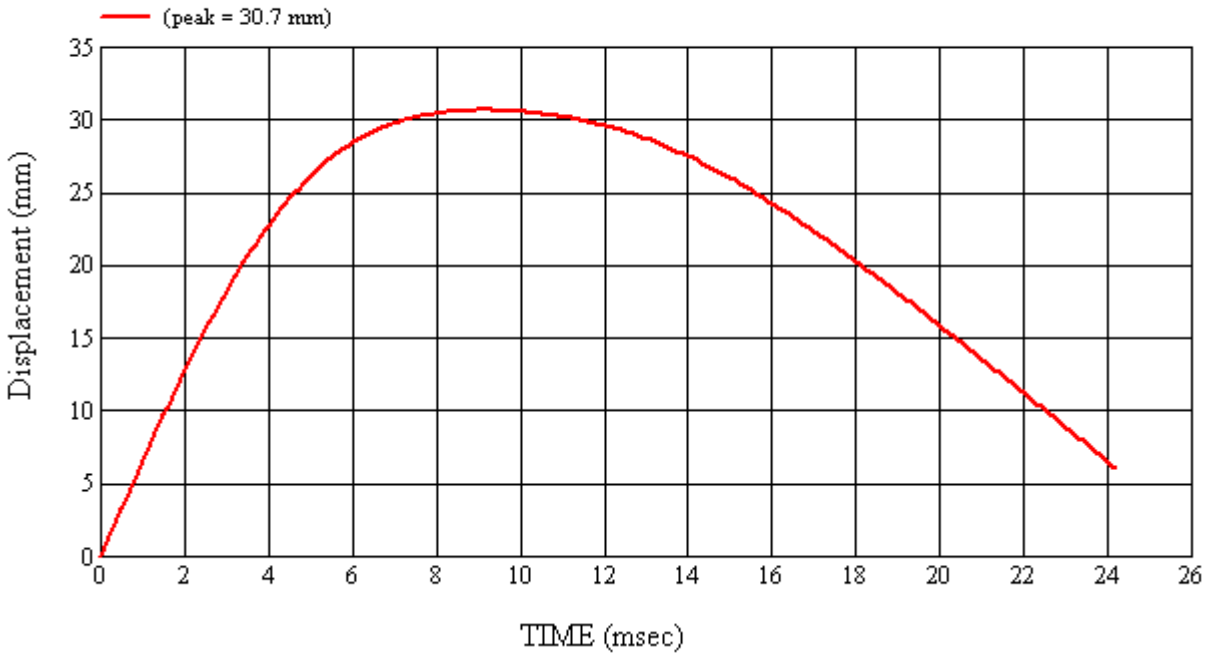



(peak = 135.3 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

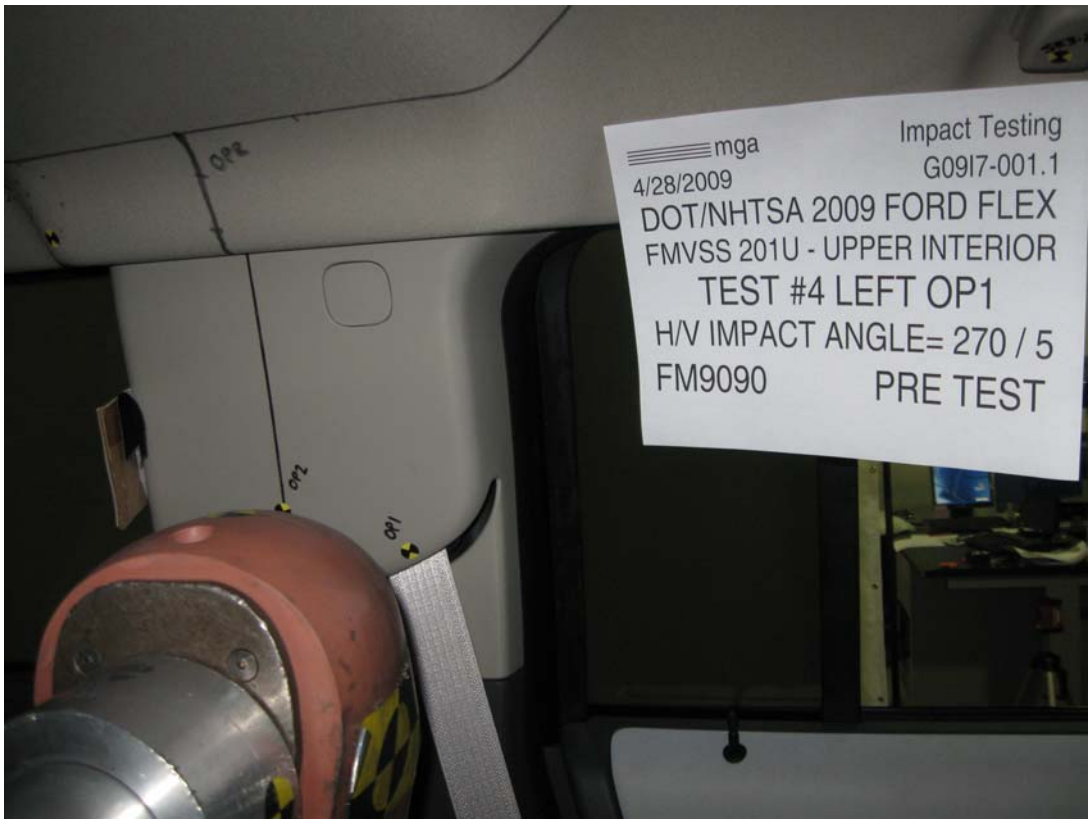

(peak = 12.4 G)
Head Y (G)
14
12
10
8
6
4
2
0
-2
-4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 37.3 G)
Head Z (G)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

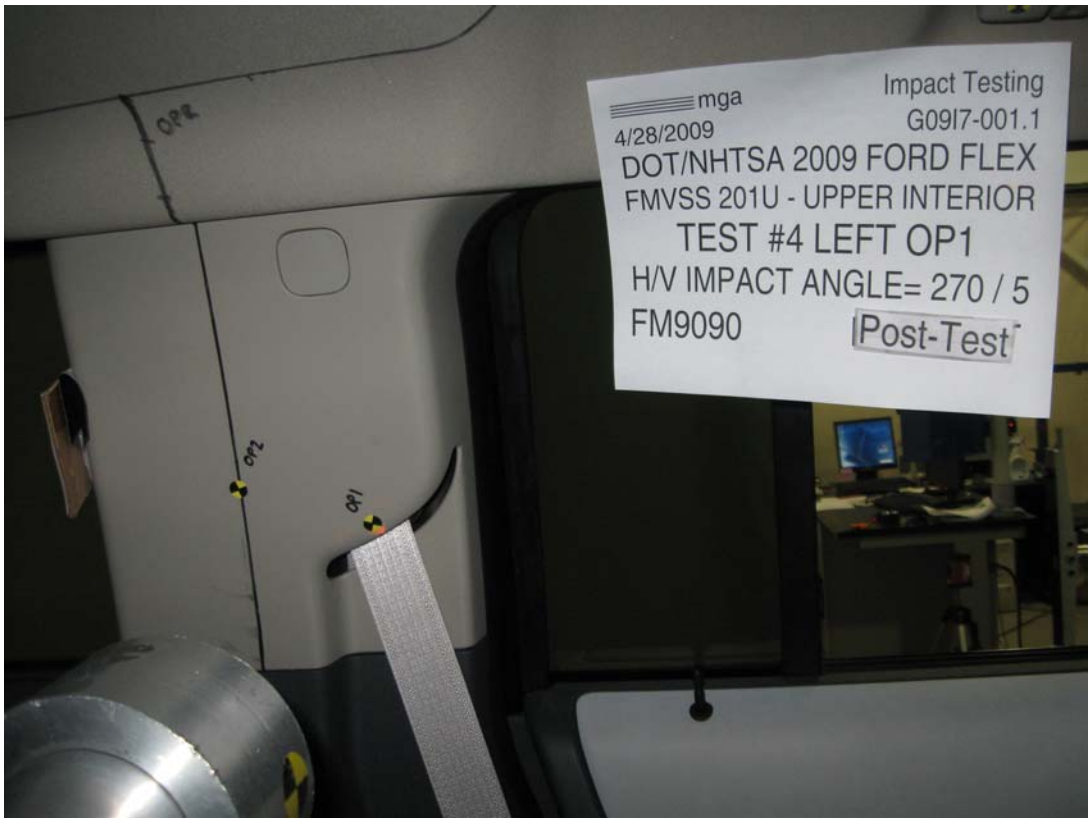

(peak = 23.8 kph)
Impact Velocity: 23.76 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

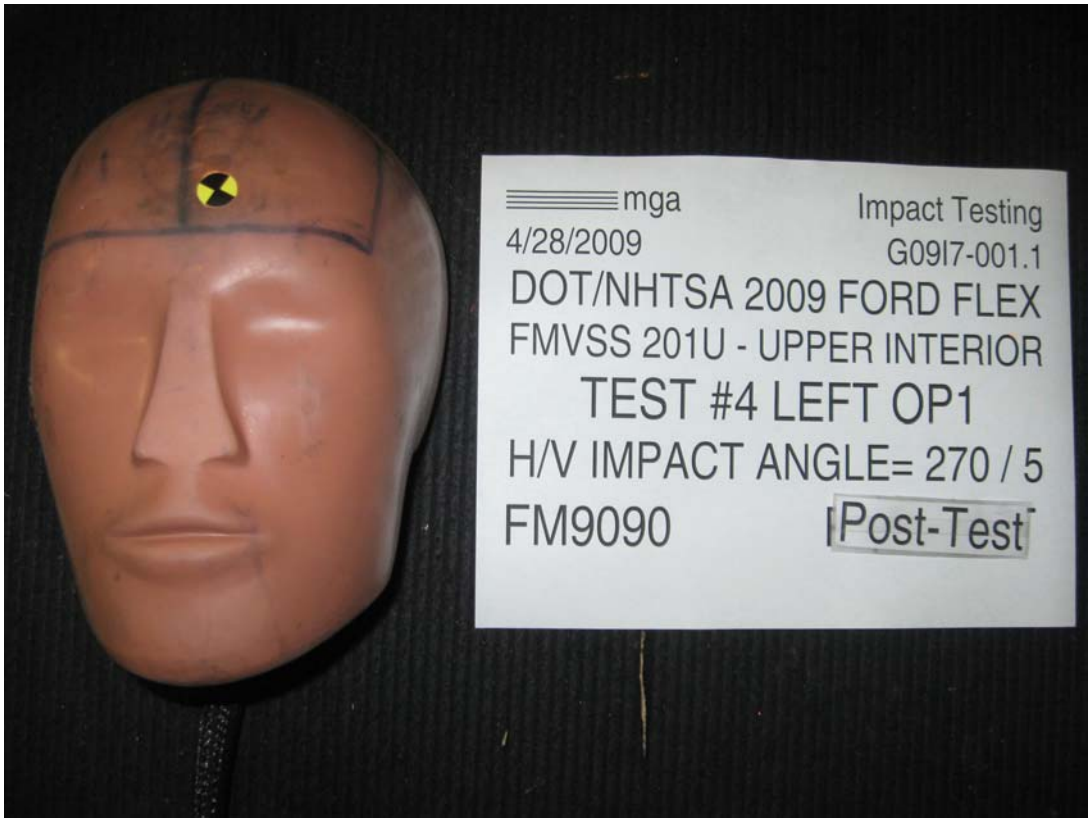

(peak = 30.7 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


C90204
FM9090
LEFT OP1
H/V 270/5
mga
4/28/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT OP1
H/V IMPACT ANGLE= 270 / 5
FM9090
PRE TEST


mga
4/28/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT OP1
H/V IMPACT ANGLE= 270 / 5
FM9090
PRE TEST


C90204
FM9090
LEFT OP1
H/V 270/5
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT OP1
H/V IMPACT ANGLE= 270 / 5
FM9090
Post-Test


OP2
OP2
OP1
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT OP1
H/V IMPACT ANGLE= 270 / 5
FM9090
Post-Test


mga
4/28/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #4 LEFT OP1
H/V IMPACT ANGLE= 270 / 5
FM9090
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#4

Target (Vehicle Side): OP1Left

Temperature:21.8C

MGA Test Reference No.:FM9090

Humidity:50.8%

Approach Horizontal Angles:270º

Time of Test:2:18:32 PM

Approach Vertical Angles:5º

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
789	825	6.5	24.0	13	11 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

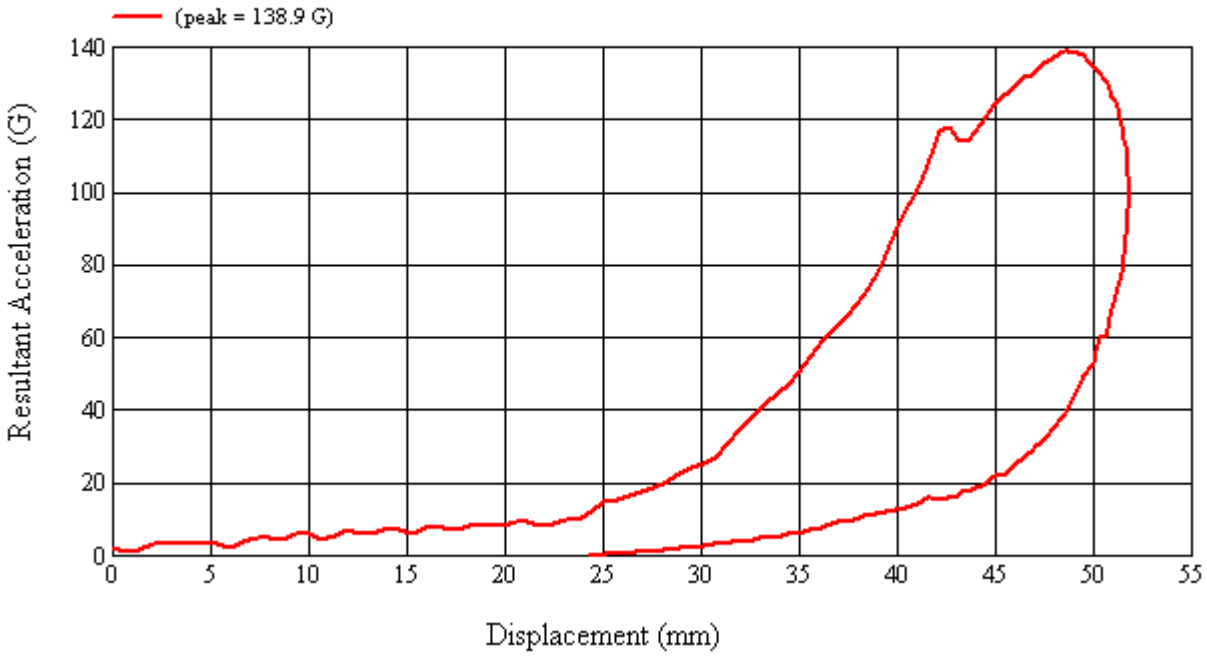
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

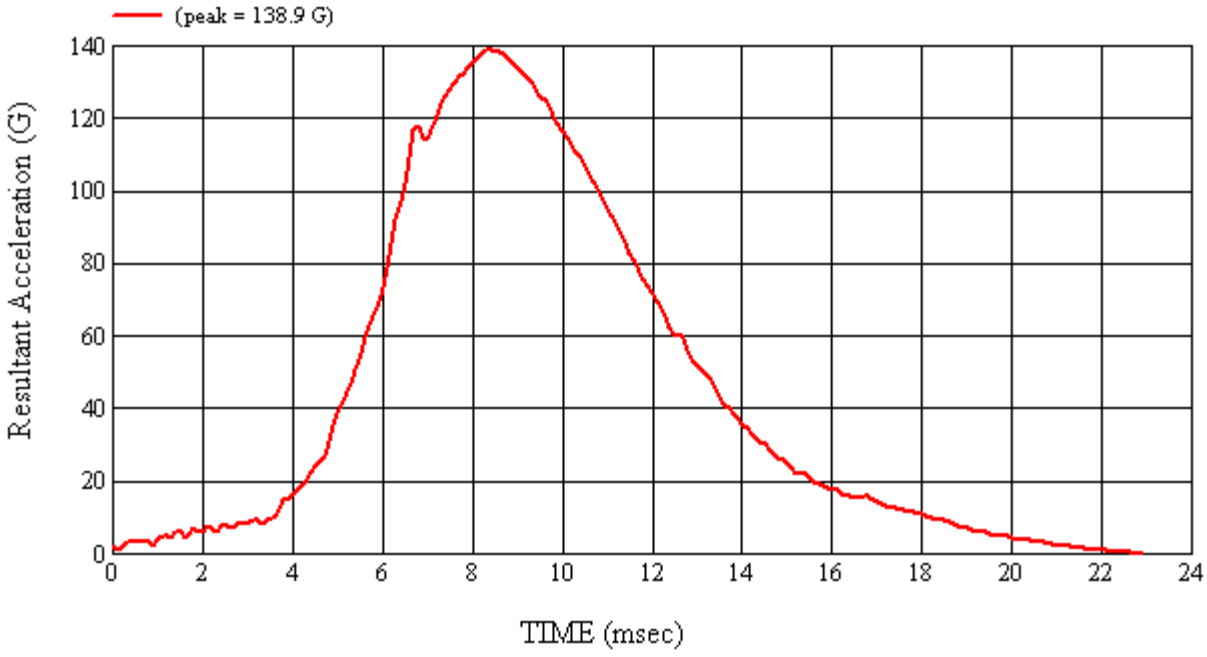
No damage observed

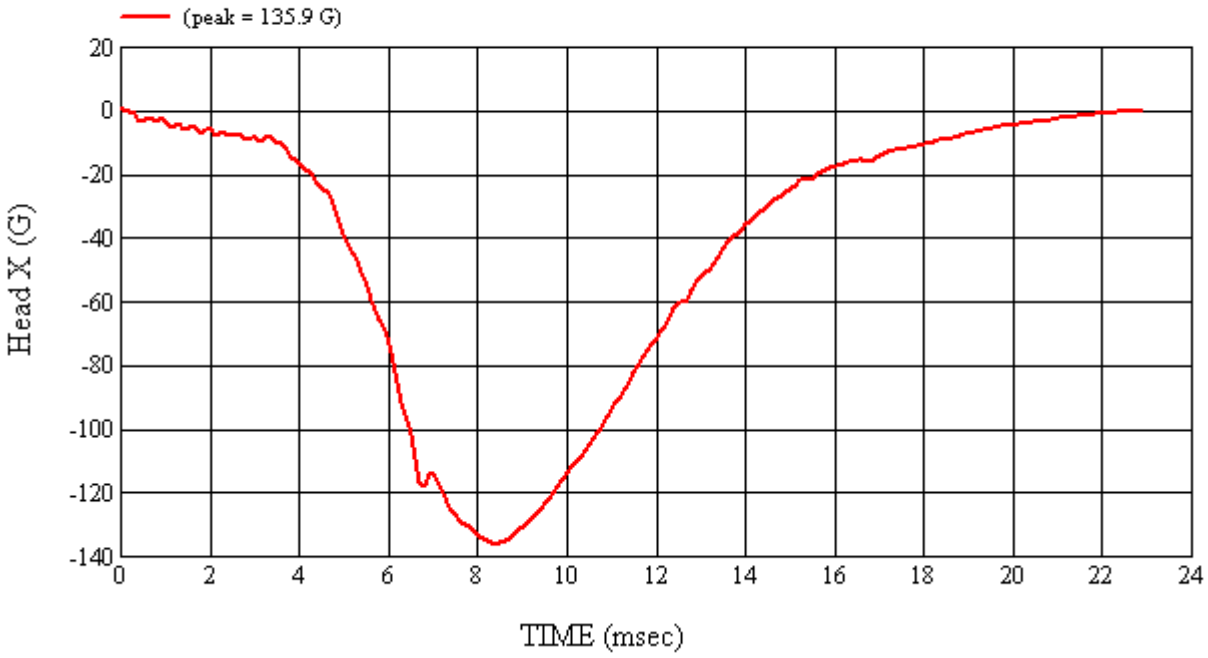
Recorded By:_____ Approved By*: _____ Date: 4/28/2009

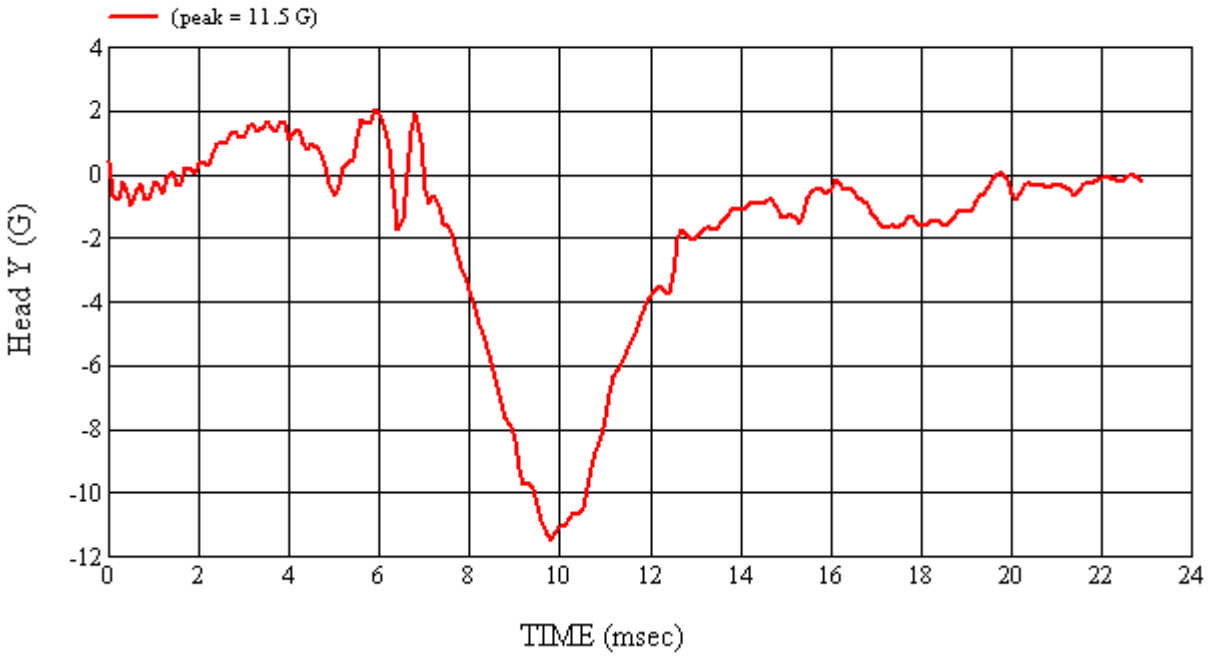
*Only necessary for NHTSA (Government) Compliance testing.

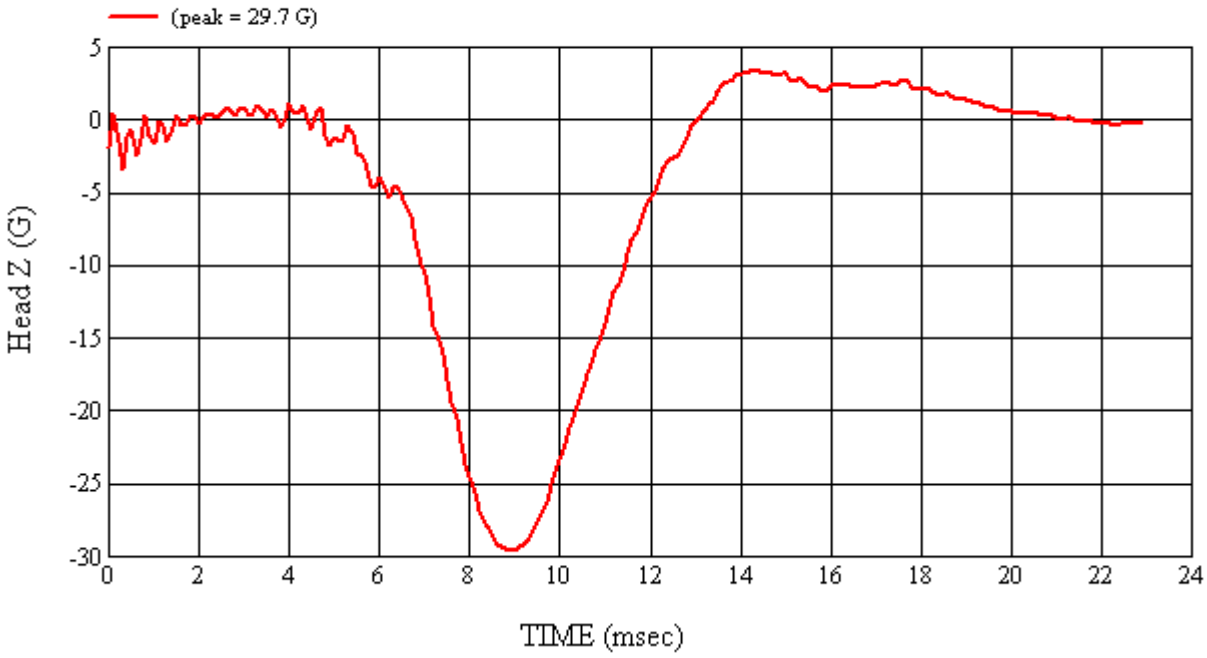
MGA Test #: FM9090 Target Location: OP1, Left Side Test Date: 4/28/2009

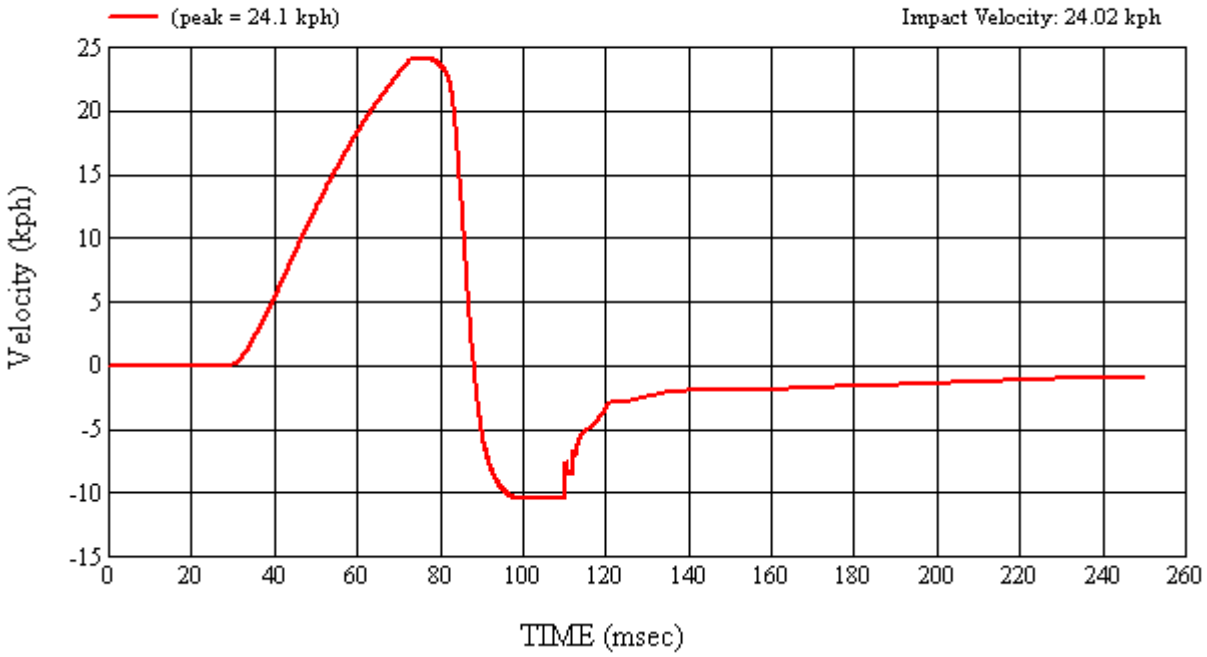


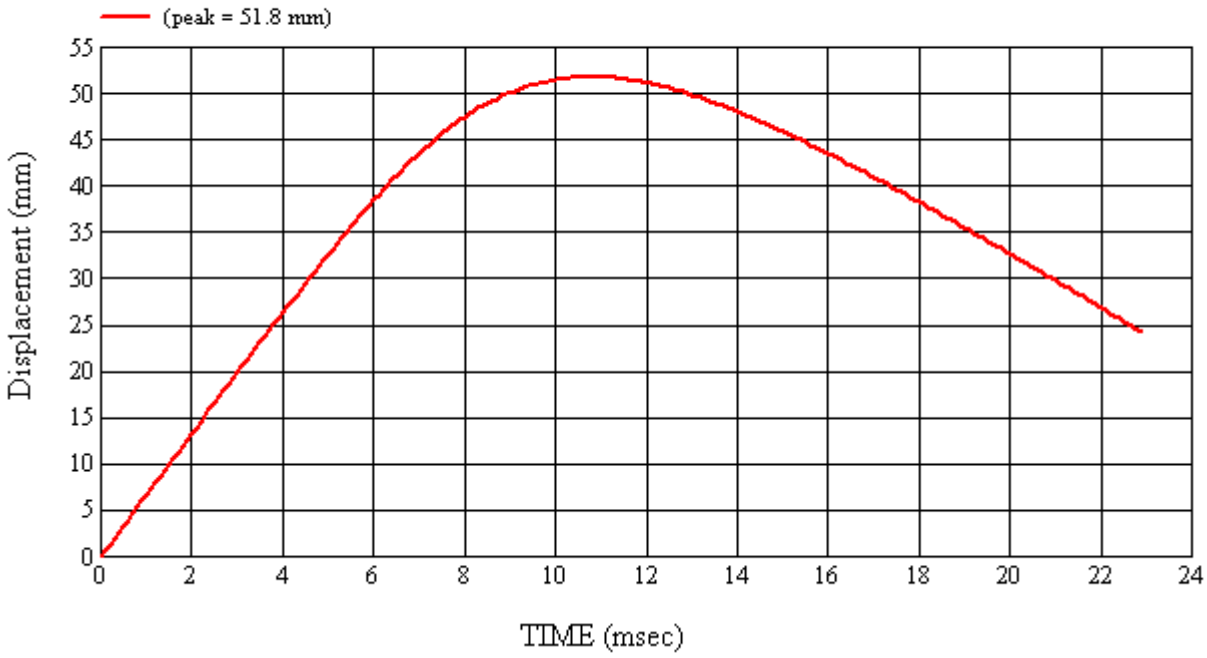



(peak = 135.9 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 11.5 G)
Head Y (G)
4
2
0
-2
-4
-6
-8
-10
-12
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 29.7 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 24.1 kph)
Impact Velocity: 24.02 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 = 51.8 mm)
Displacement (mm)
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
TIME (msec)


mga
Impact Testing
G09I7-001.1
4/29/2009
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT OP2
H/V IMPACT ANGLE= 90 / 1
FM9093
PRE TEST
C90204
FM9093
RIGHT OP
H/V 90/1


mga
4/29/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT OP2
H/V IMPACT ANGLE= 90 / 1
FM9093
PRE TEST
C90204
FM9093
RIGHT OP2
H/V 90/1


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT OP2
H/V IMPACT ANGLE= 90 / 1
FM9093
Post-Test
C90204
FM9093
RIGHT OP2
H/V 90/1


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT OP2
H/V IMPACT ANGLE= 90 / 1
FM9093
Post-Test
C90204
FM9093
RIGHT OP2
H/V 90/1


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT OP2
H/V IMPACT ANGLE= 90 / 1
FM9093
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#7

Target (Vehicle Side): OP2Right

Temperature:20.7C

MGA Test Reference No.:FM9093

Humidity:45.3%

Approach Horizontal Angles:90º

Time of Test:9:37:52 AM

Approach Vertical Angles:1º

FMH Serial No:[037]

Additional Description:Relocation Spheres: 4

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
661	655	7.2	24.0	15	11 Right

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.94	0.94

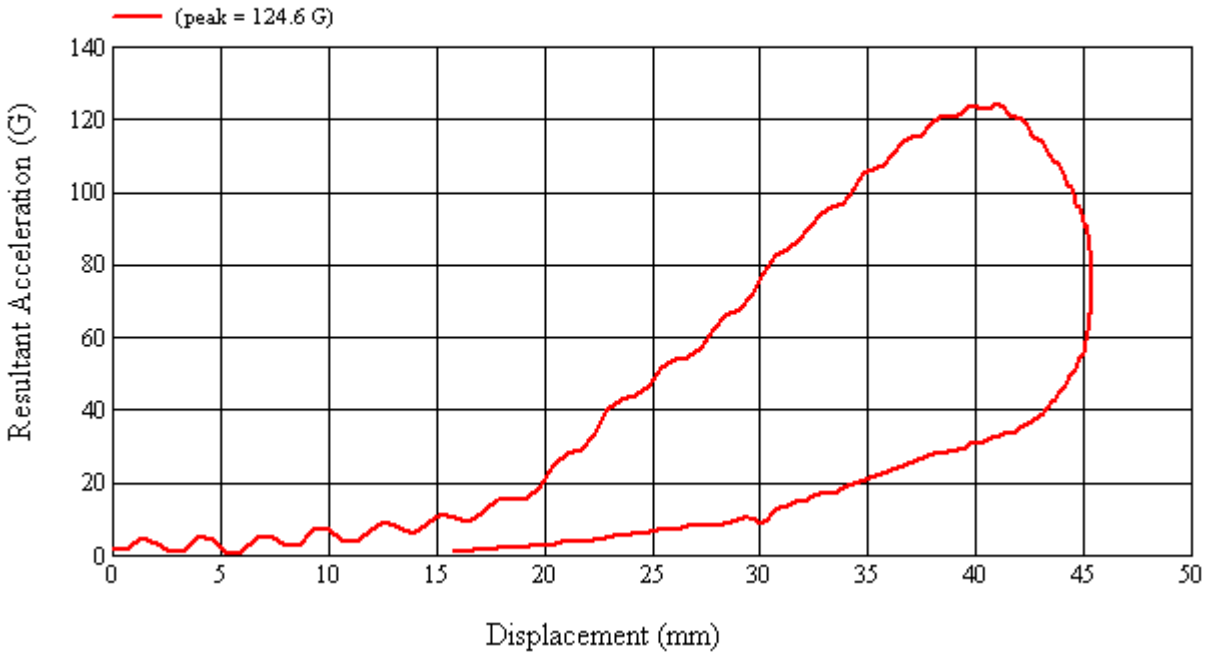
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

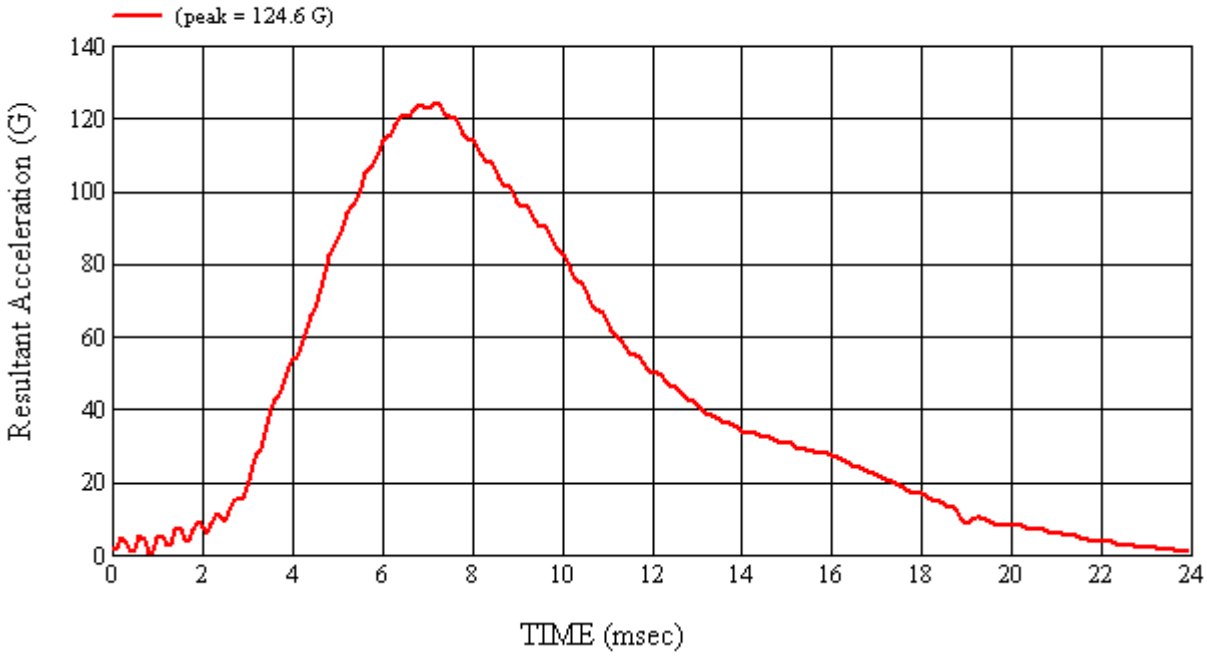
No damage observed

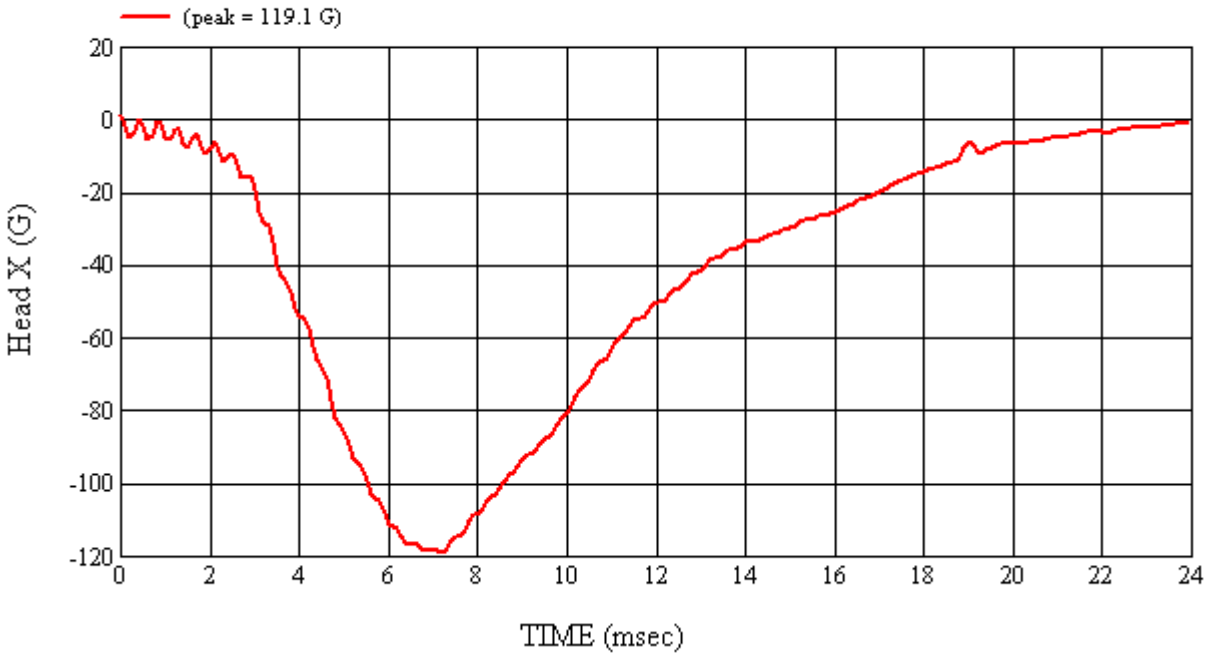
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

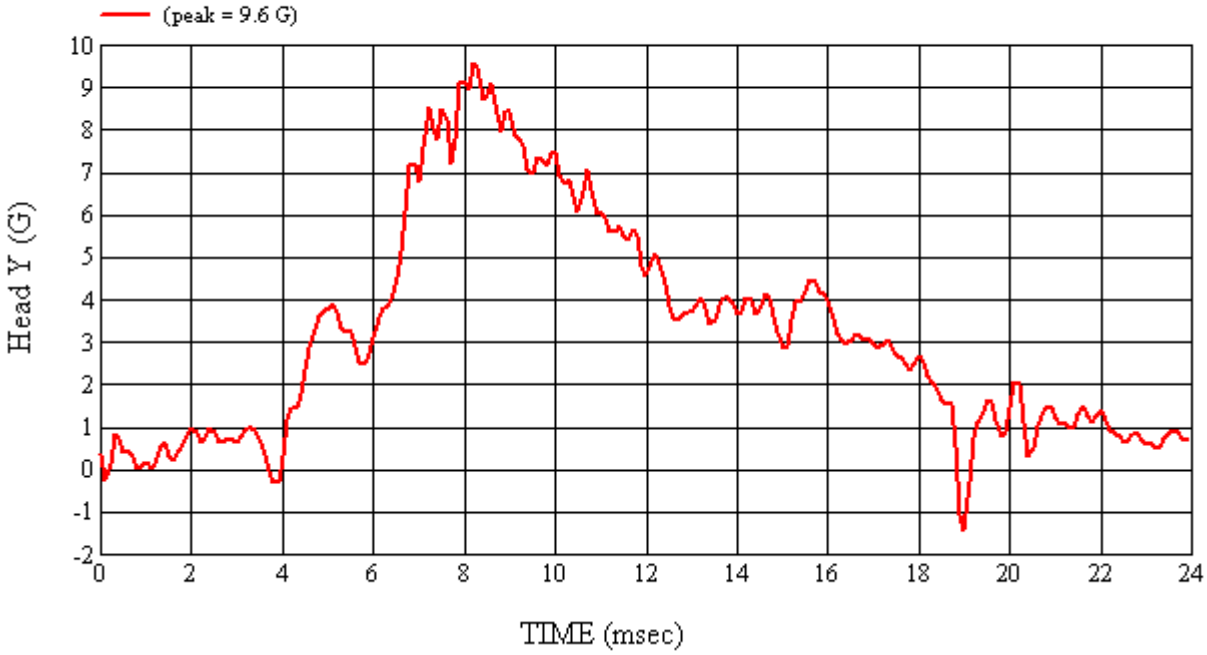
*Only necessary for NHTSA (Government) Compliance testing.

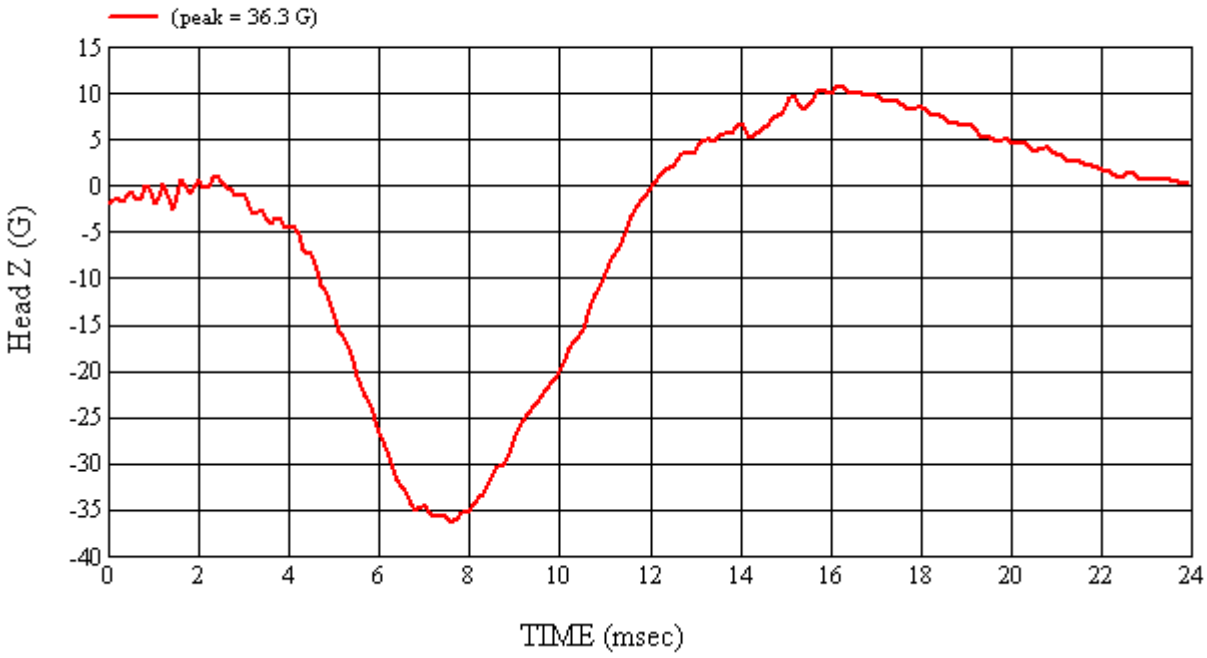
MGA Test #: FM9093 Target Location: OP2, Right Side Test Date: 4/29/2009

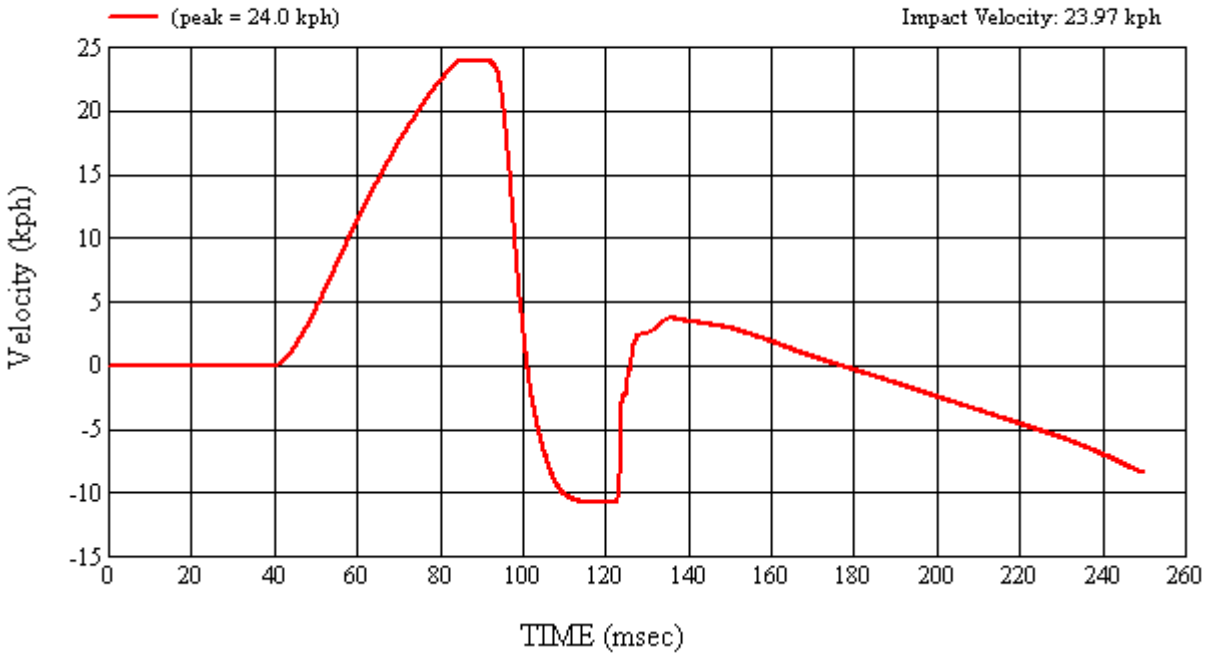


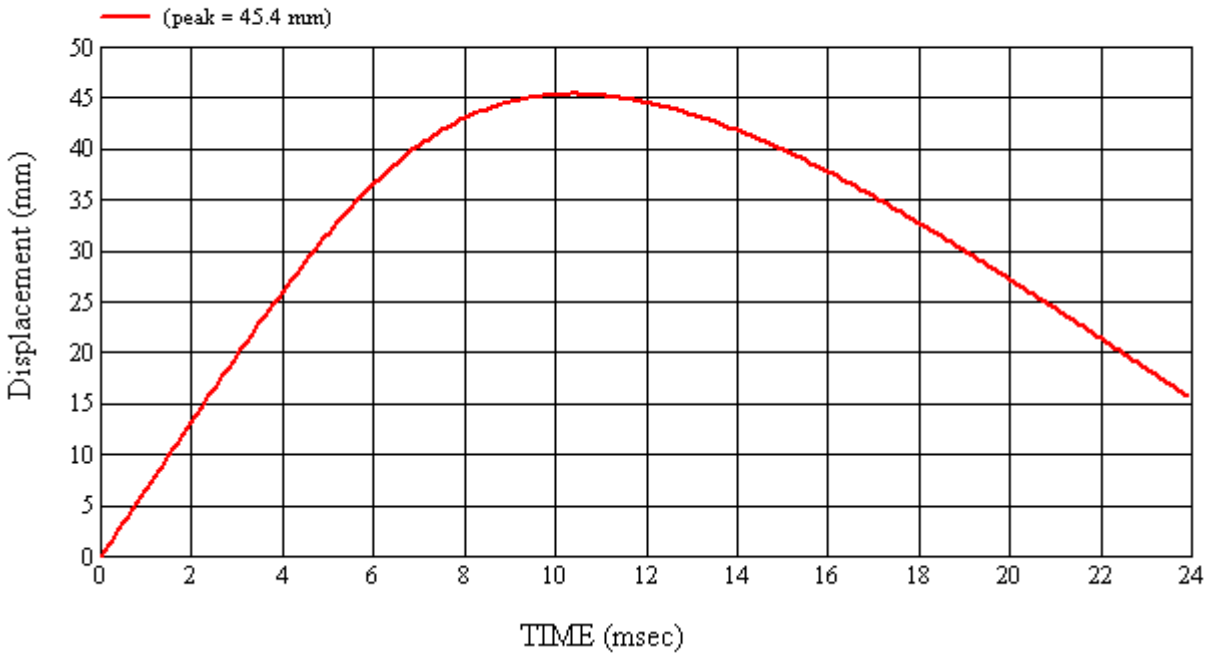



(peak = 119.1 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

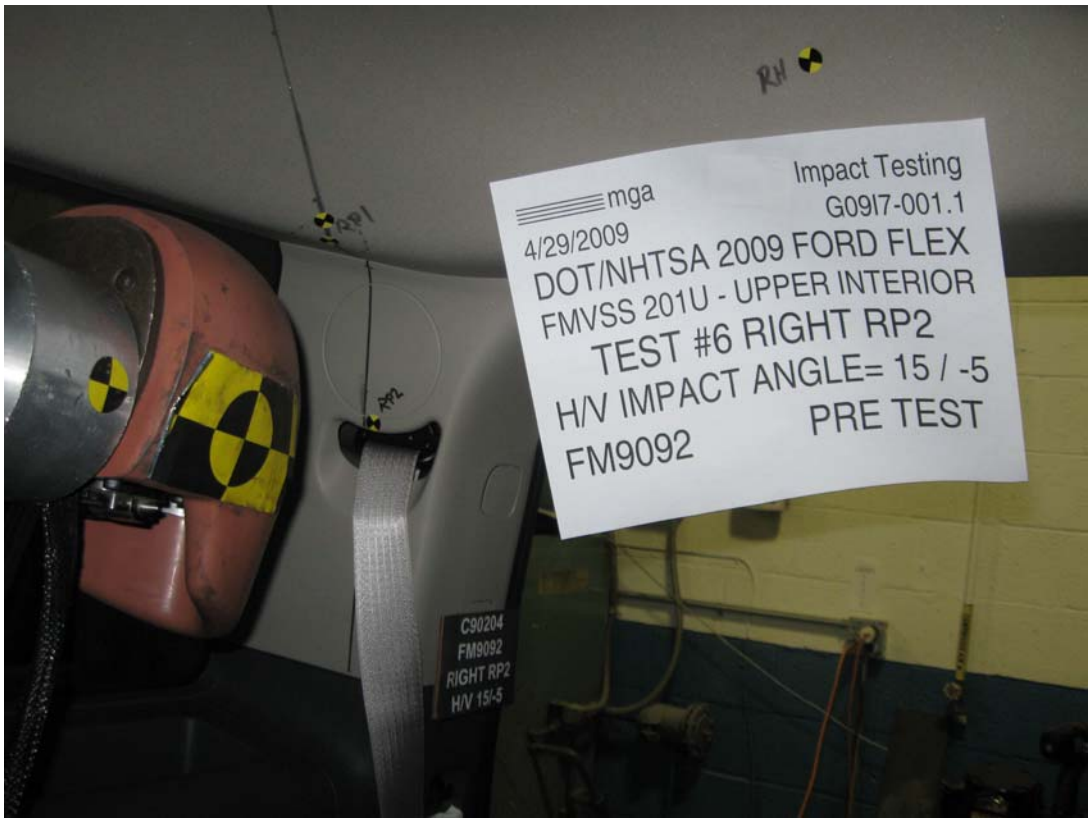

(peak = 9.6 G)
Head Y (G)
10
9
8
7
6
5
4
3
2
1
0
-1
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

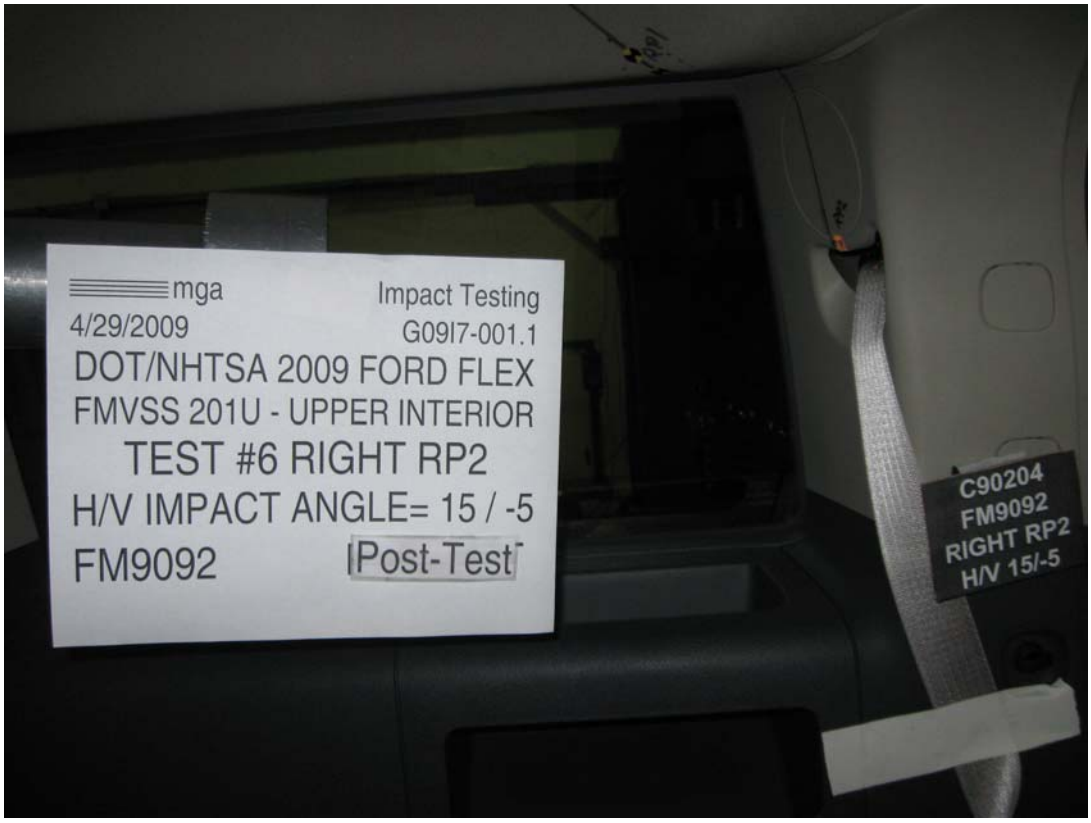

(peak = 36.3 G)
Head Z (G)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

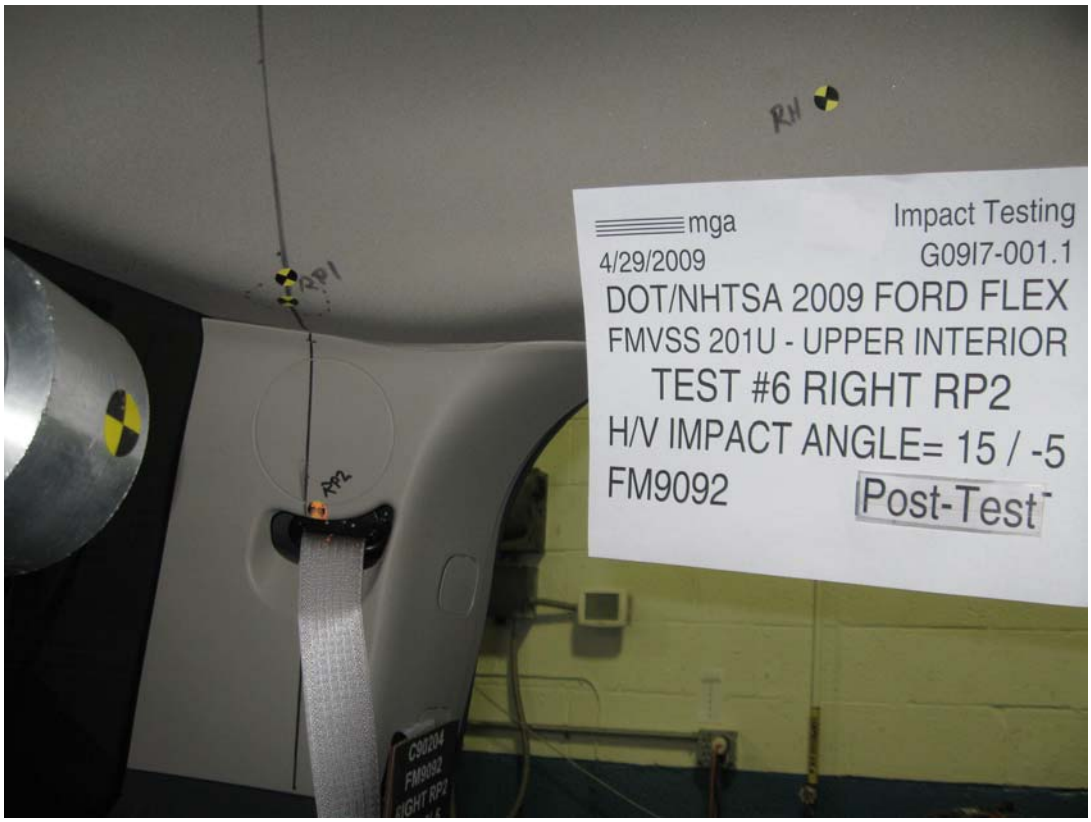

(peak = 24.0 kph)
Impact Velocity: 23.97 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 45.4 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
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #6 RIGHT RP2
H/V IMPACT ANGLE= 15 / -5
FM9092
PRE TEST
C90204
FM9092
RIGHT RP2
H/V 15/-5


RH
RP1
RP2
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #6 RIGHT RP2
H/V IMPACT ANGLE= 15 / -5
FM9092
PRE TEST
C90204
FM9092
RIGHT RP2
H/V 15/-5


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #6 RIGHT RP2
H/V IMPACT ANGLE= 15 / -5
FM9092
Post-Test
C90204
FM9092
RIGHT RP2
H/V 15/-5


RP1
RP2
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #6 RIGHT RP2
H/V IMPACT ANGLE= 15 / -5
FM9092
Post-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #6 RIGHT RP2
H/V IMPACT ANGLE= 15 / -5
FM9092
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#6

Target (Vehicle Side): RP2Right

Temperature:21.0C

MGA Test Reference No.:FM9092

Humidity:42.7%

Approach Horizontal Angles:15º

Time of Test:8:39:32 AM

Approach Vertical Angles:-5º

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
564	527	8.4	24.0	27	5 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

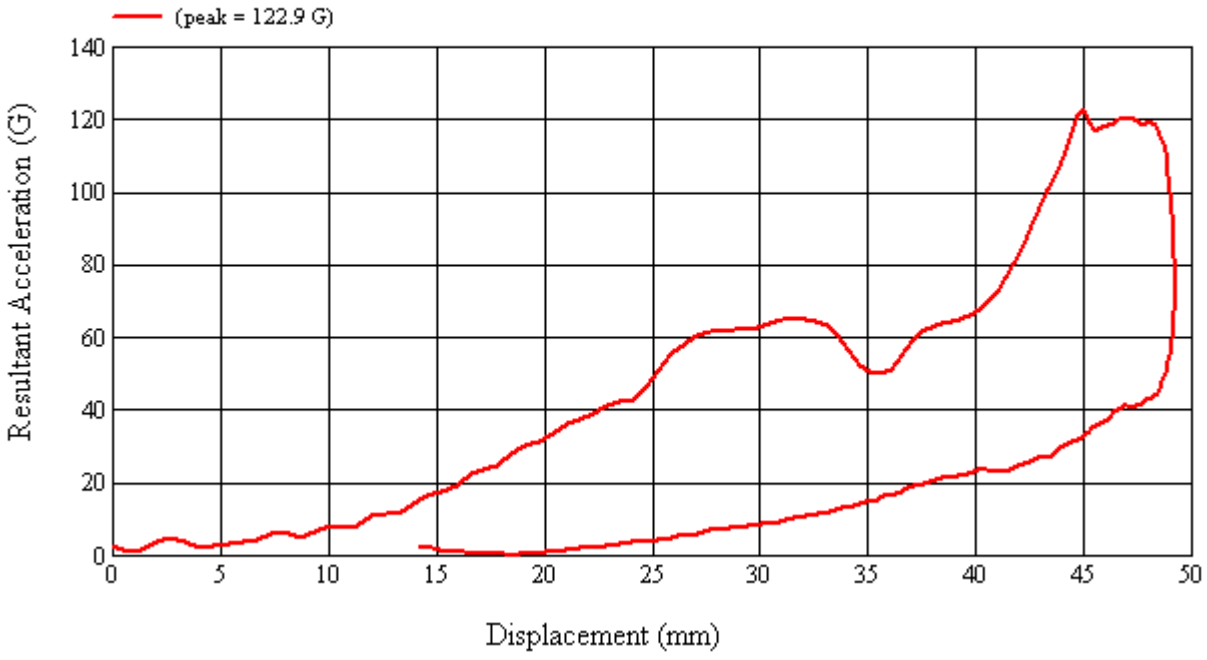
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

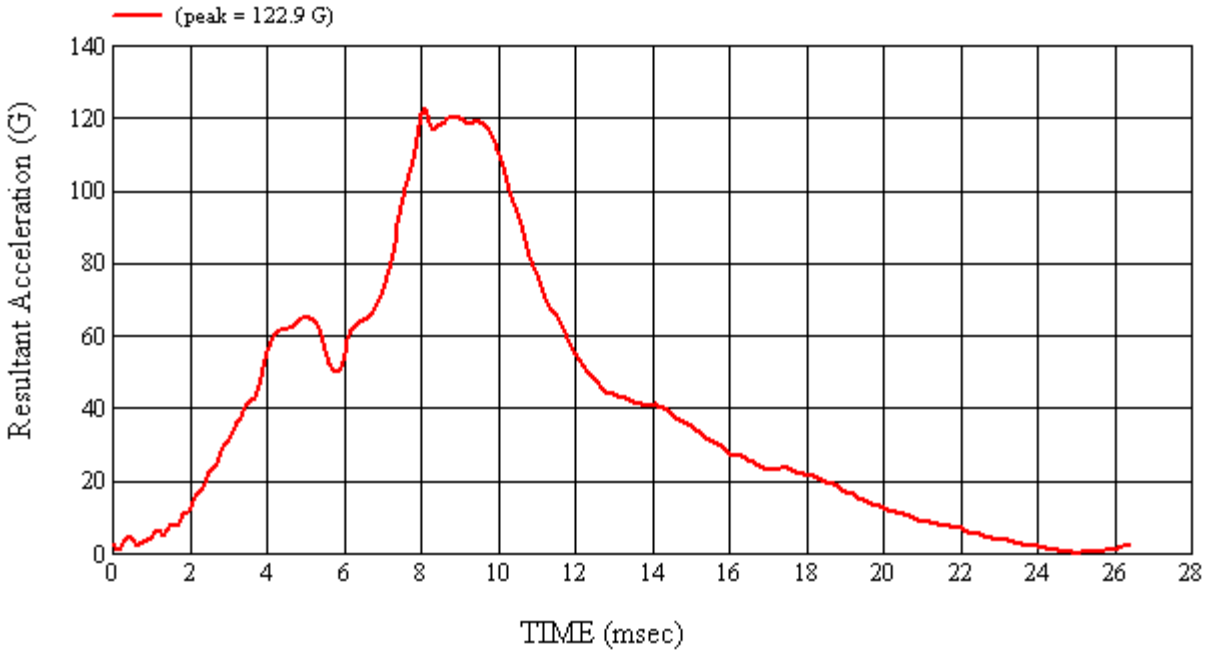
Dislodged trim panel

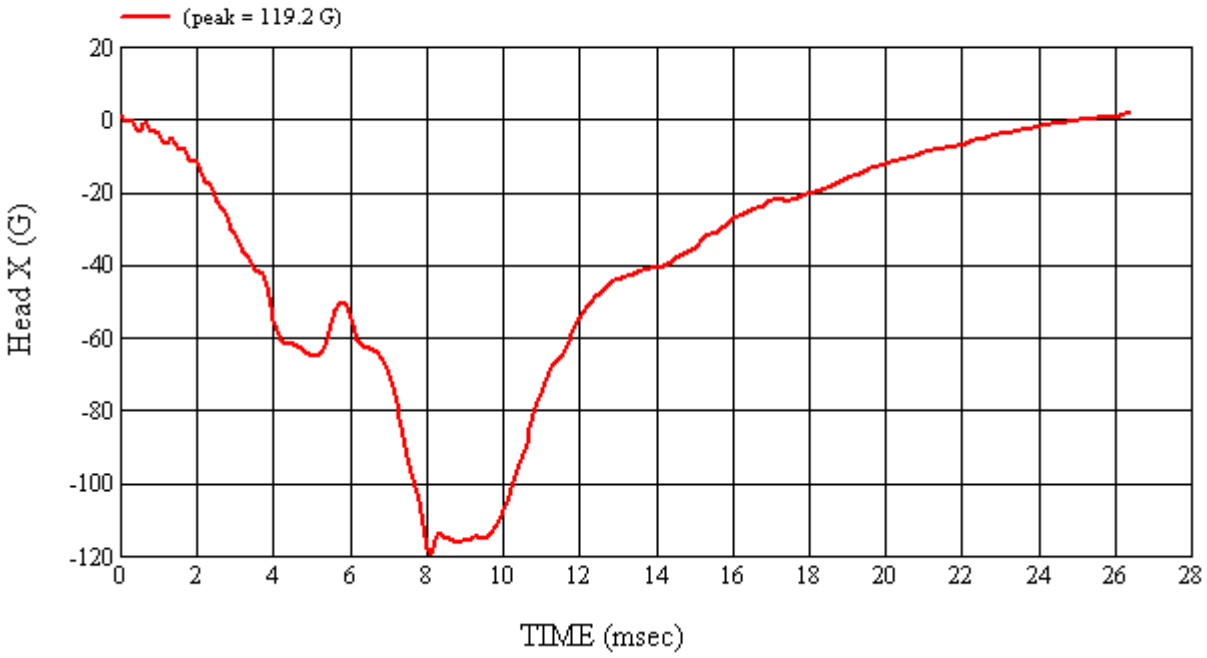
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

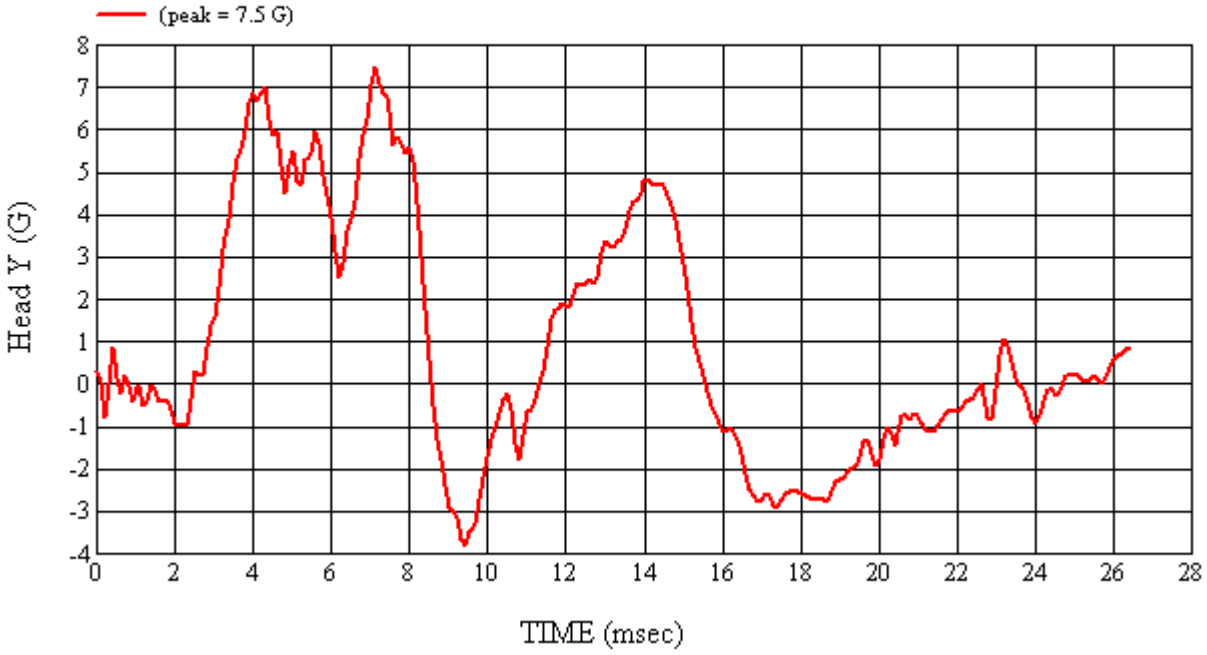
*Only necessary for NHTSA (Government) Compliance testing.

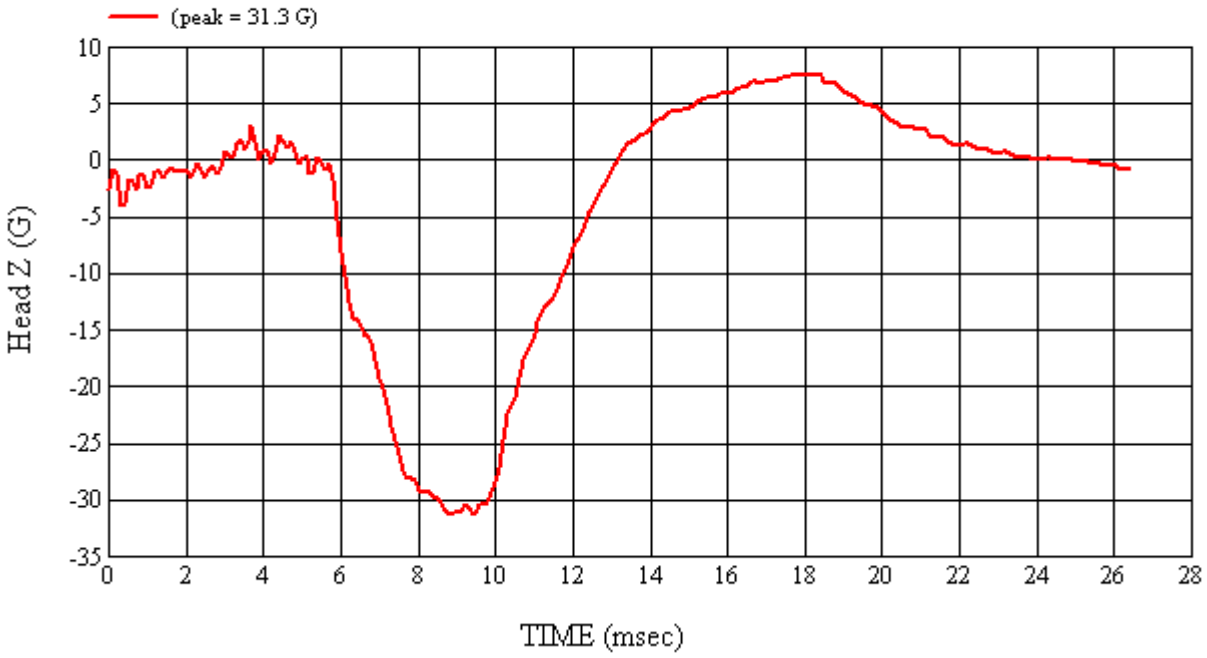
MGA Test #: FM9092 Target Location: RP2, Right Side Test Date: 4/29/2009

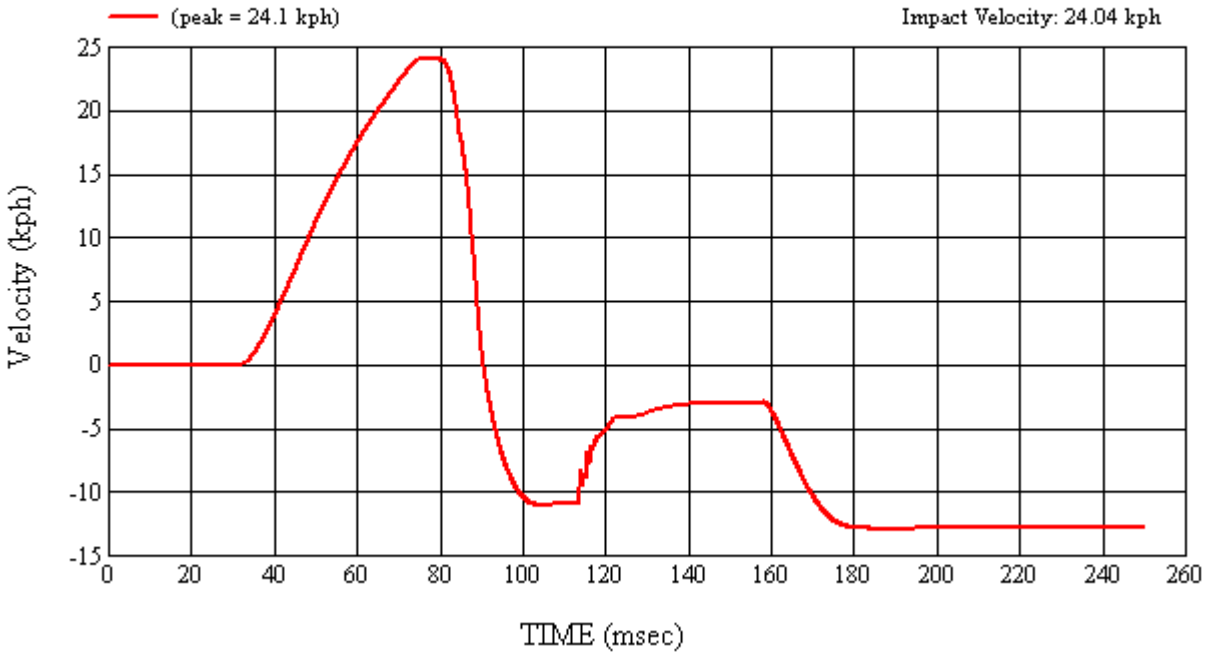


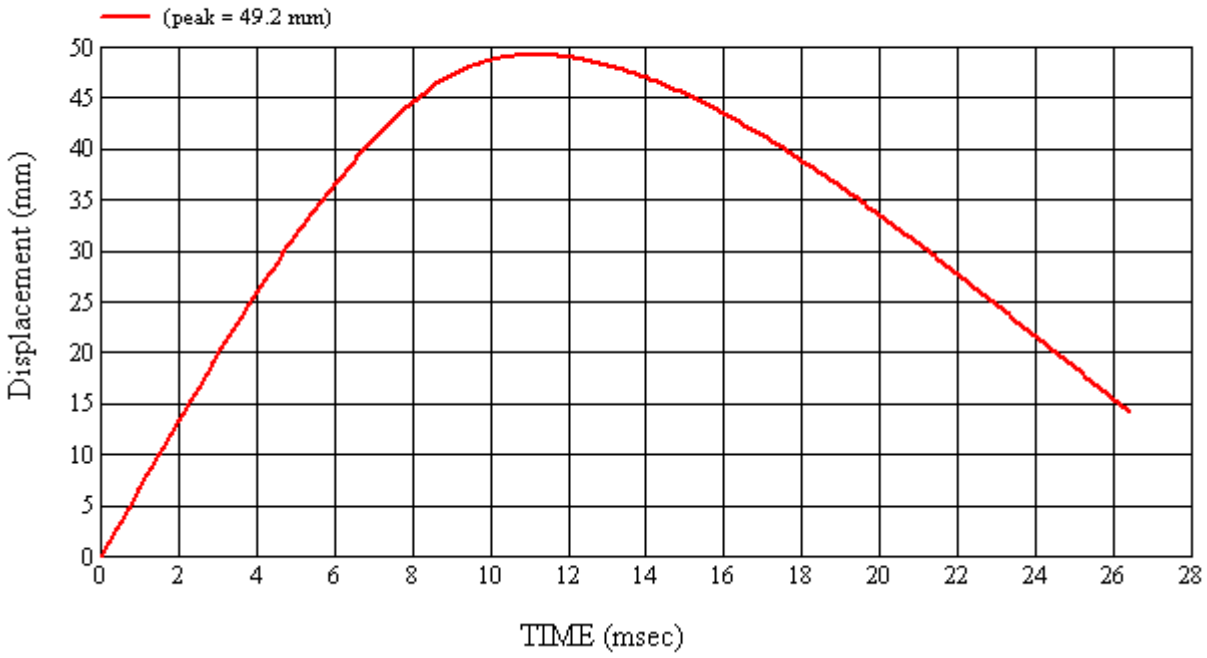



(peak = 119.2 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)

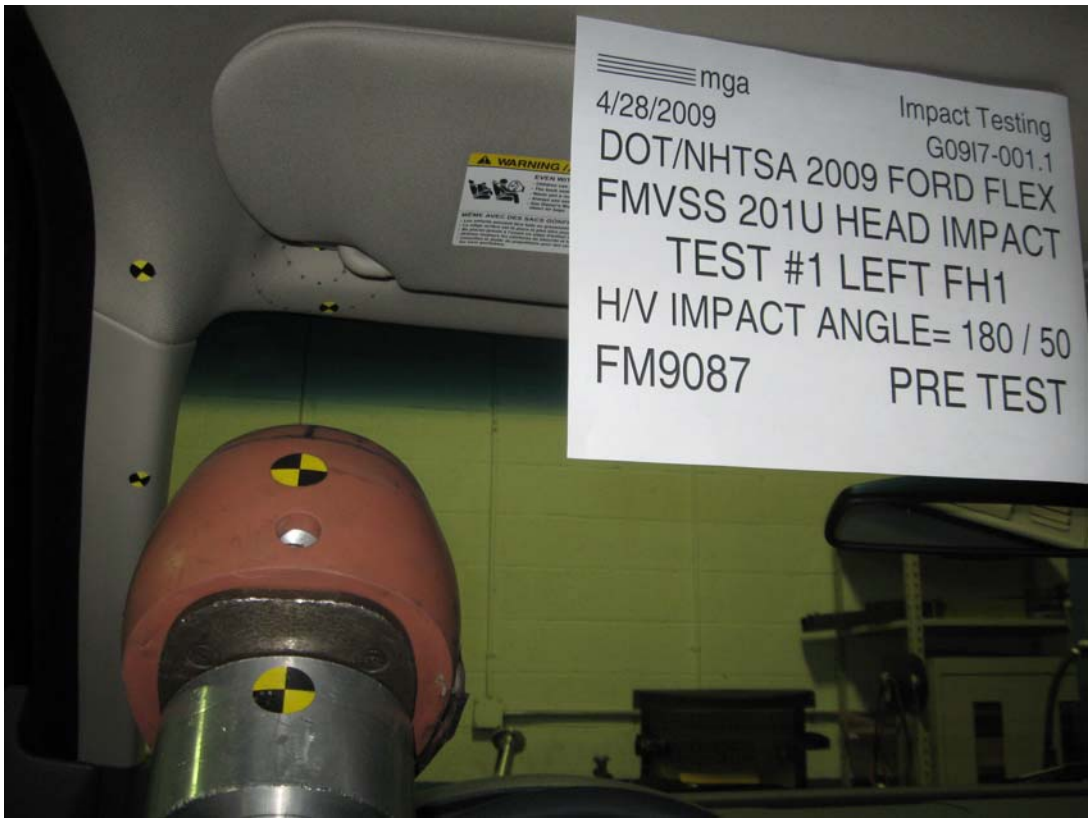

(peak = 7.5 G)
Head Y (G)
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)


(peak = 31.3 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
22
24
26
28
TIME (msec)

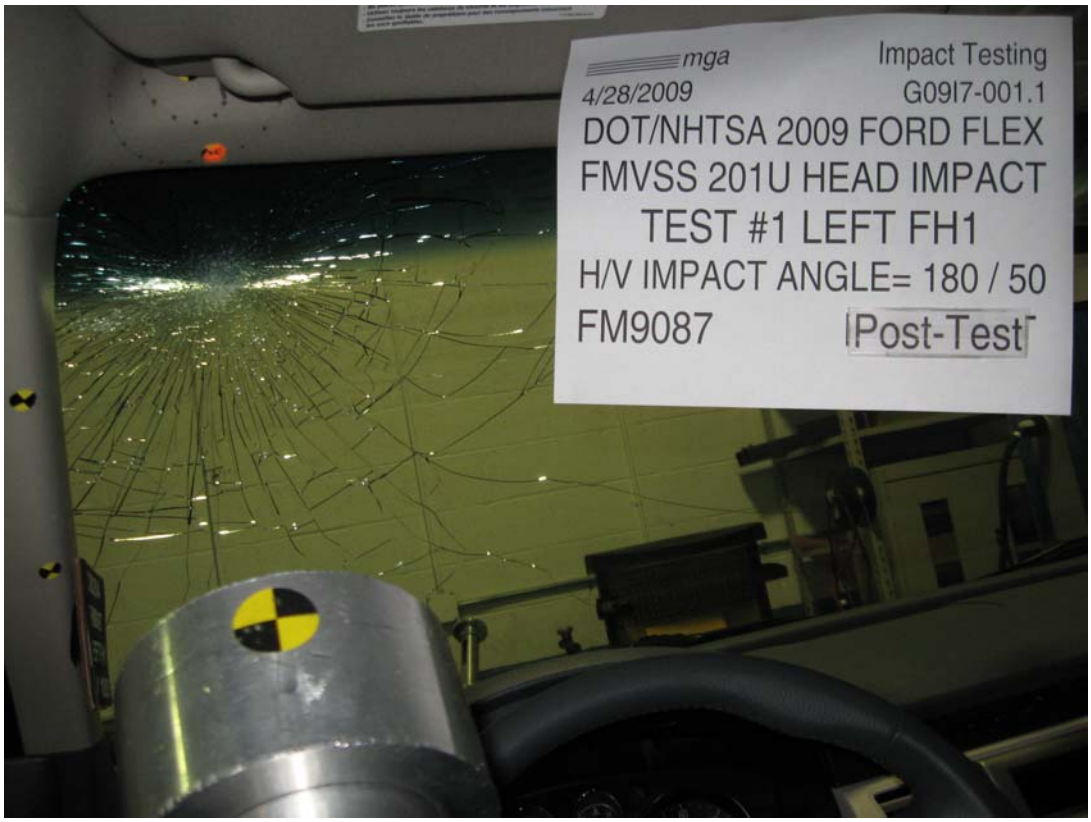

(peak = 24.1 kph)
Impact Velocity: 24.04 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

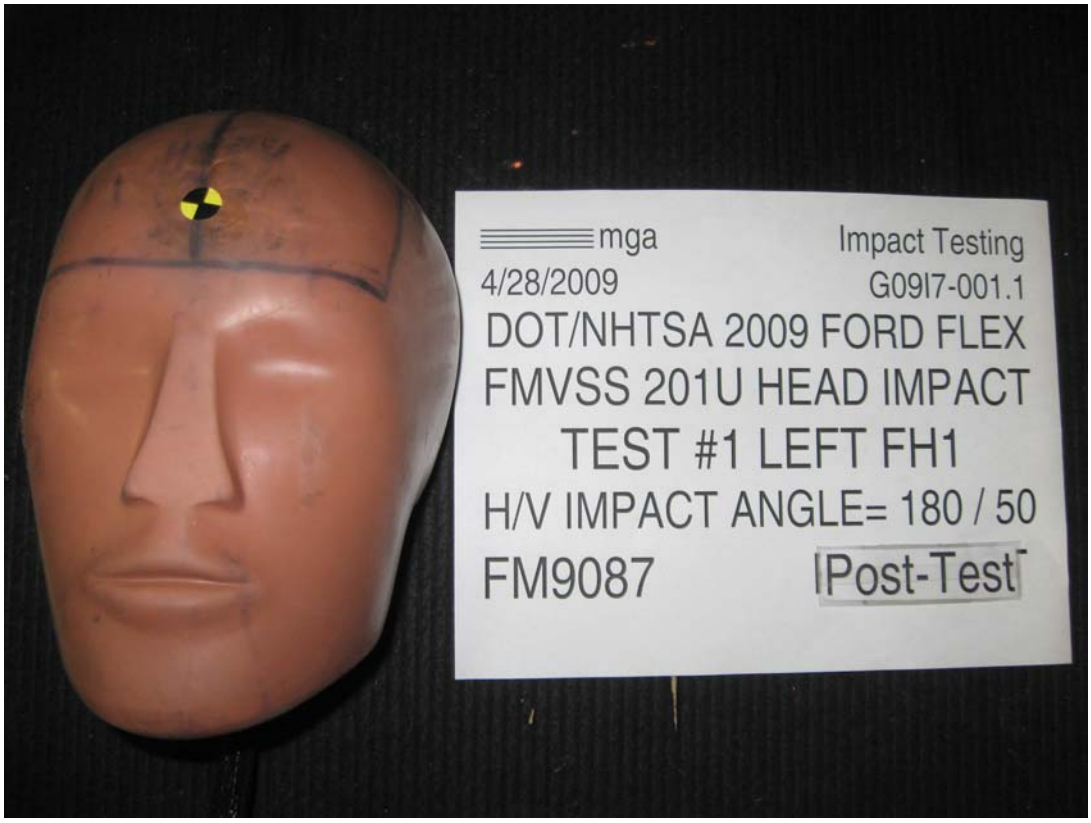

(peak = 49.2 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
50
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)


mga
4/28/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U HEAD IMPACT
TEST #1 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
FM9087
PRE TEST


mga
4/28/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U HEAD IMPACT
TEST #1 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
FM9087
PRE TEST


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U HEAD IMPACT
TEST #1 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
FM9087
Post-Test
C90204
FM9087
LEFT FH1
H/V 180/50


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U HEAD IMPACT
TEST #1 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
FM9087
Post-Test


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U HEAD IMPACT
TEST #1 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
FM9087
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#1

Target (Vehicle Side): FH1Left

Temperature:21.9C

MGA Test Reference No.:FM9087

Humidity:53.7%

Approach Horizontal Angles:180º

Time of Test:11:03:56 AM

Approach Vertical Angles:50º

FMH Serial No:[035]

Additional Description:2 Relocation Spheres

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
575	541	5.5	24.0	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	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

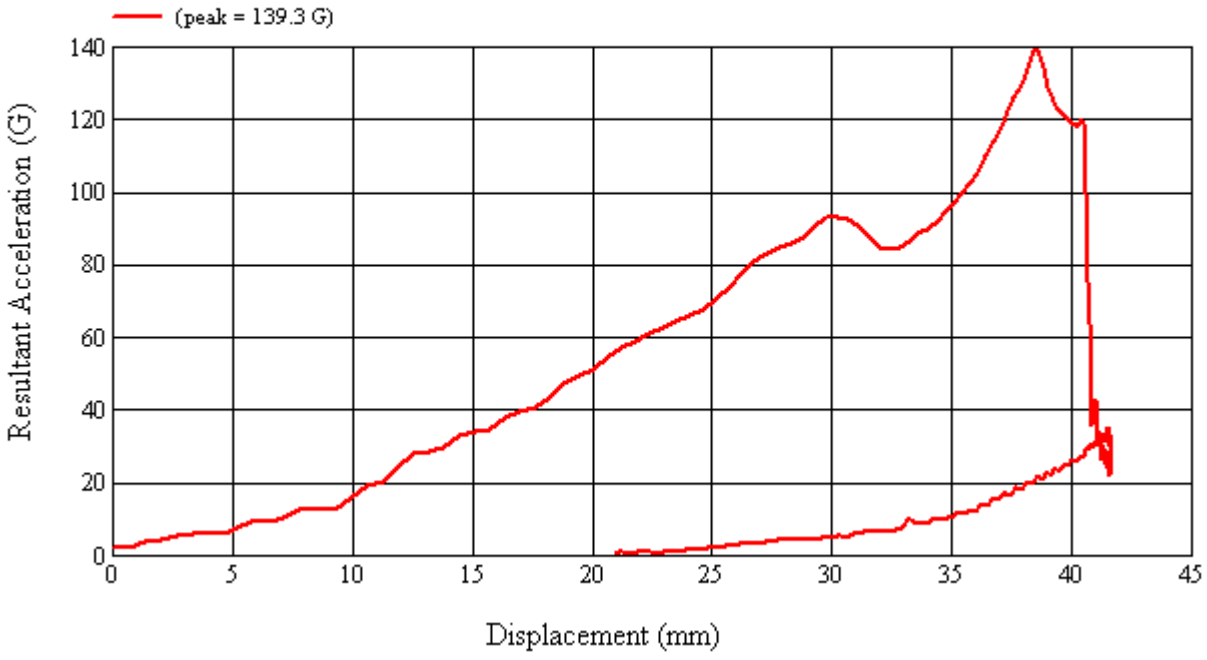
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

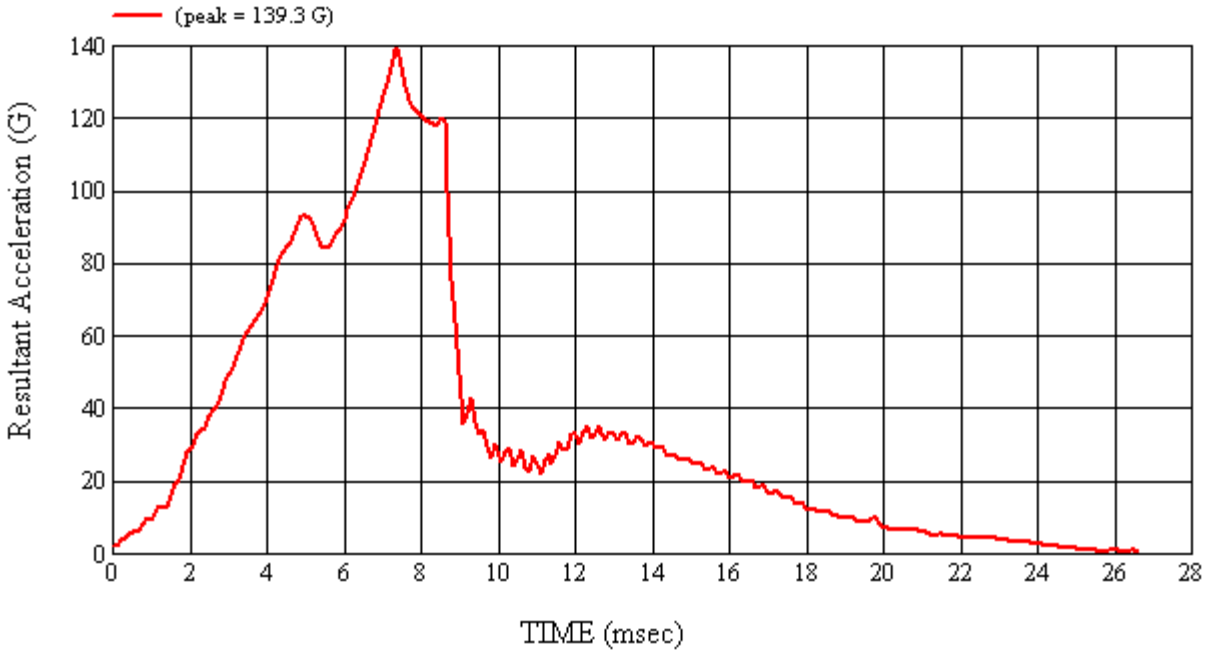
Windshield broke after FMH chin rotation.

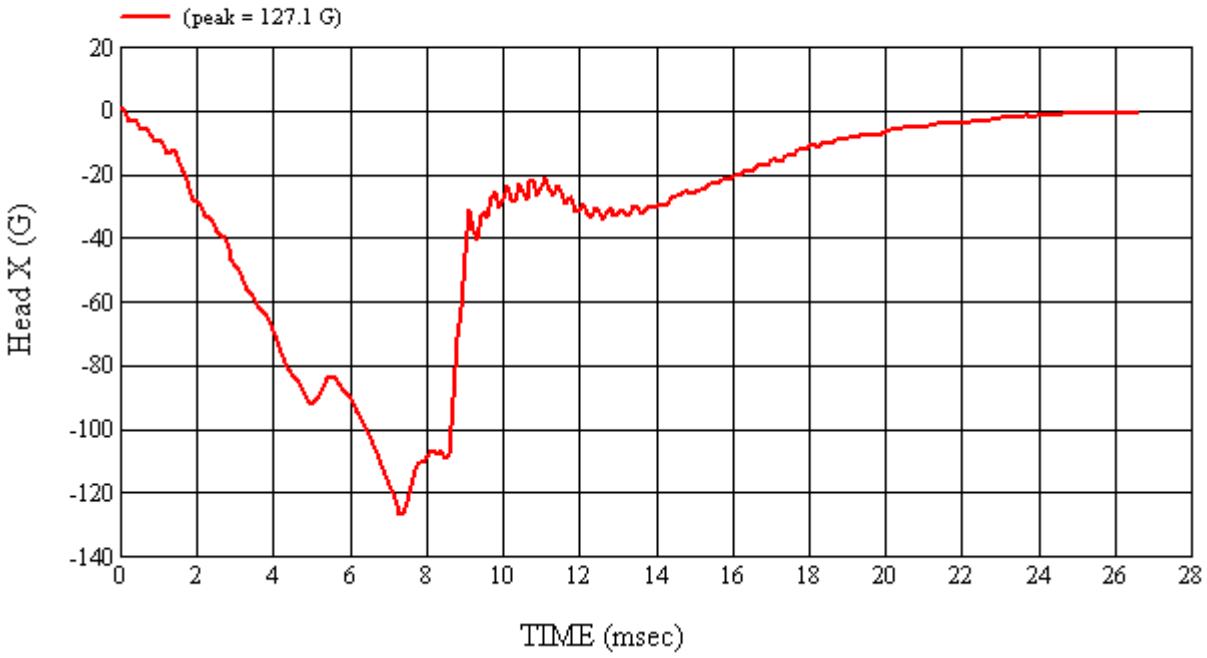
Recorded By:_____ Approved By*: _____ Date: 4/28/2009

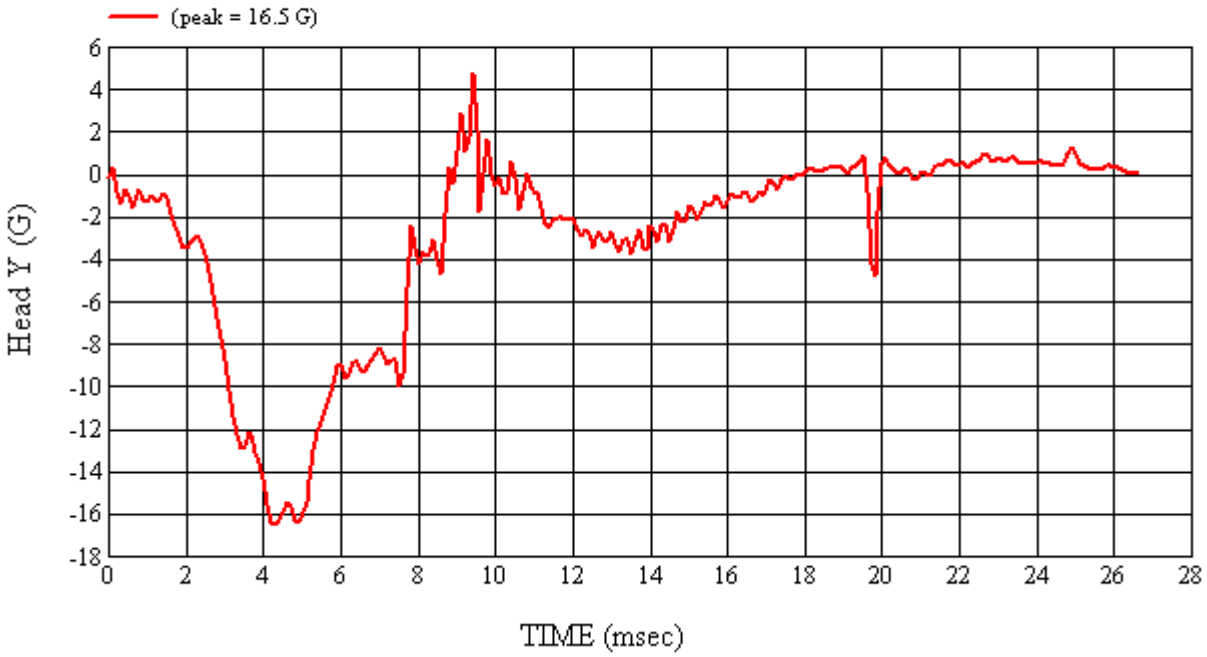
*Only necessary for NHTSA (Government) Compliance testing.

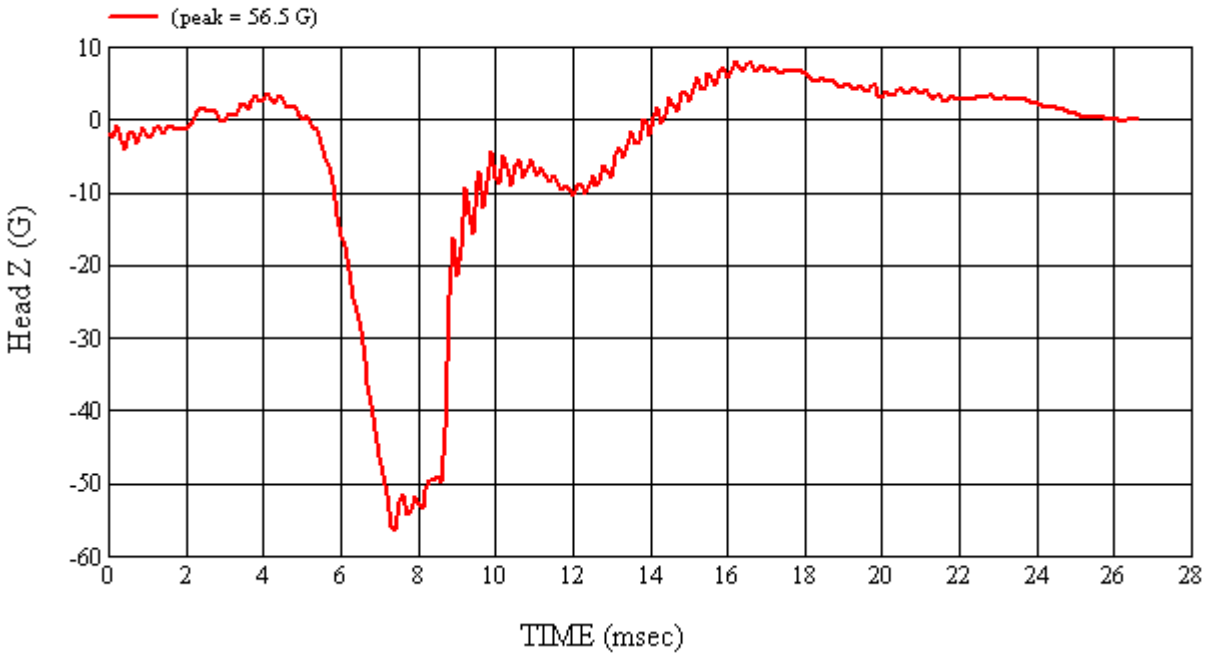
MGA Test #: FM9087 Target Location: FH1, Left Side Test Date: 4/28/2009

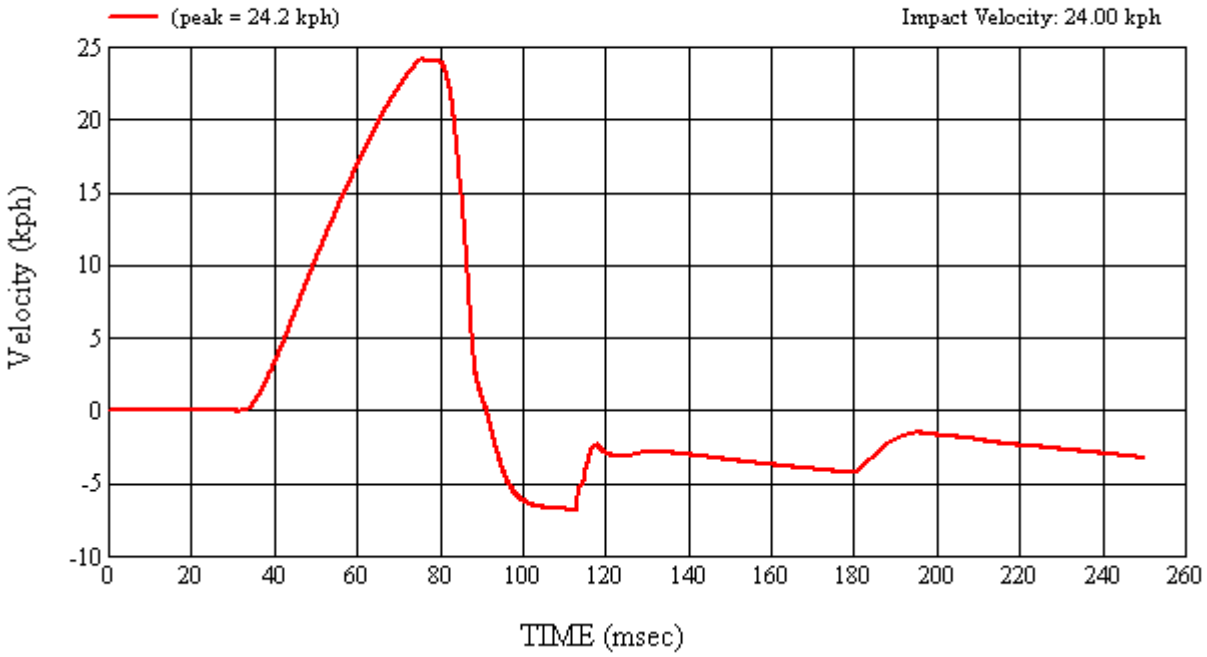


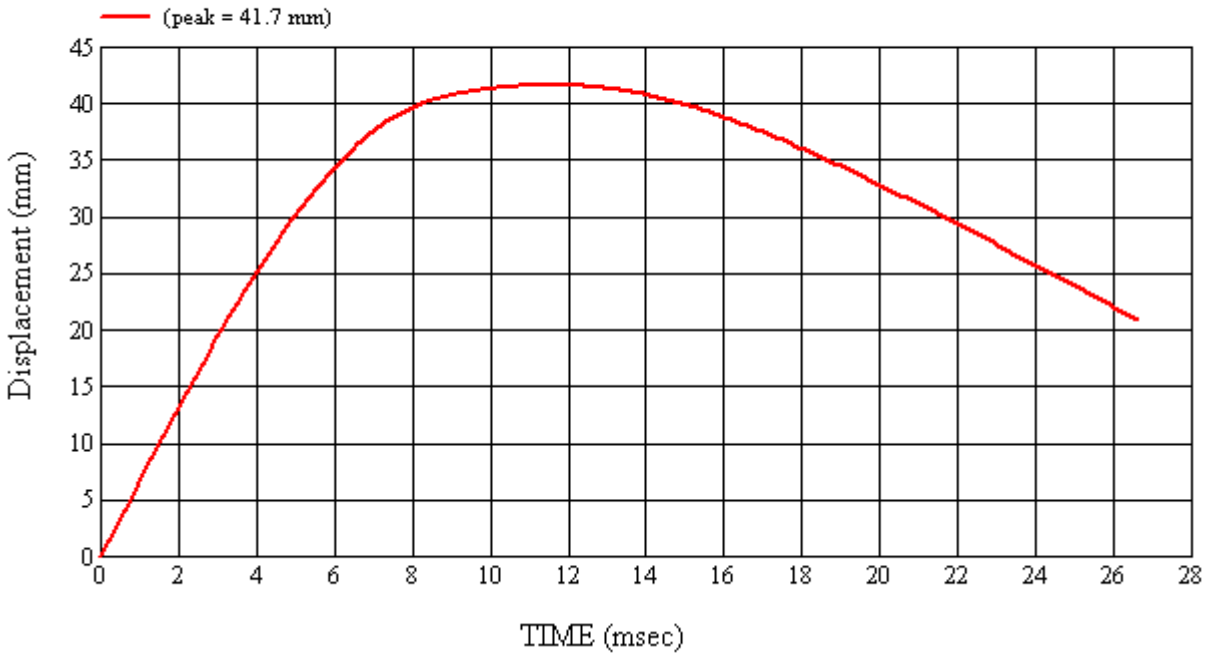



(peak = 127.1 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)

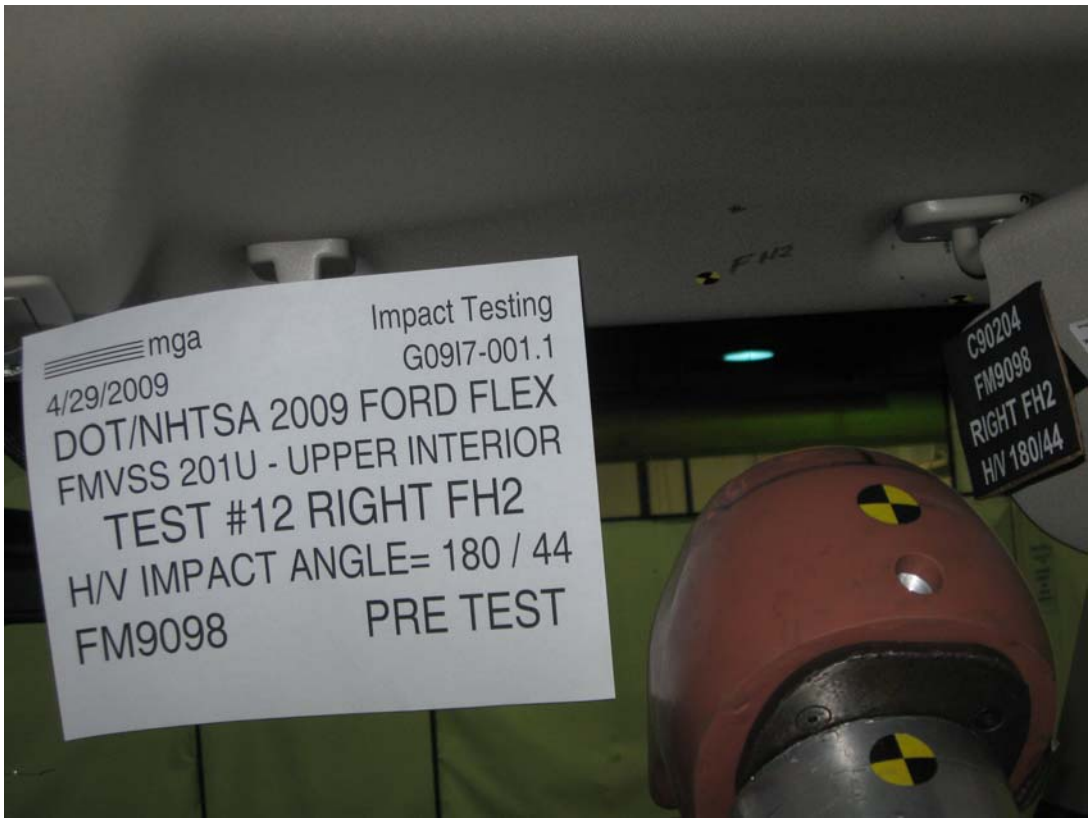

(peak = 16.5 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)


(peak = 56.5 G)
Head Z (G)
10
0
-10
-20
-30
-40
-50
-60
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
TIME (msec)

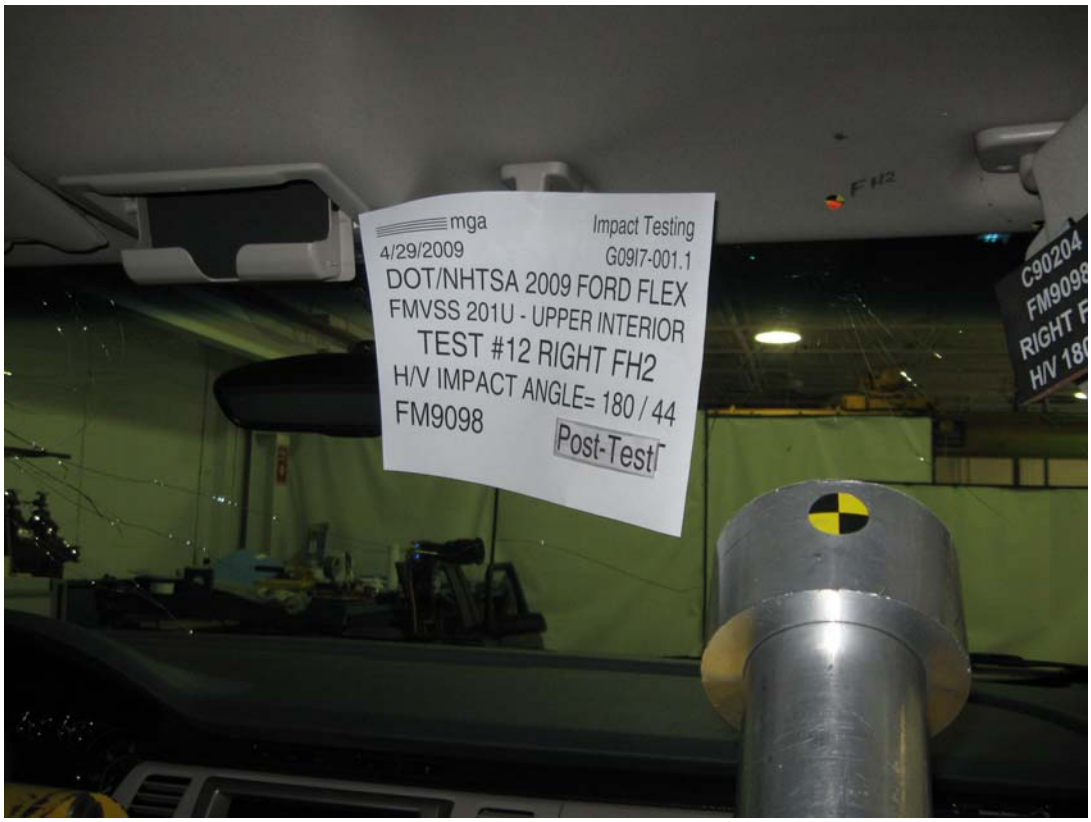

(peak = 24.2 kph)
Impact Velocity: 24.00 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 41.7 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
28
TIME (msec)


mga
4/29/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT FH2
H/V IMPACT ANGLE= 180 / 44
FM9098
PRE TEST


mga
4/29/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT FH2
H/V IMPACT ANGLE= 180 / 44
FM9098
PRE TEST
C90204
FM9098
RIGHT FH2
H/V 180/44


C90204
FM9098
RIGHT FH2
H/V 180/44
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT FH2
H/V IMPACT ANGLE= 180 / 44
FM9098
Post-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT FH2
H/V IMPACT ANGLE= 180 / 44
FM9098
Post-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #12 RIGHT FH2
H/V IMPACT ANGLE= 180 / 44
FM9098
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#12

Target (Vehicle Side): FH2Right

Temperature:21.2C

MGA Test Reference No.:FM9098

Humidity:47.0%

Approach Horizontal Angles:180º

Time of Test:3:24:32 PM

Approach Vertical Angles:44º

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
489	428	6.7	24.0	14	10 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

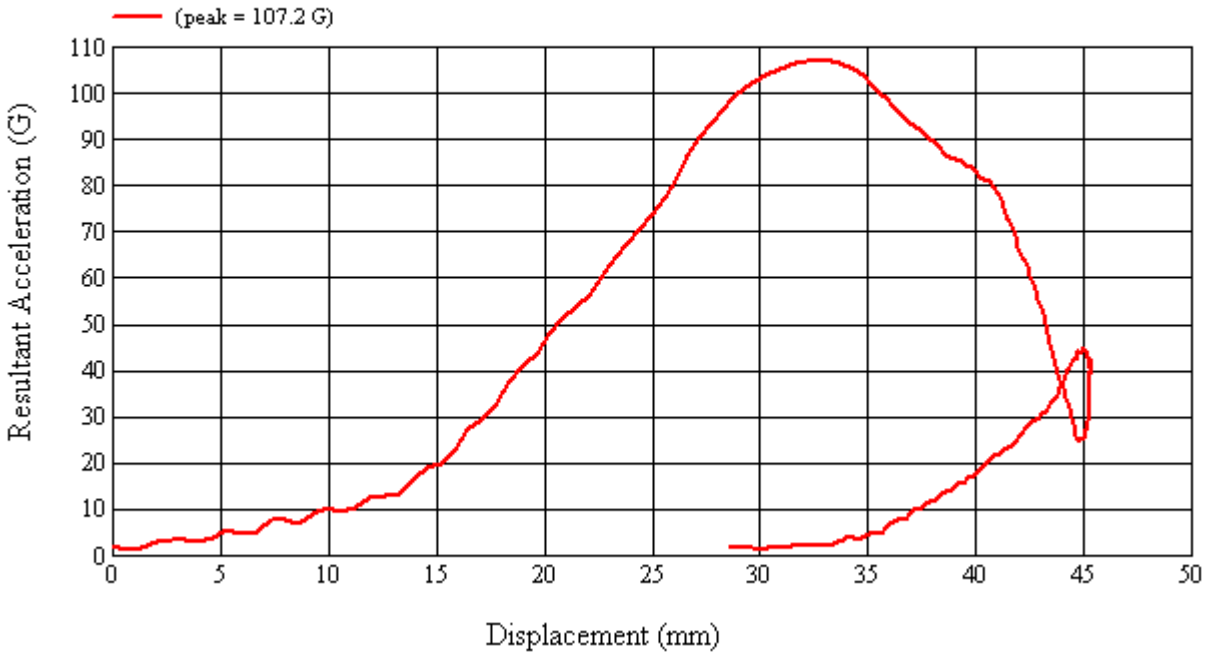
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

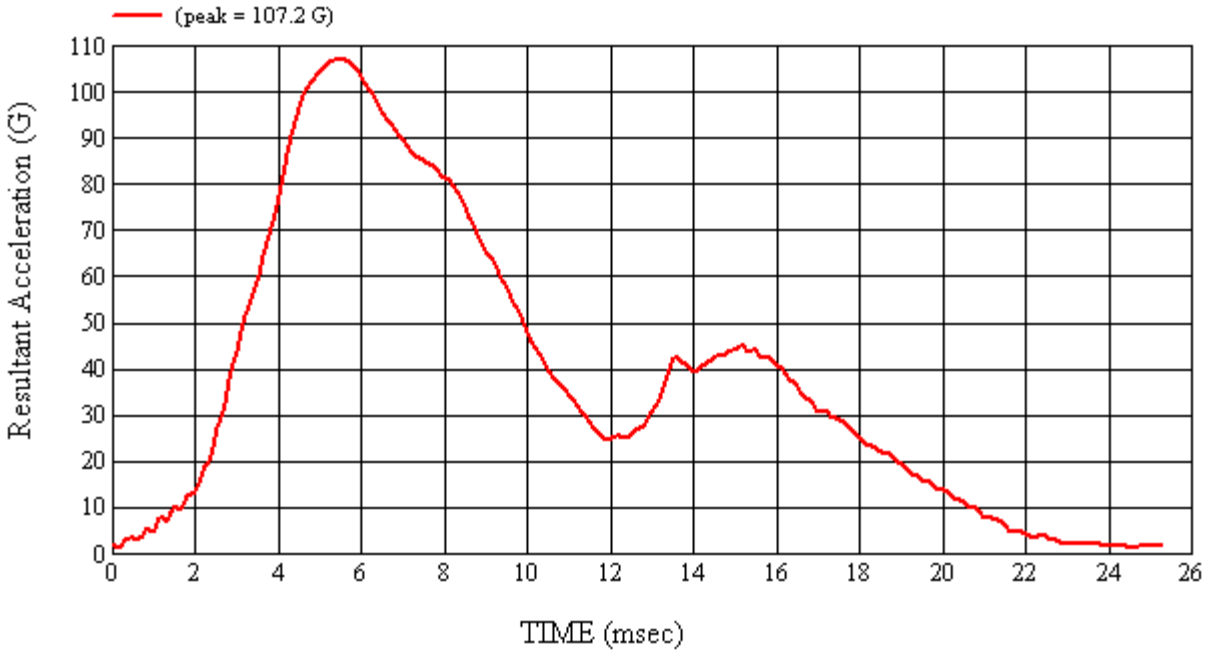
Overhead console opened during impact; Windshield broke after FMH chin rotation.

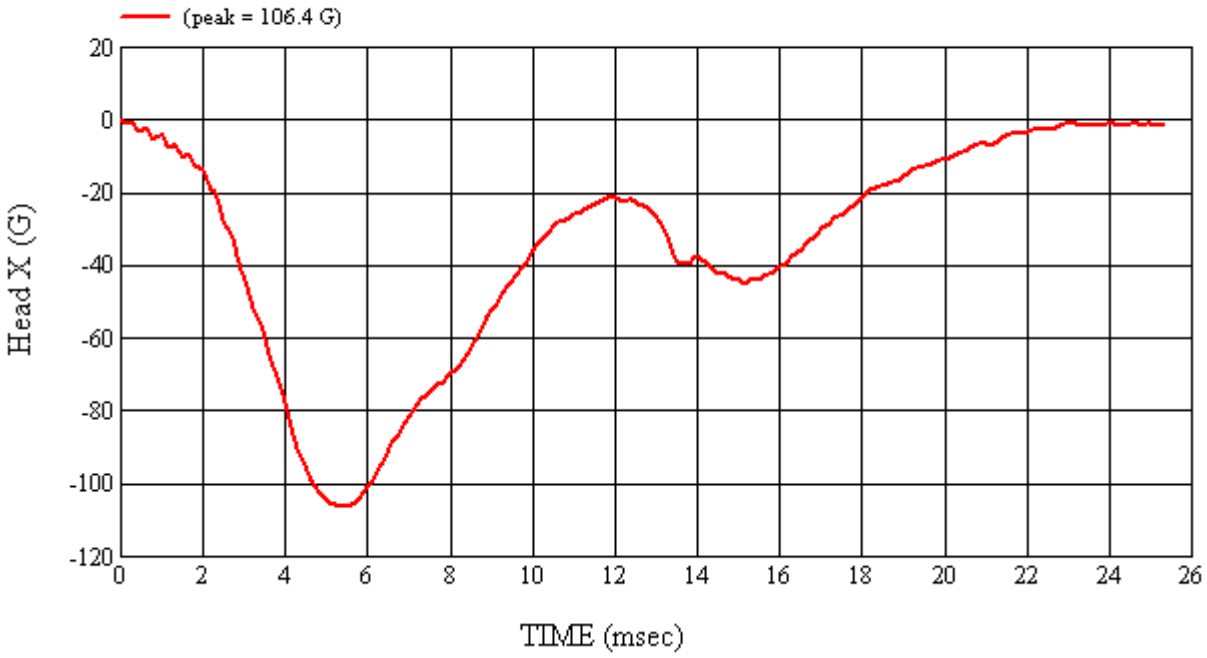
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

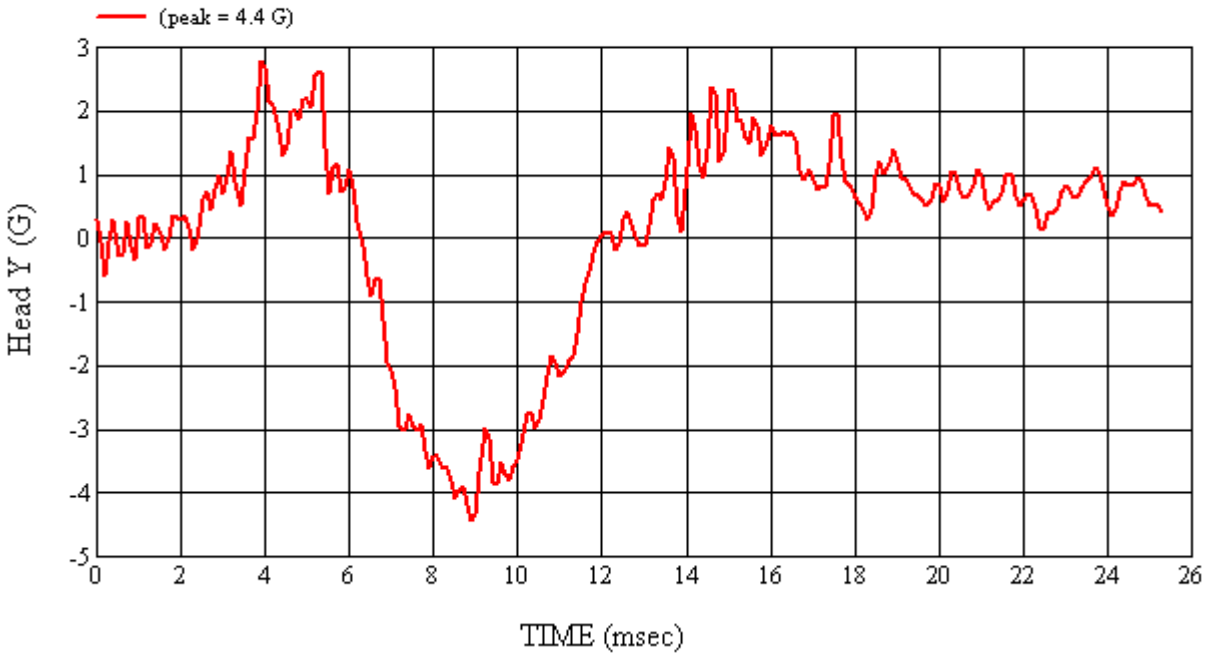
*Only necessary for NHTSA (Government) Compliance testing.

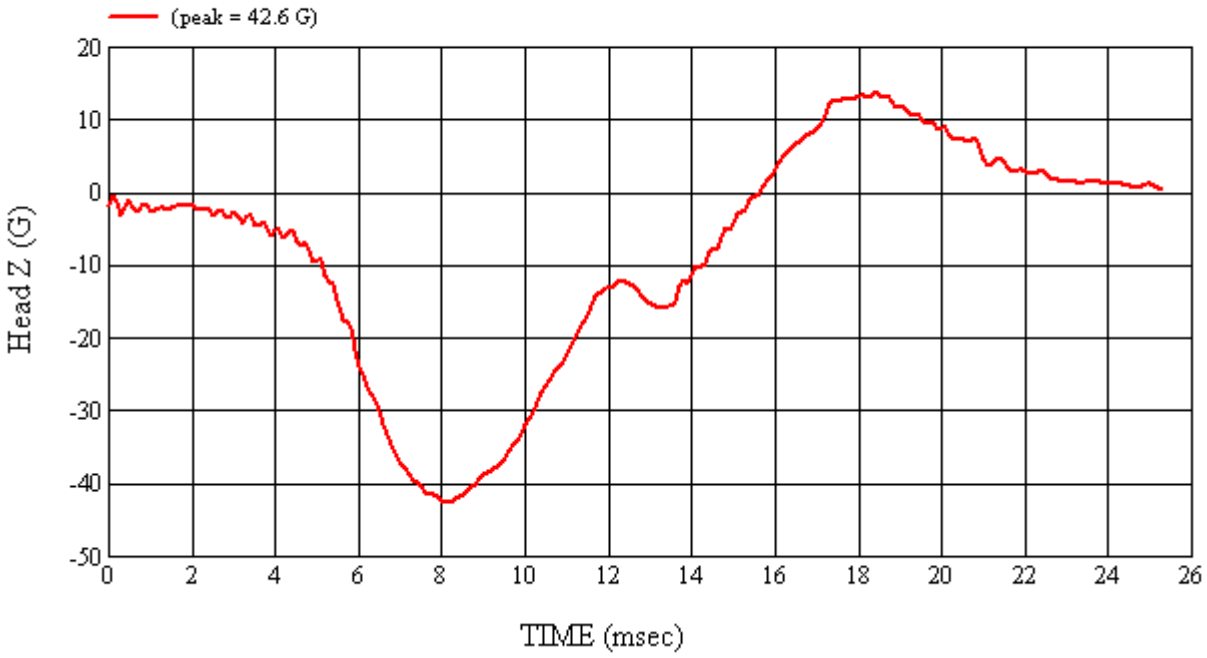
MGA Test #: FM9098 Target Location: FH2, Right Side Test Date: 4/29/2009

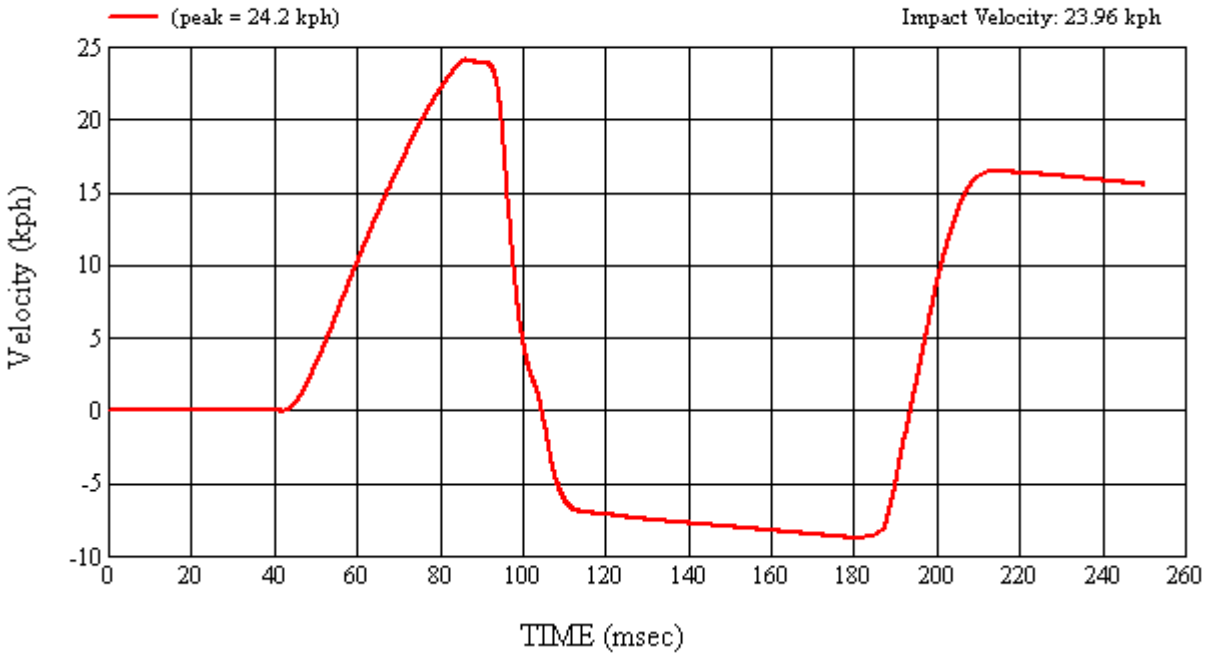


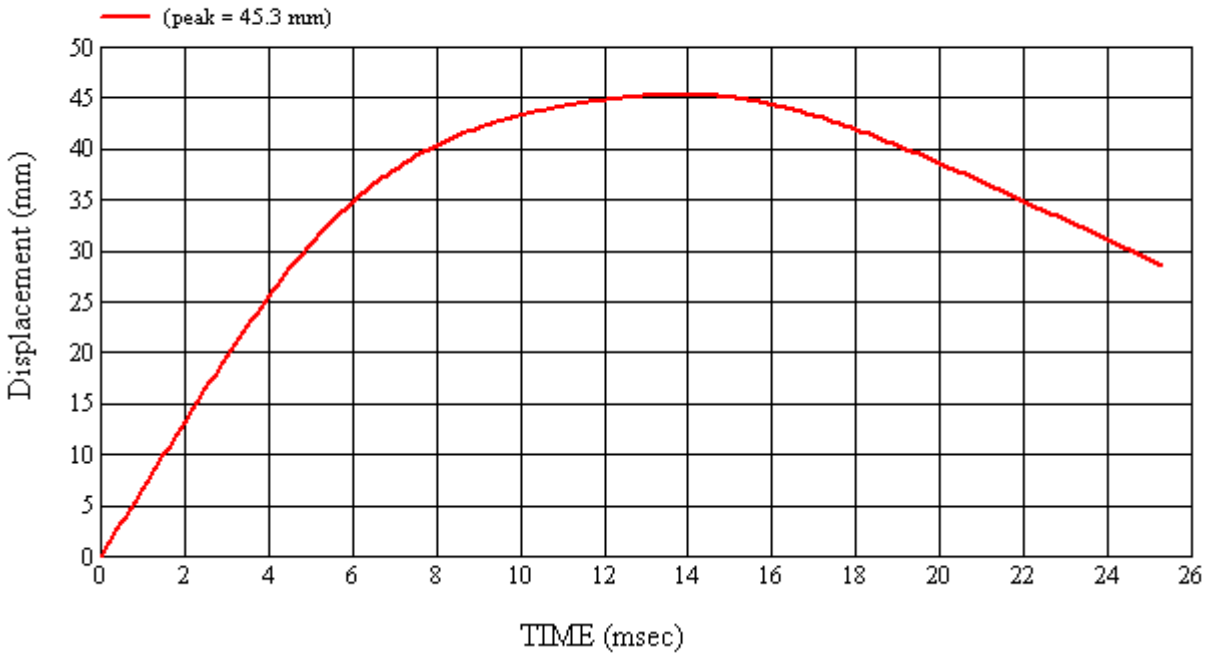


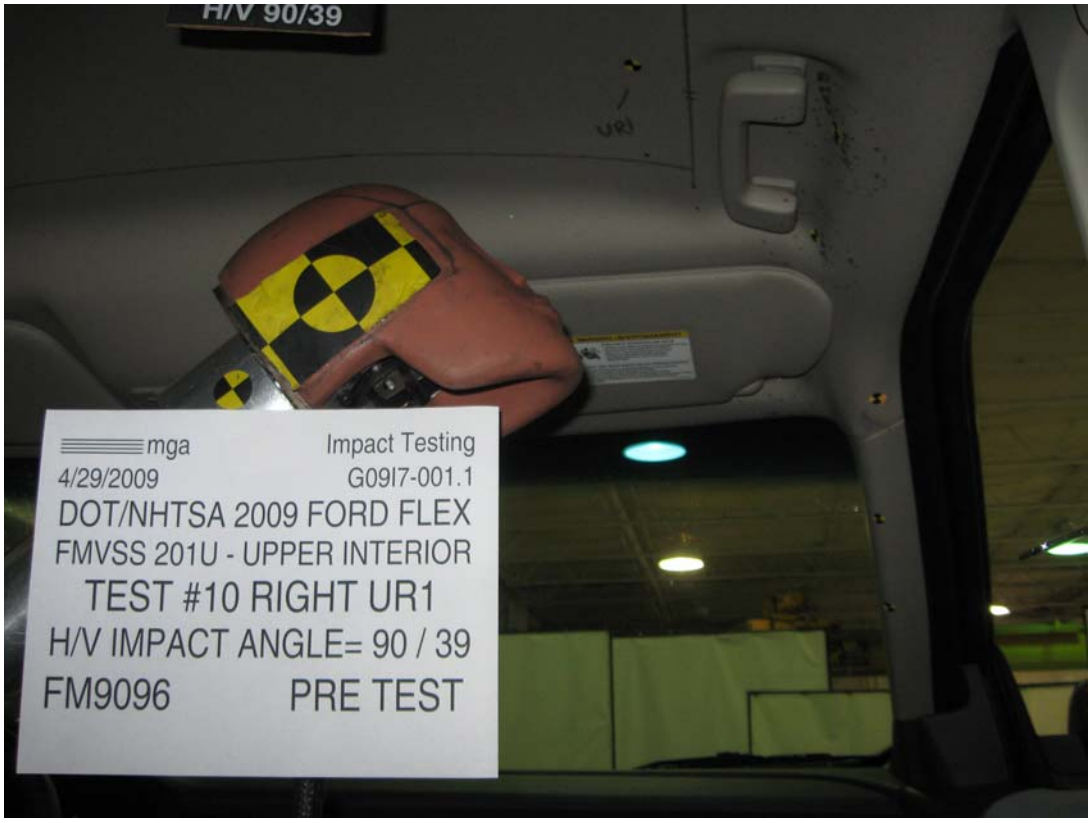

(peak = 106.4 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

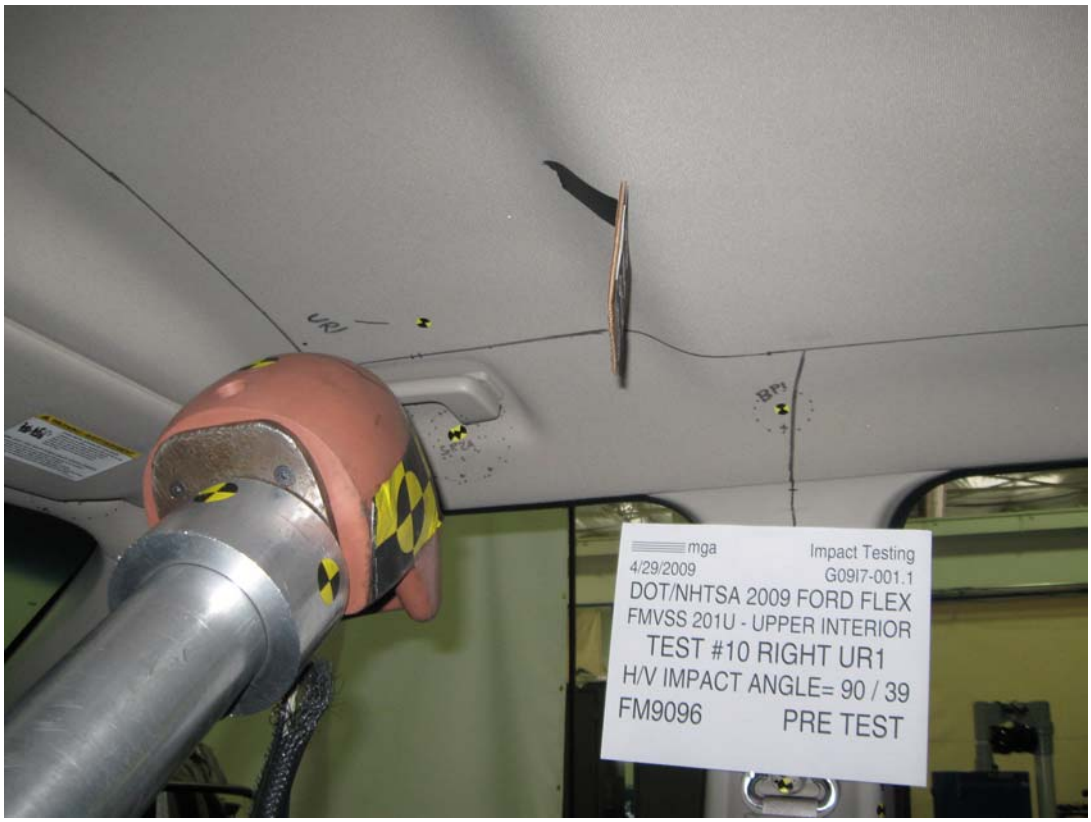

(peak = 4.4 G)
Head Y (G)
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

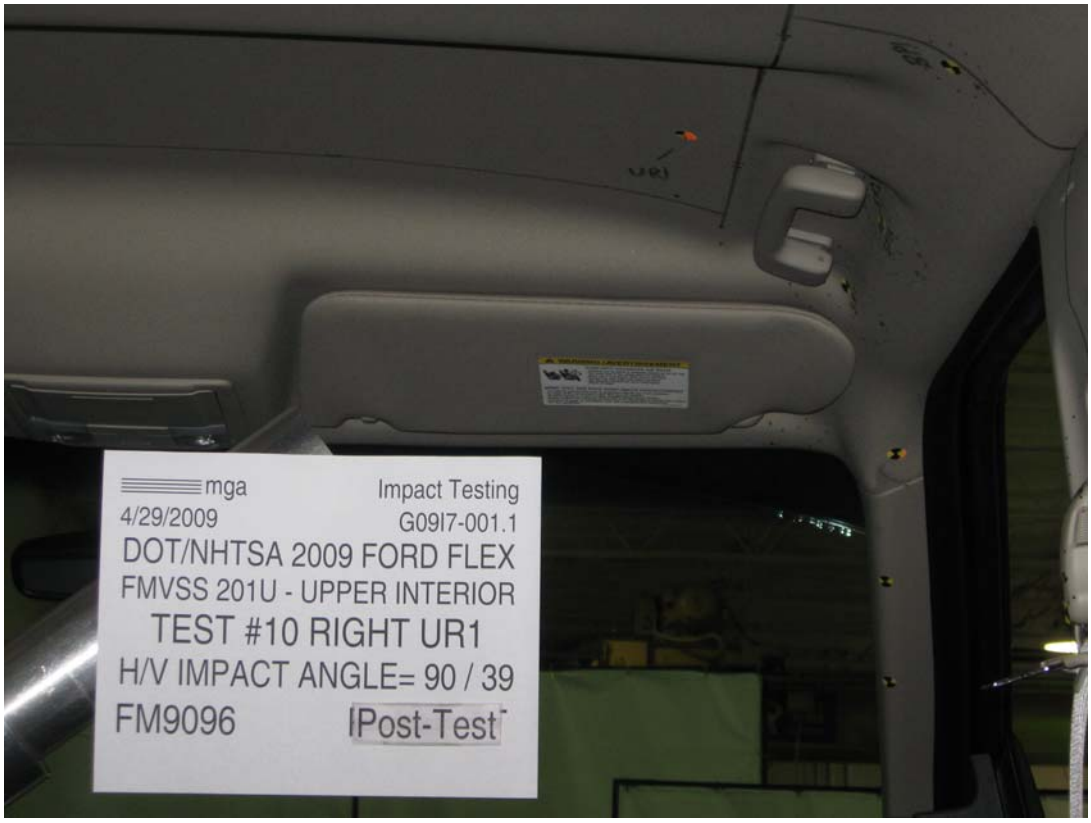

(peak = 42.6 G)
Head Z (G)
20
10
0
-10
-20
-30
-40
-50
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

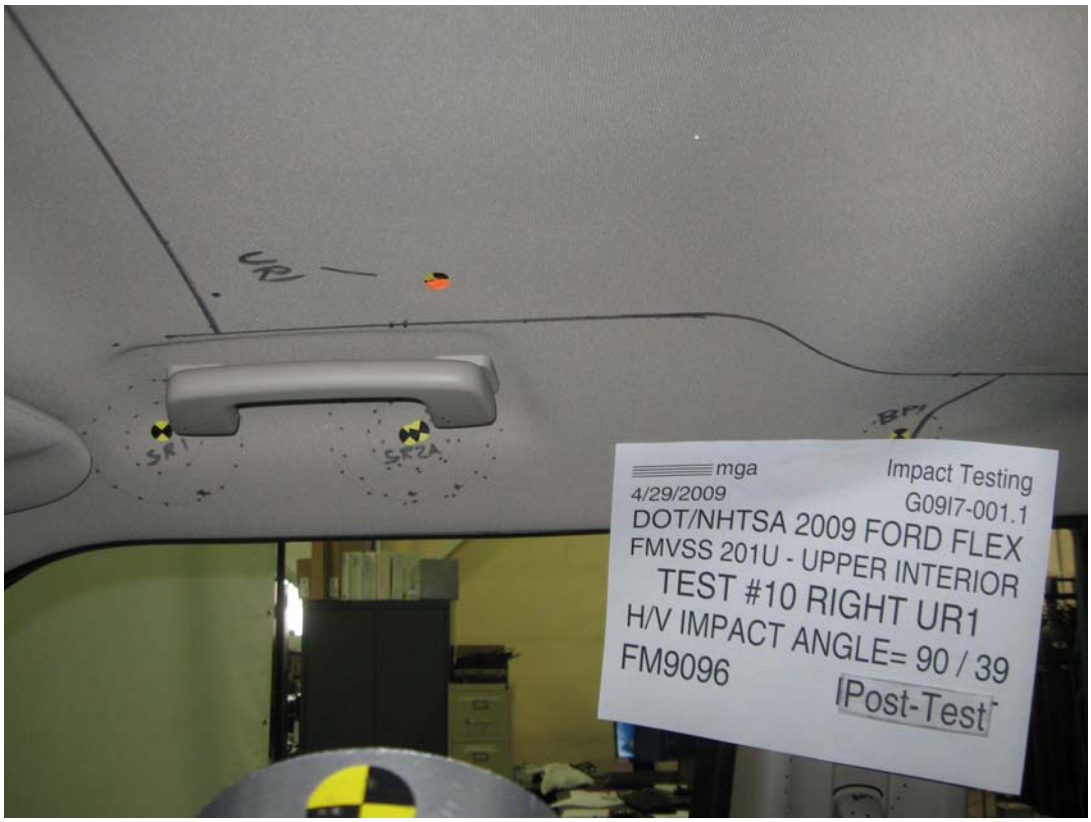

(peak = 24.2 kph)
Impact Velocity: 23.96 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 45.3 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
26
TIME (msec)


H/V 90/39
UR1
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR1
H/V IMPACT ANGLE= 90 / 39
FM9096
PRE TEST


UR1
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR1
H/V IMPACT ANGLE= 90 / 39
FM9096
PRE TEST


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR1
H/V IMPACT ANGLE= 90 / 39
FM9096
Post-Test


UR1
SR1
SR2A
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR1
H/V IMPACT ANGLE= 90 / 39
FM9096
Post-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #10 RIGHT UR1
H/V IMPACT ANGLE= 90 / 39
FM9096
IPost-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#10

Target (Vehicle Side): UR1Right

Temperature:21.1C

MGA Test Reference No.:FM9096

Humidity:41.6%

Approach Horizontal Angles:90º

Time of Test:1:22:14 PM

Approach Vertical Angles:39º

FMH Serial No:[037]

Additional Description:Upper Roof at SR2

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
949	1037	6.2	24.0	34	4 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.94	0.94

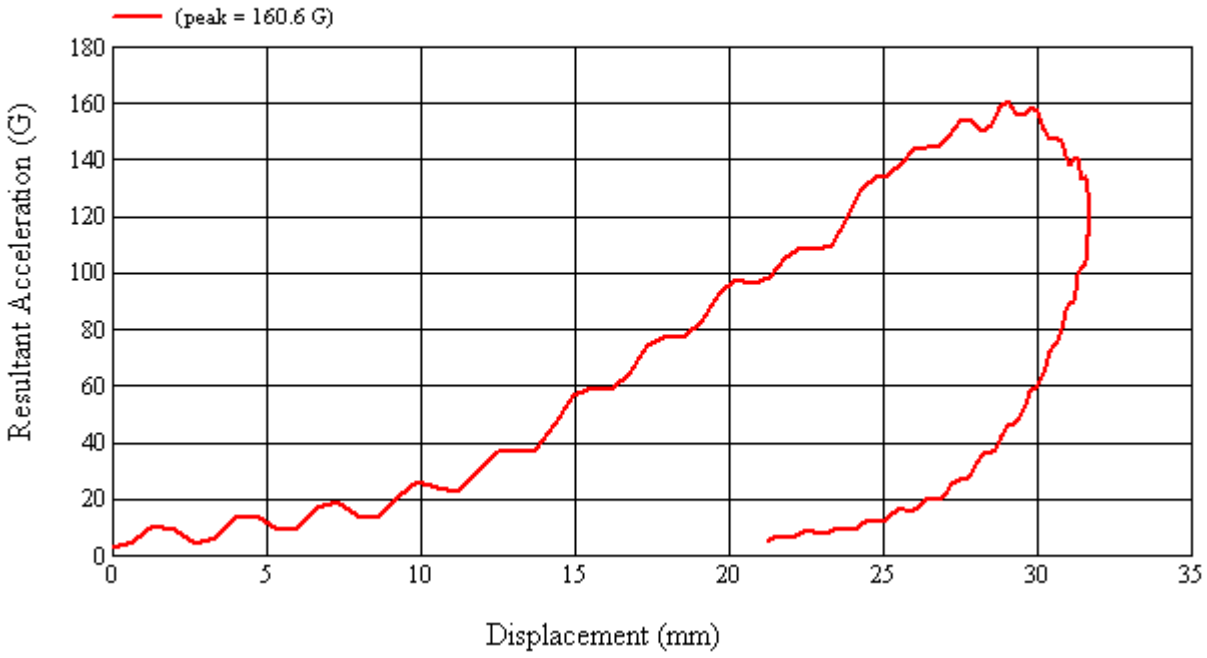
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

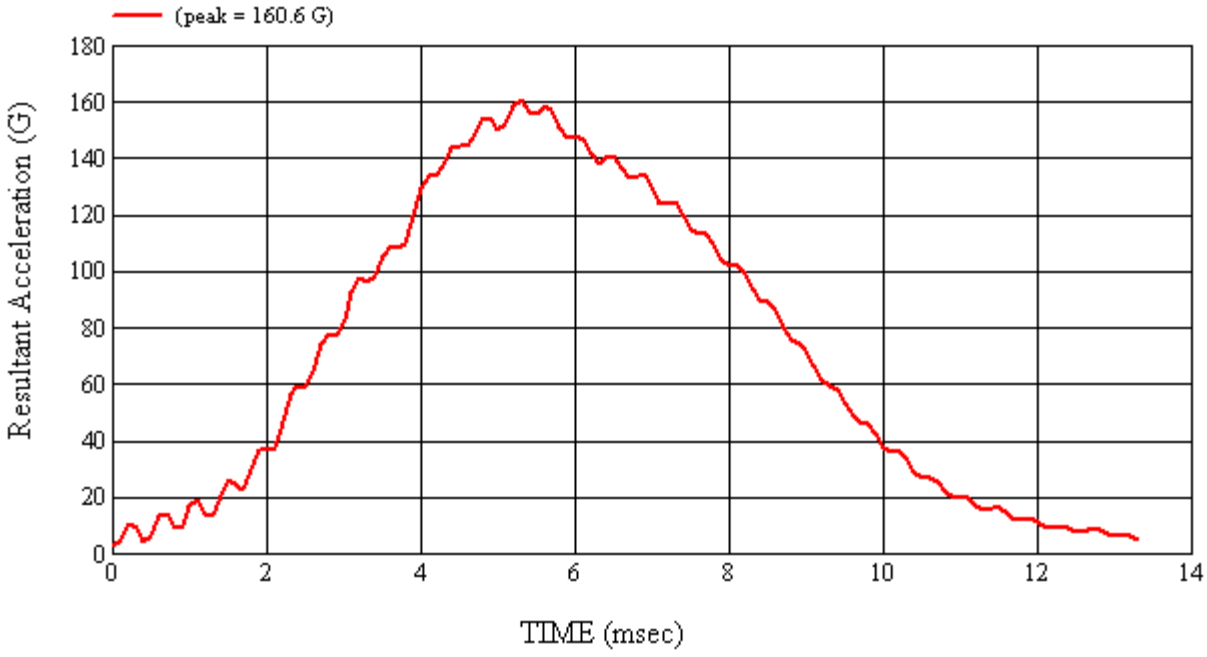
No damage observed

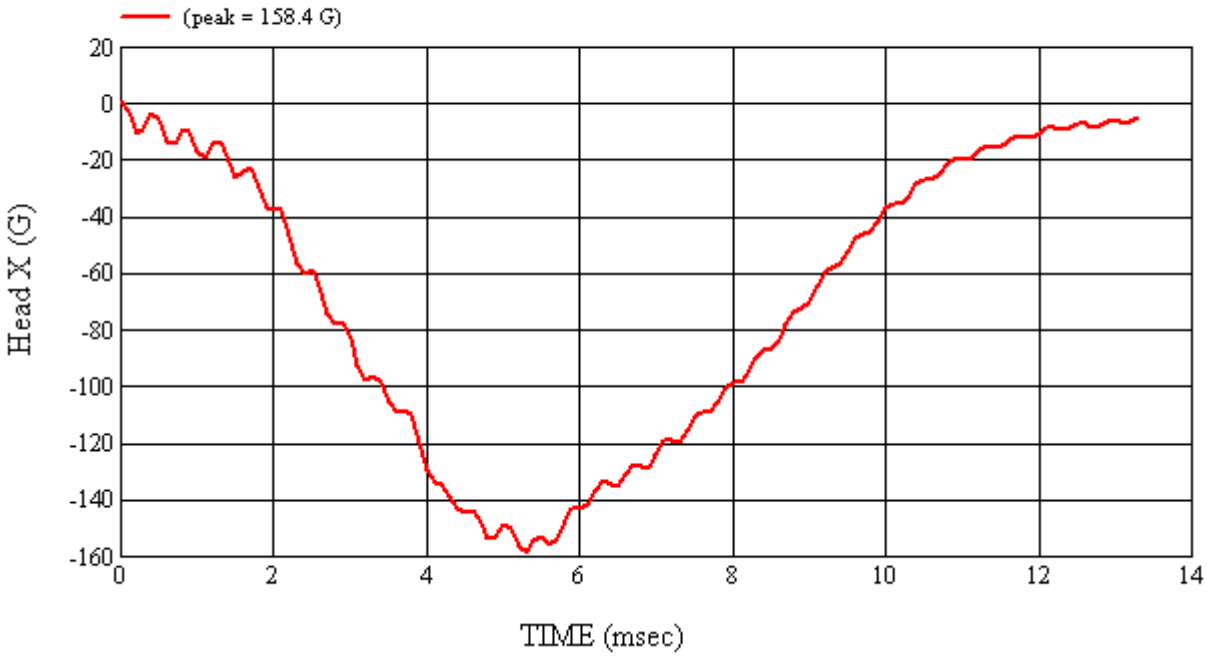
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

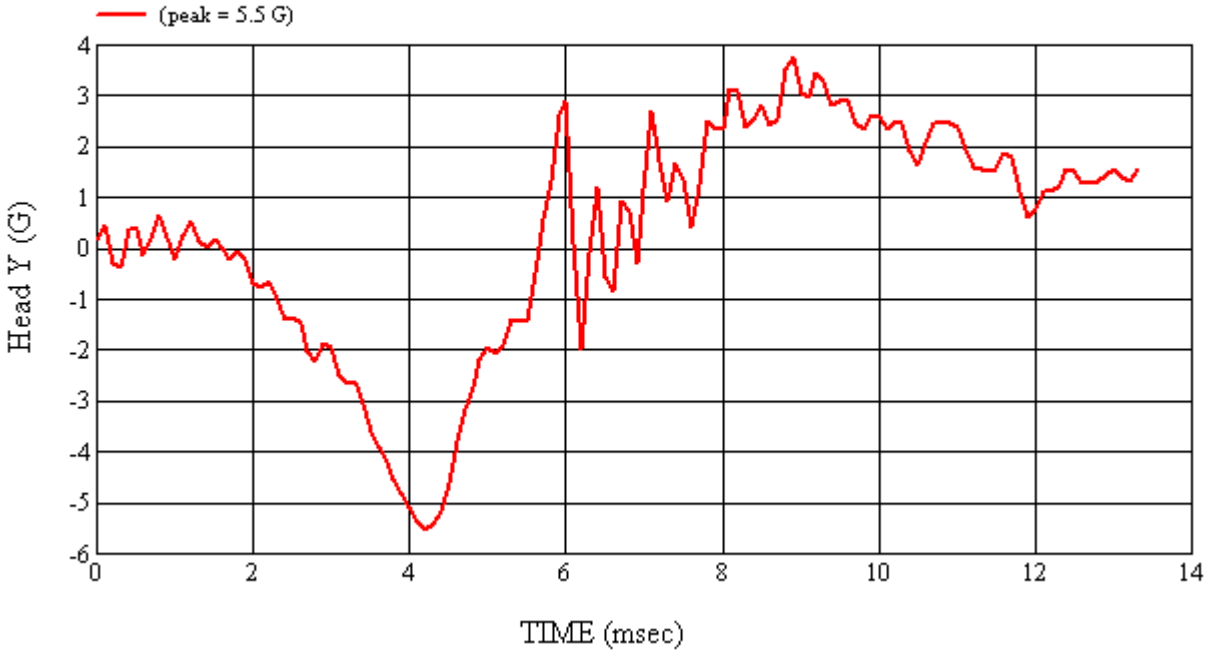
*Only necessary for NHTSA (Government) Compliance testing.

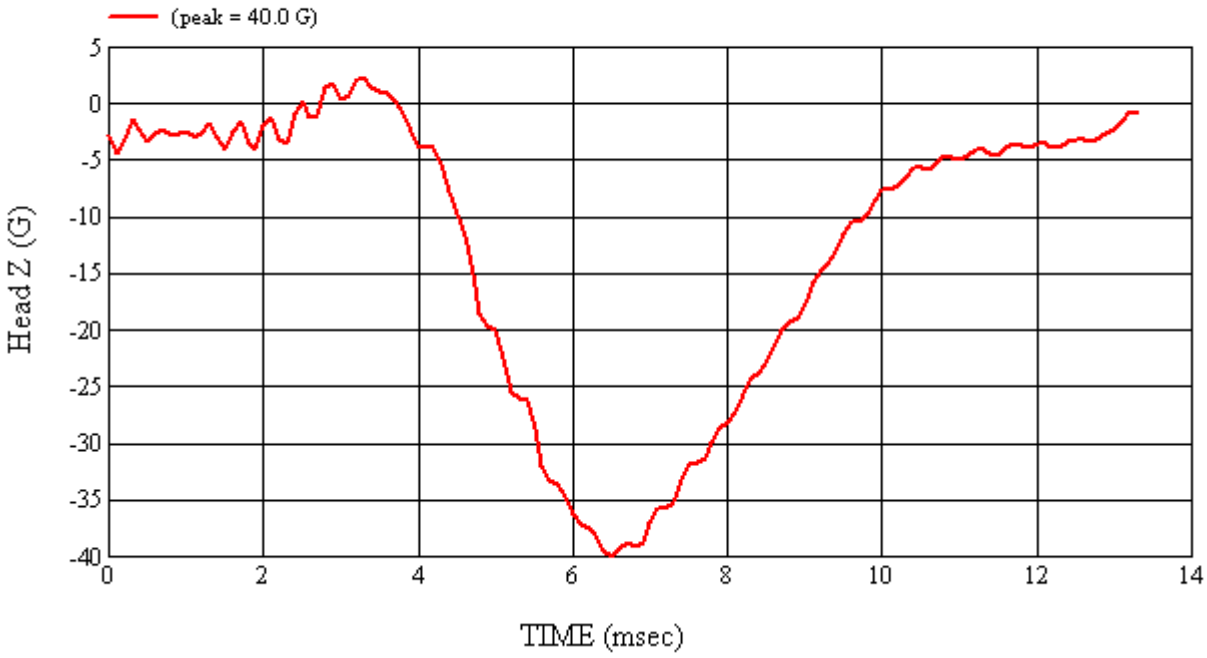
MGA Test #: FM9096 Target Location: UR1, Right Side Test Date: 4/29/2009

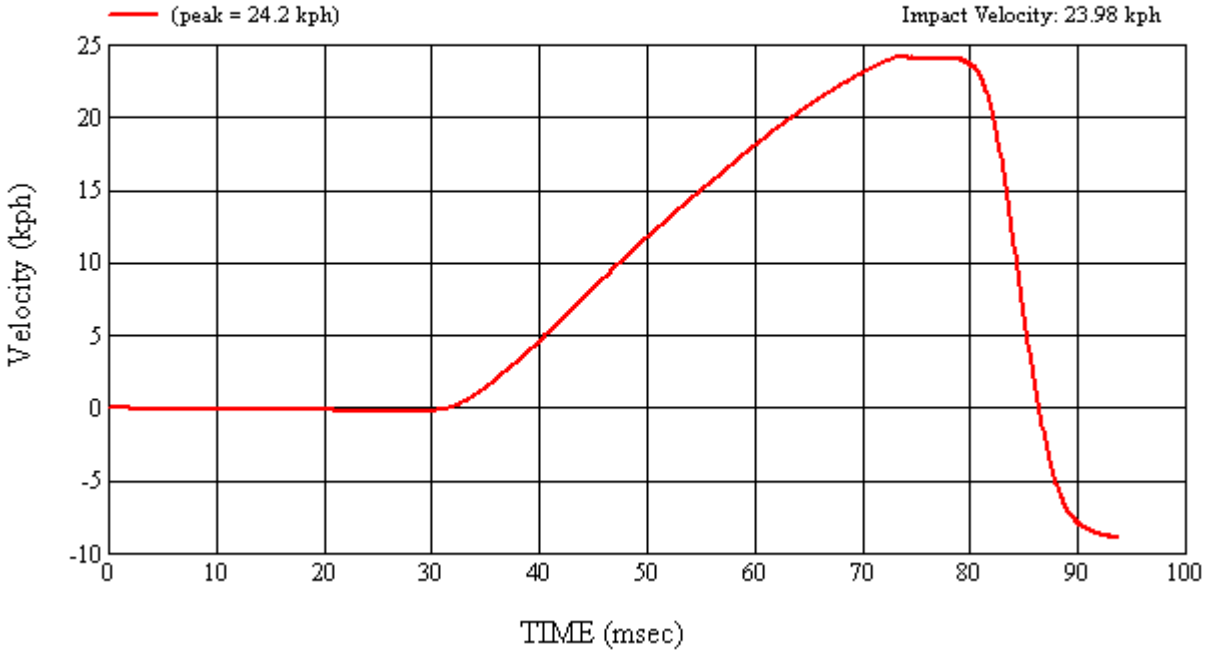


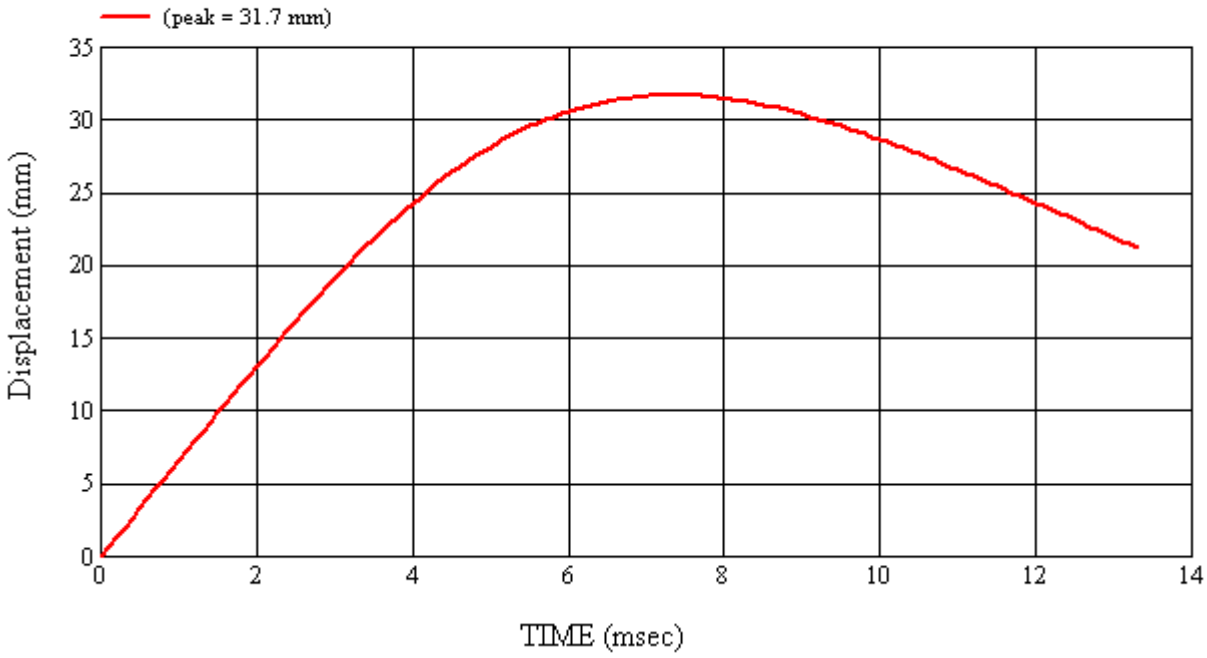



(peak = 158.4 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
2
4
6
8
10
12
14
TIME (msec)

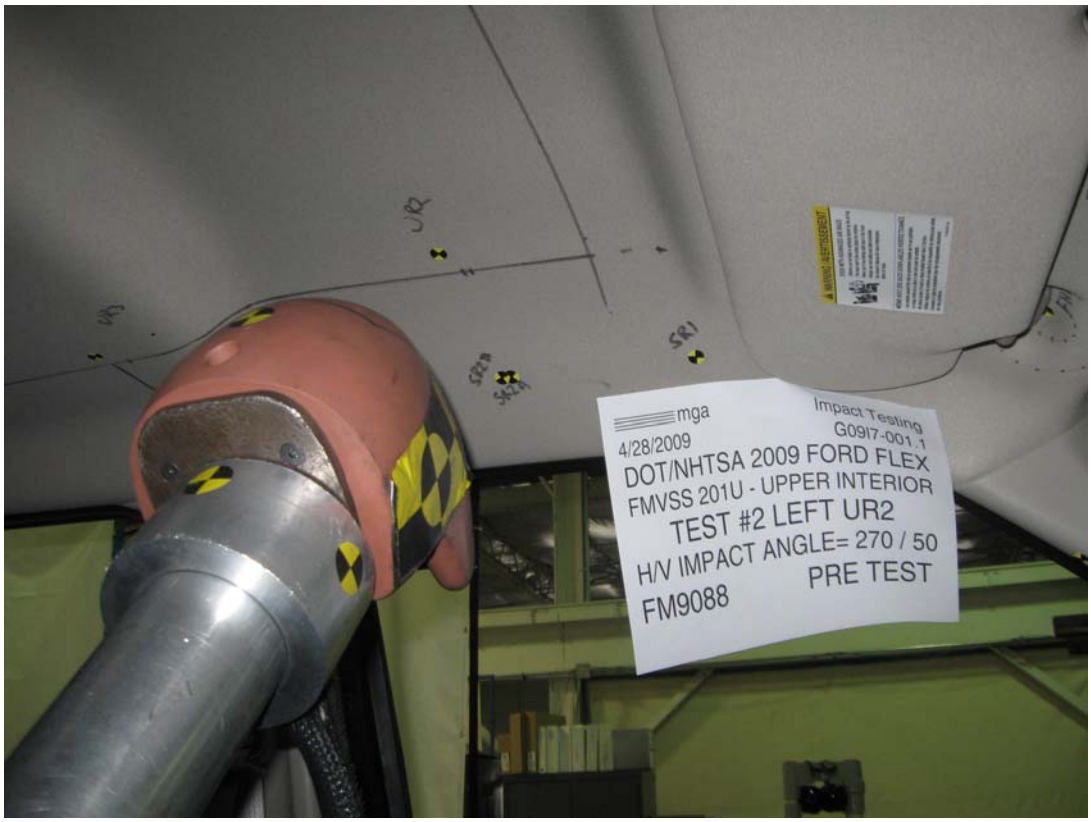

(peak = 5.5 G)
Head Y (G)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
0
2
4
6
8
10
12
14
TIME (msec)


(peak = 40.0 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 23.98 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
60
70
80
90
100
TIME (msec)


(peak = 31.7 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
TIME (msec)


mga
Impact Testing
G09I7-001.1
4/28/2009
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR2
H/V IMPACT ANGLE= 270 / 50
FM9088
PRE TEST


mga
Impact Testing
G09I7-001.1
4/28/2009
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR2
H/V IMPACT ANGLE= 270 / 50
FM9088
PRE TEST


C90204
FM9088
LEFT UR2
H/V 270/50
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR2
H/V IMPACT ANGLE= 270 / 50
FM9088
Post-Test


UR2
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR2
H/V IMPACT ANGLE= 270 / 50
FM9088
Post-Test


mga
4/28/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #2 LEFT UR2
H/V IMPACT ANGLE= 270 / 50
FM9088
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#2

Target (Vehicle Side): UR2Left

Temperature:21.8C

MGA Test Reference No.:FM9088

Humidity:53.1%

Approach Horizontal Angles:270º

Time of Test:11:50:53 AM

Approach Vertical Angles:50º

FMH Serial No:[037]

Additional Description:Upper Roof at SR2

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
650	641	9.3	24.1	18	6 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.94	0.94

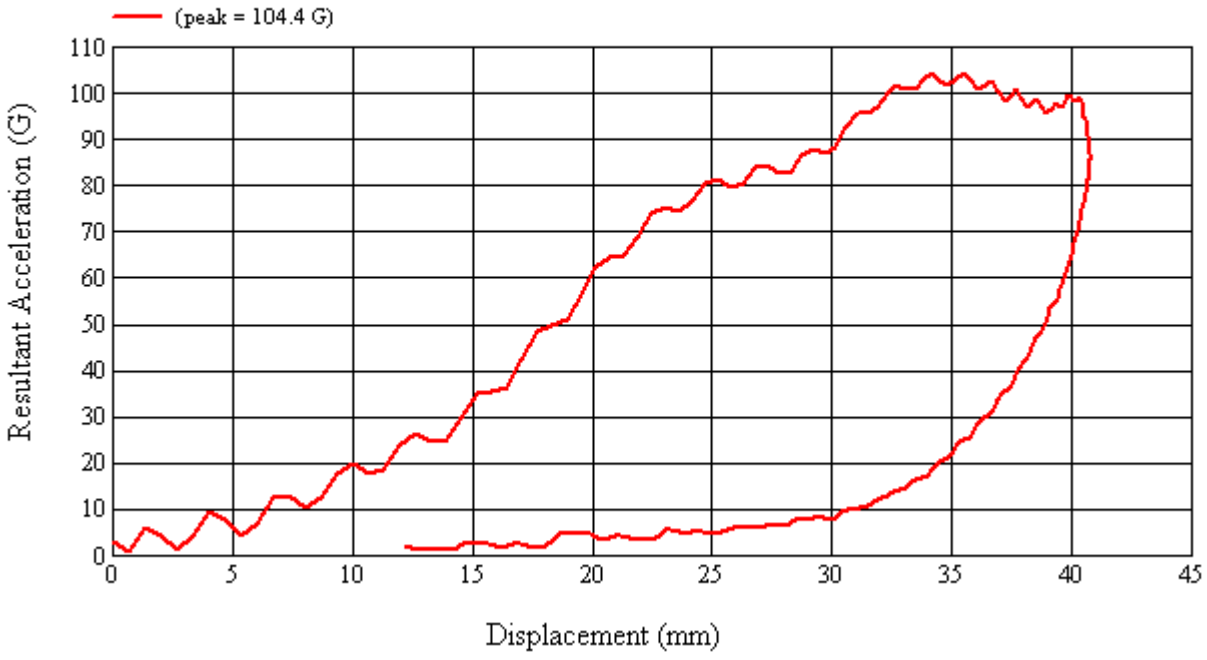
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

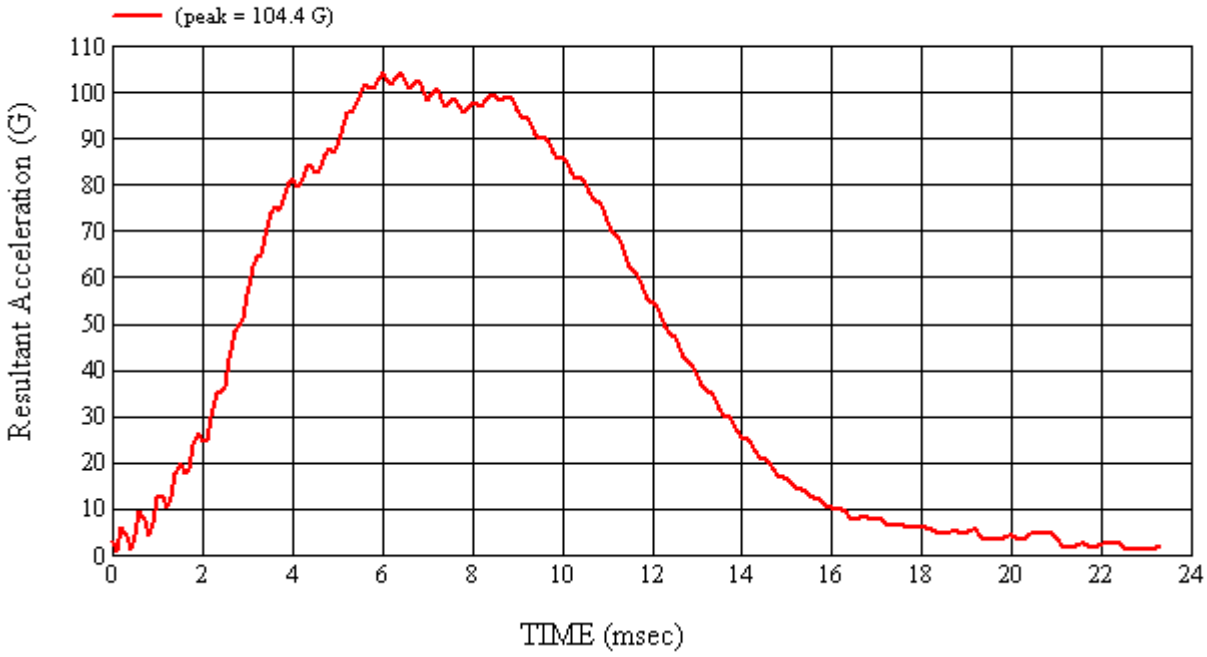
Rear right roof vent popped out

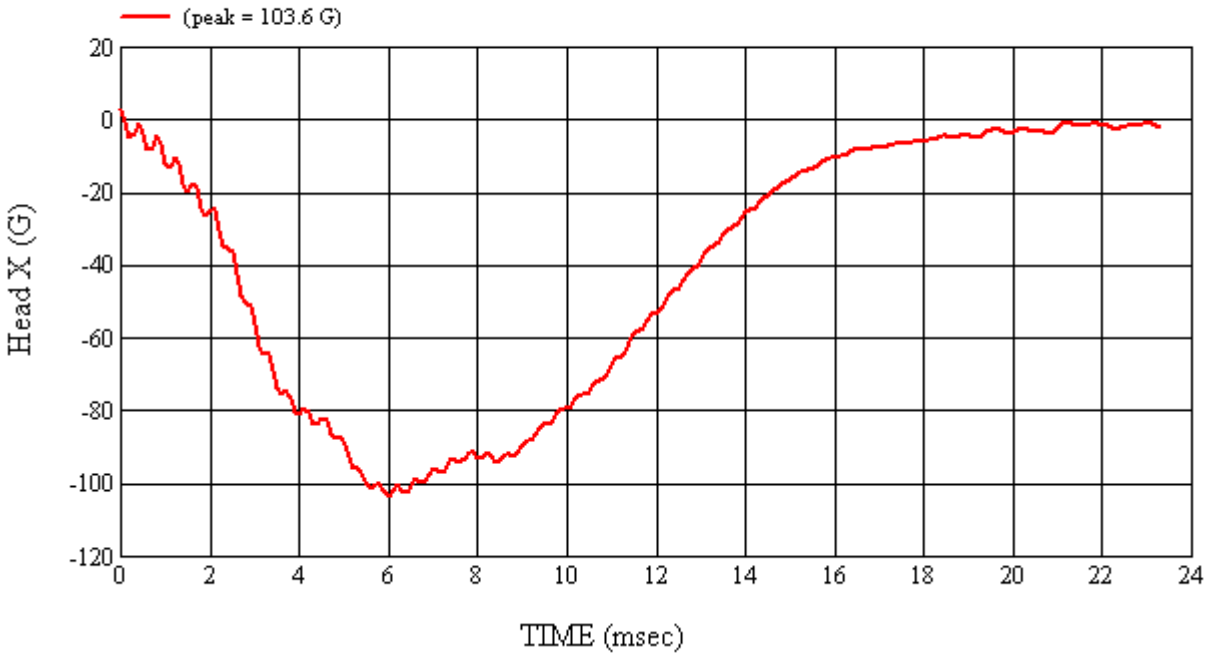
Recorded By:_____ Approved By*: _____ Date: 4/28/2009

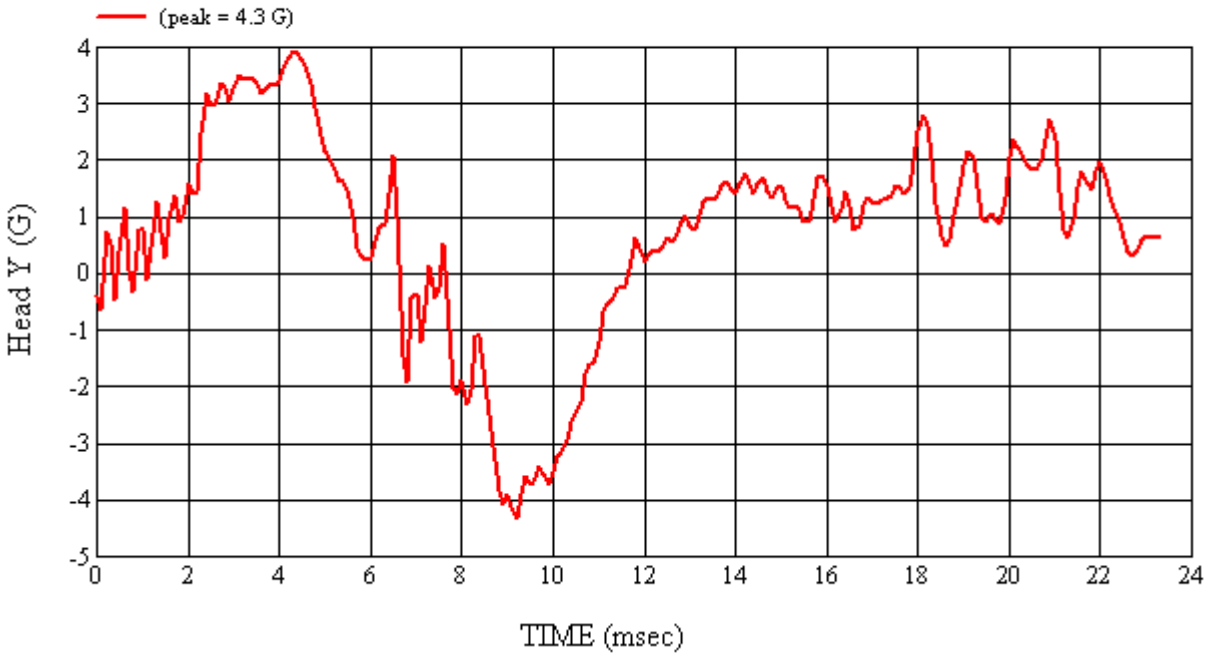
*Only necessary for NHTSA (Government) Compliance testing.

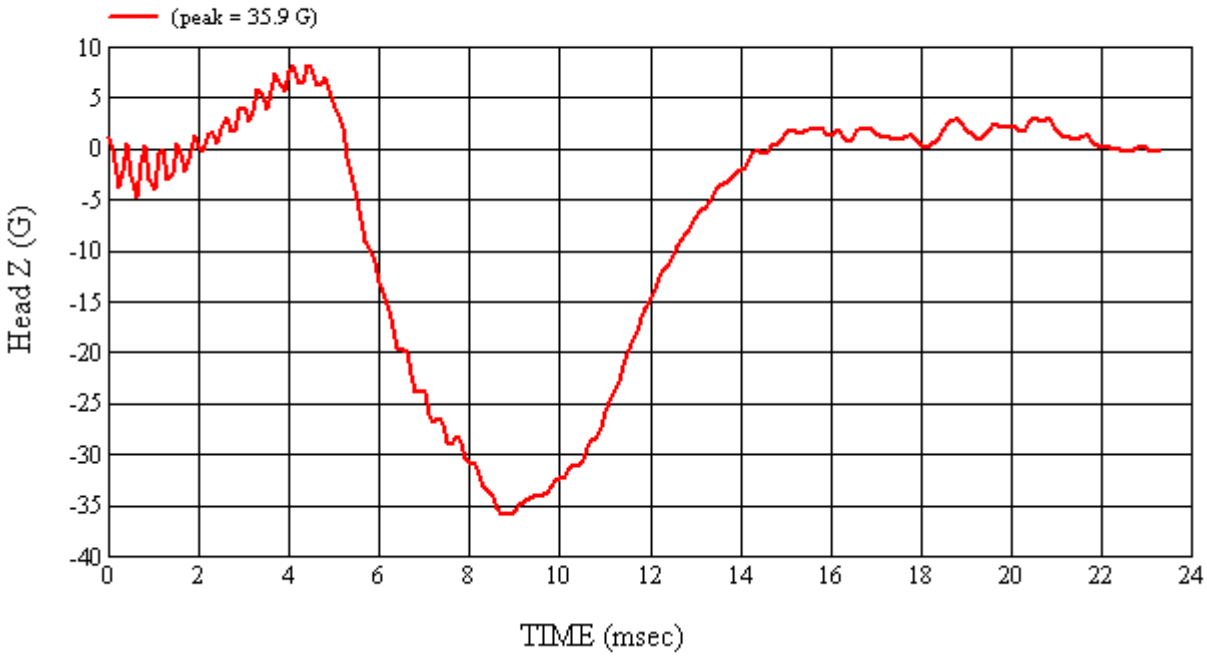
MGA Test #: FM9088 Target Location: UR2, Left Side Test Date: 4/28/2009

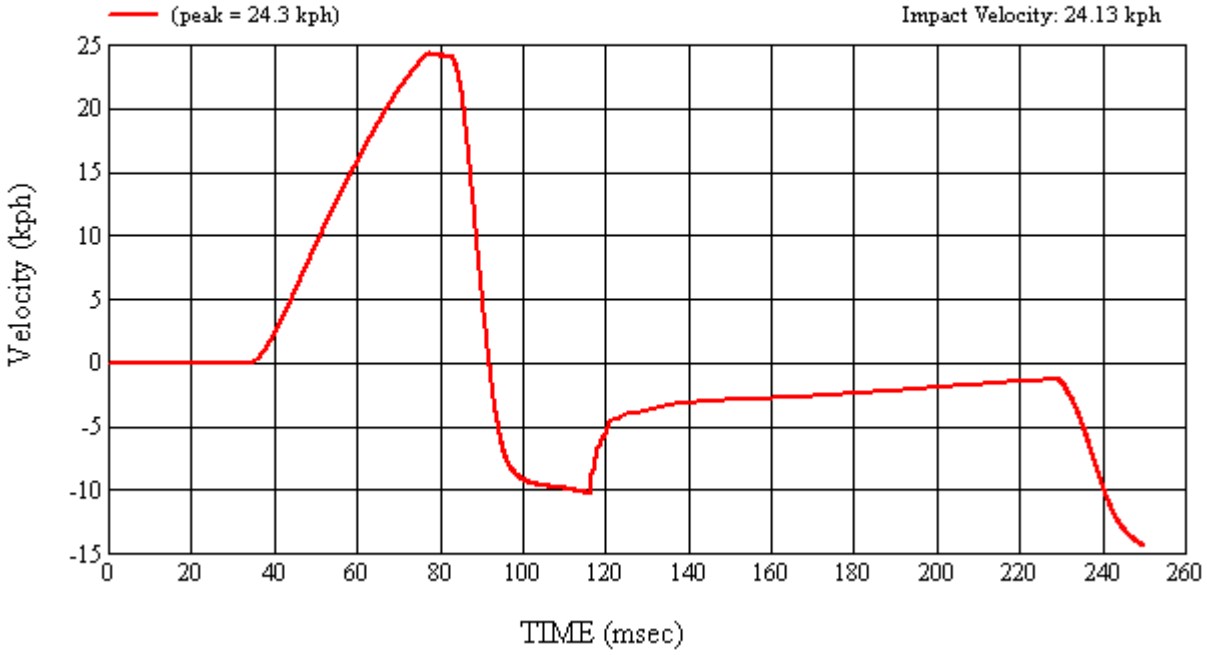


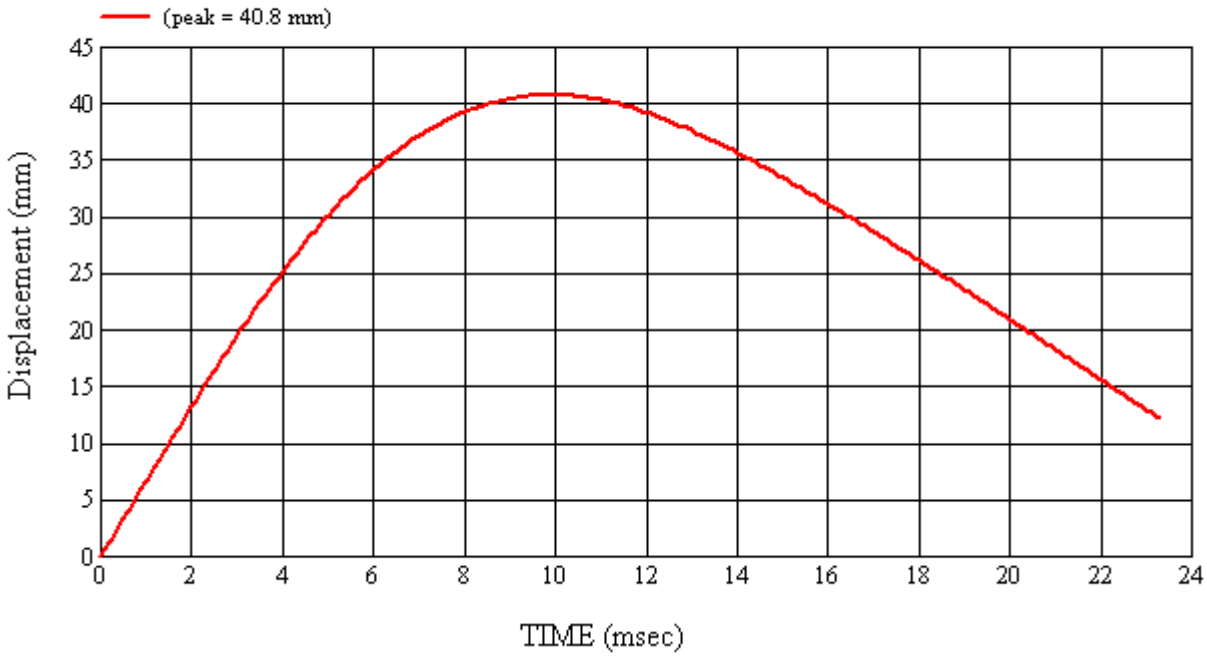



(peak = 103.6 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

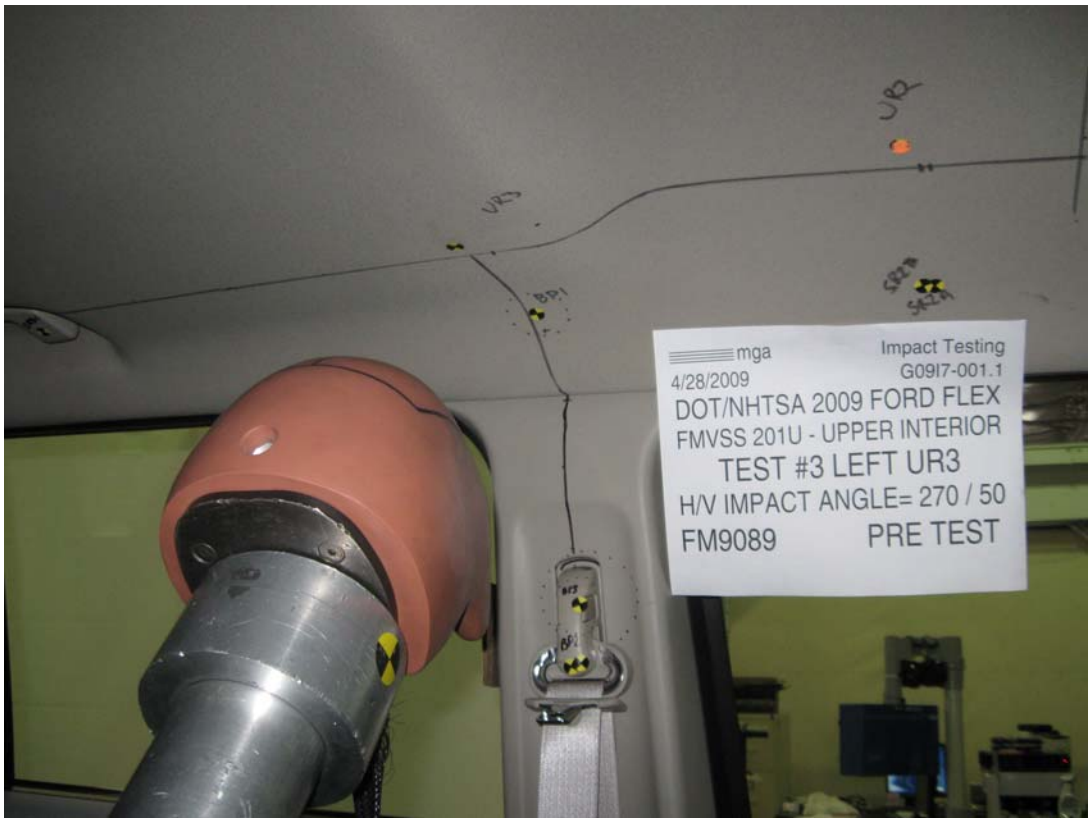

(peak = 4.3 G)
Head Y (G)
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 35.9 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

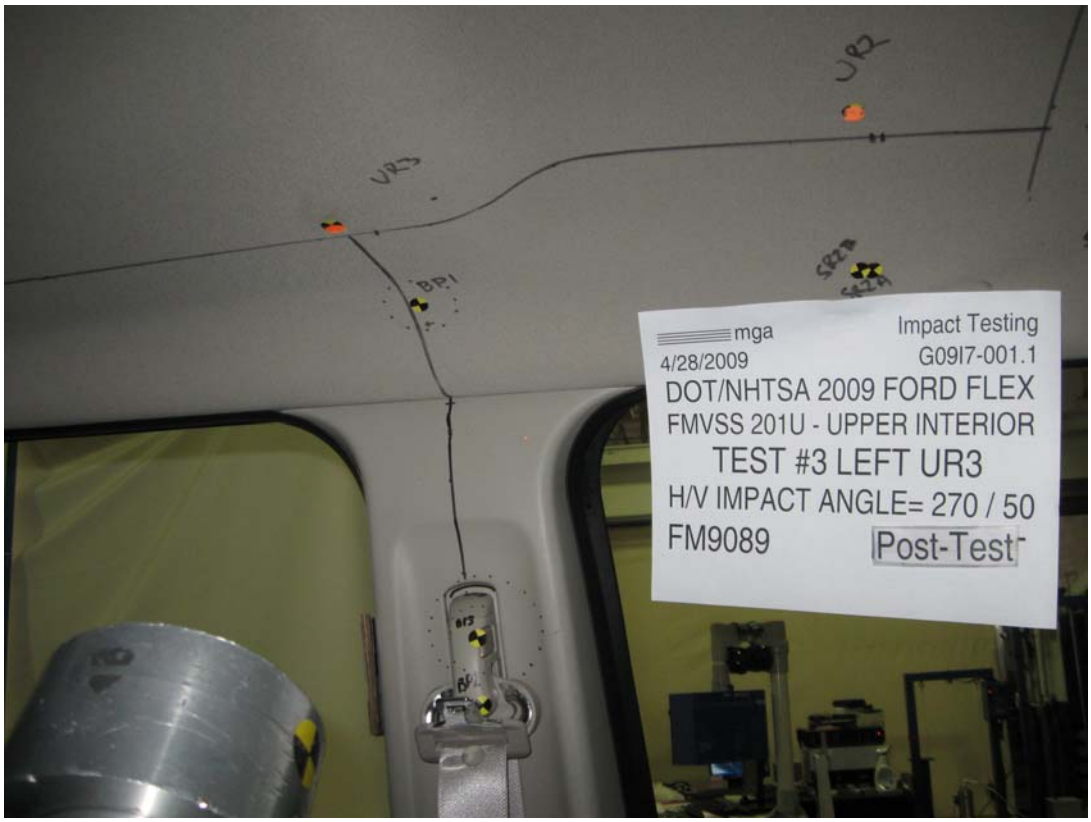

(peak = 24.3 kph)
Impact Velocity: 24.13 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 40.8 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
TIME (msec)


C90204
FM9089
LEFT UR3
H/V 270/50
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
FM9089
PRE TEST


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
FM9089
PRE TEST


C90204
FM9089
LEFT UR3
H/V 270/50
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
FM9089
Post-Test


UR2
UR3
BP1
SB2B
SB2A
mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
FM9089
Post-Test


mga
Impact Testing
4/28/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #3 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
FM9089
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Target (Vehicle Side): UR3Left

MGA Test Reference No.:FM9089

Approach Horizontal Angles:270º

Approach Vertical Angles:50º

Additional Description:Upper Roof at BP1

Test Number:#3

Temperature:21.7C

Humidity:51.2%

Time of Test:1:30:33 PM

FMH Serial No:[038]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
553	512	11.4	24.0	27	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	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.94	0.94

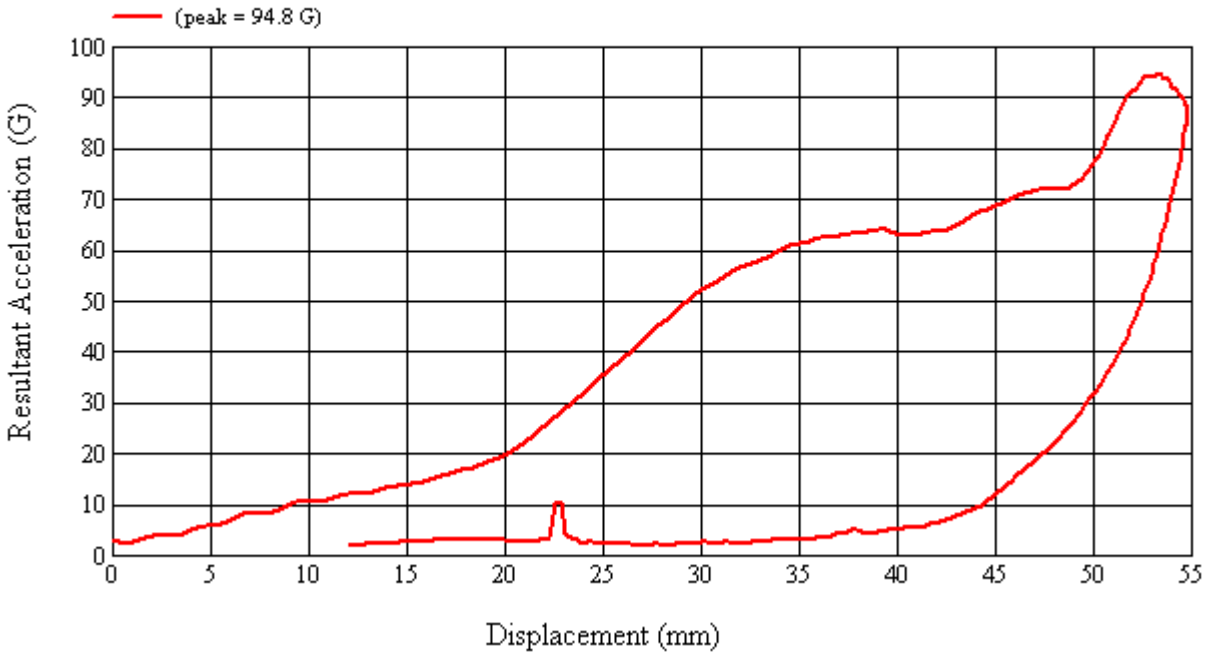
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

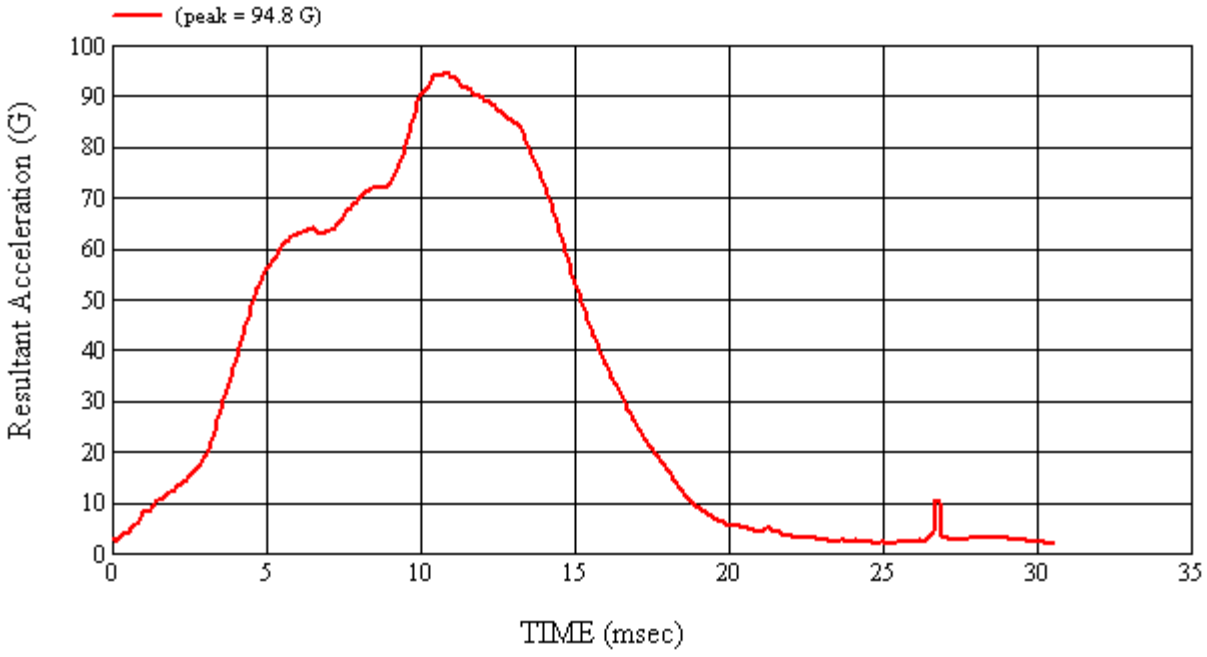
No damage observed

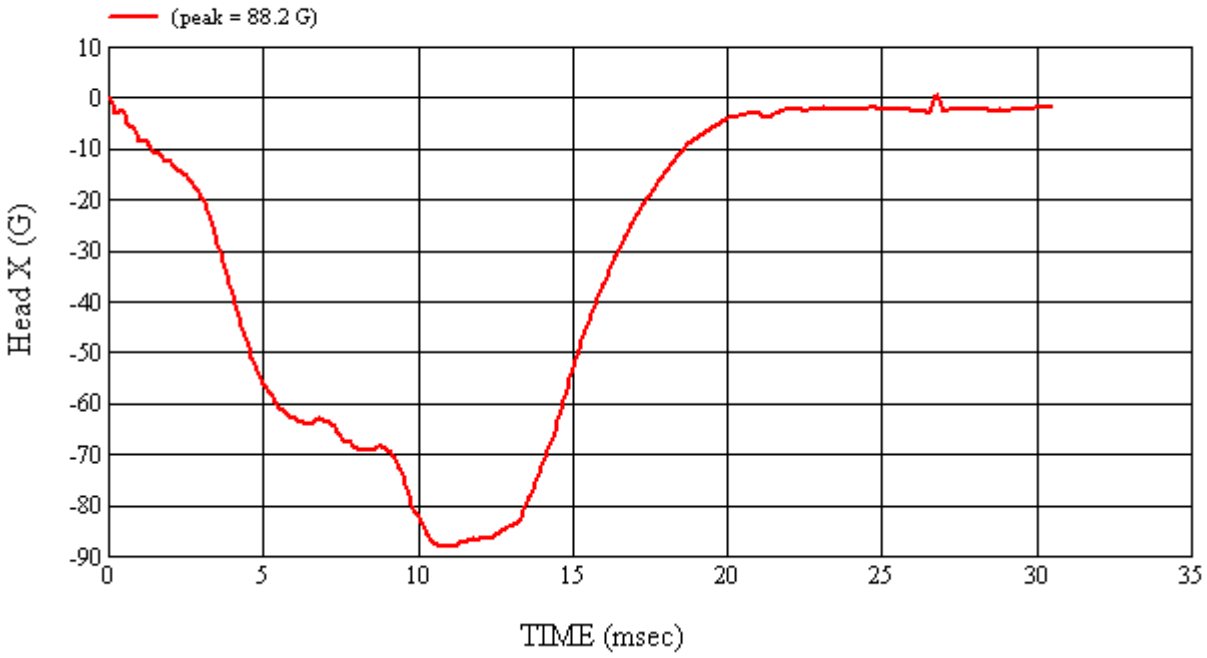
Recorded By:_____ Approved By*: _____ Date: 4/28/2009

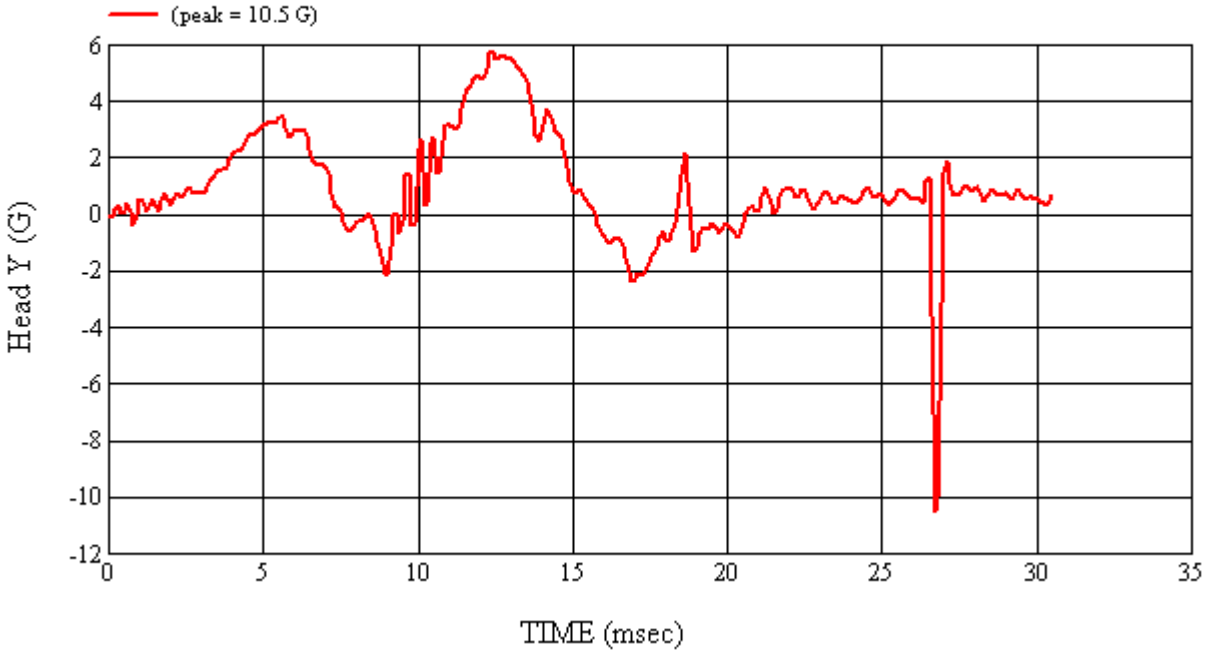
*Only necessary for NHTSA (Government) Compliance testing.

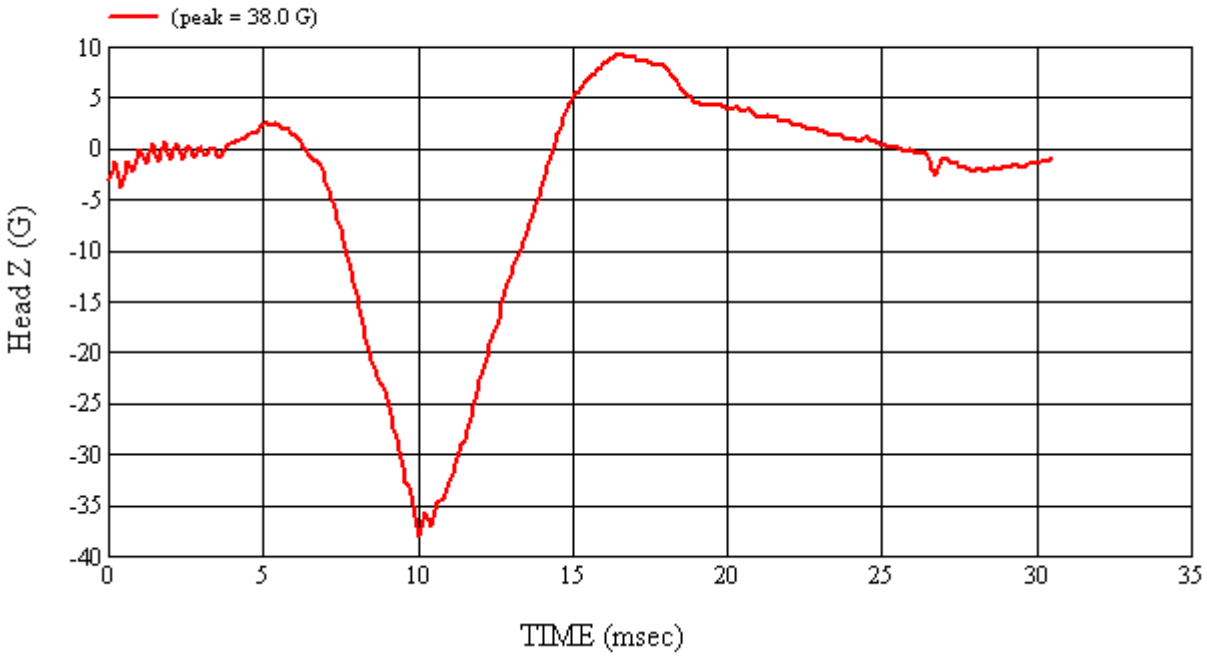
MGA Test #: FM9089 Target Location: UR3, Left Side Test Date: 4/28/2009

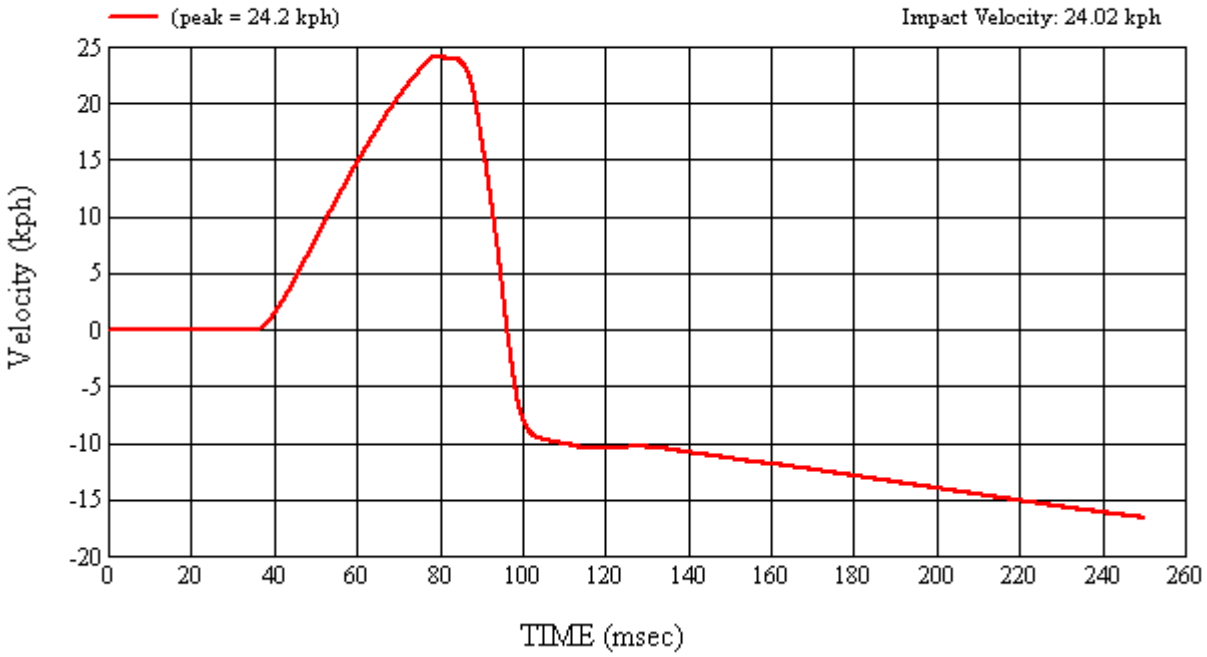


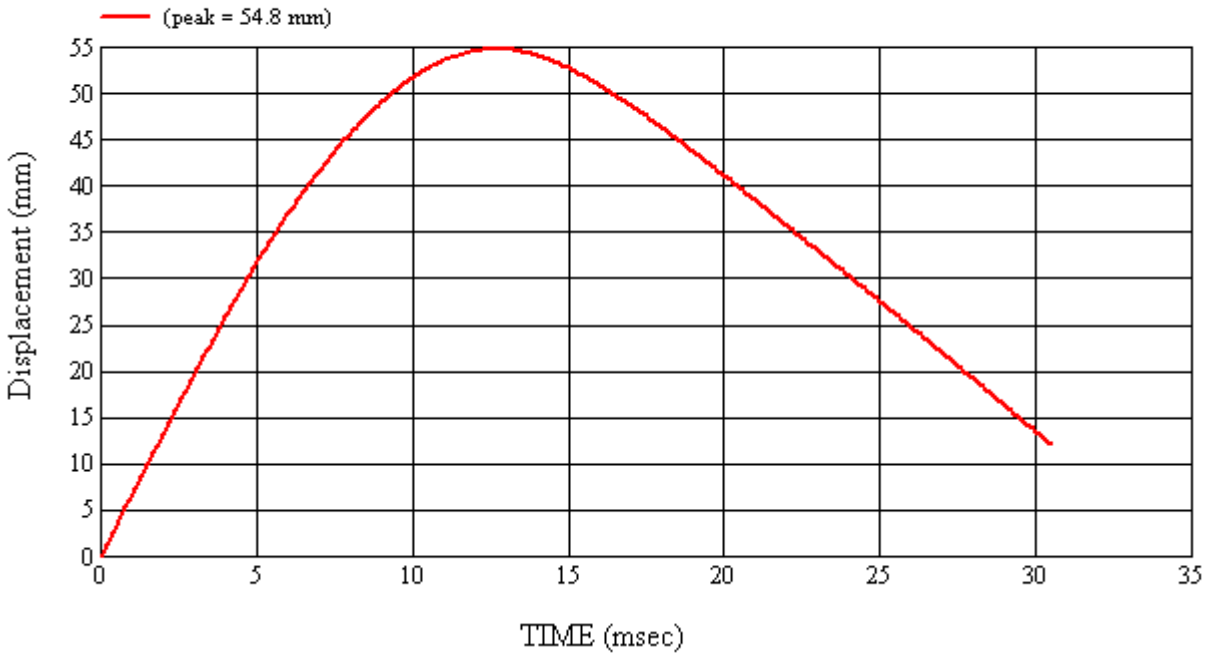



(peak = 88.2 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
5
10
15
20
25
30
35
TIME (msec)

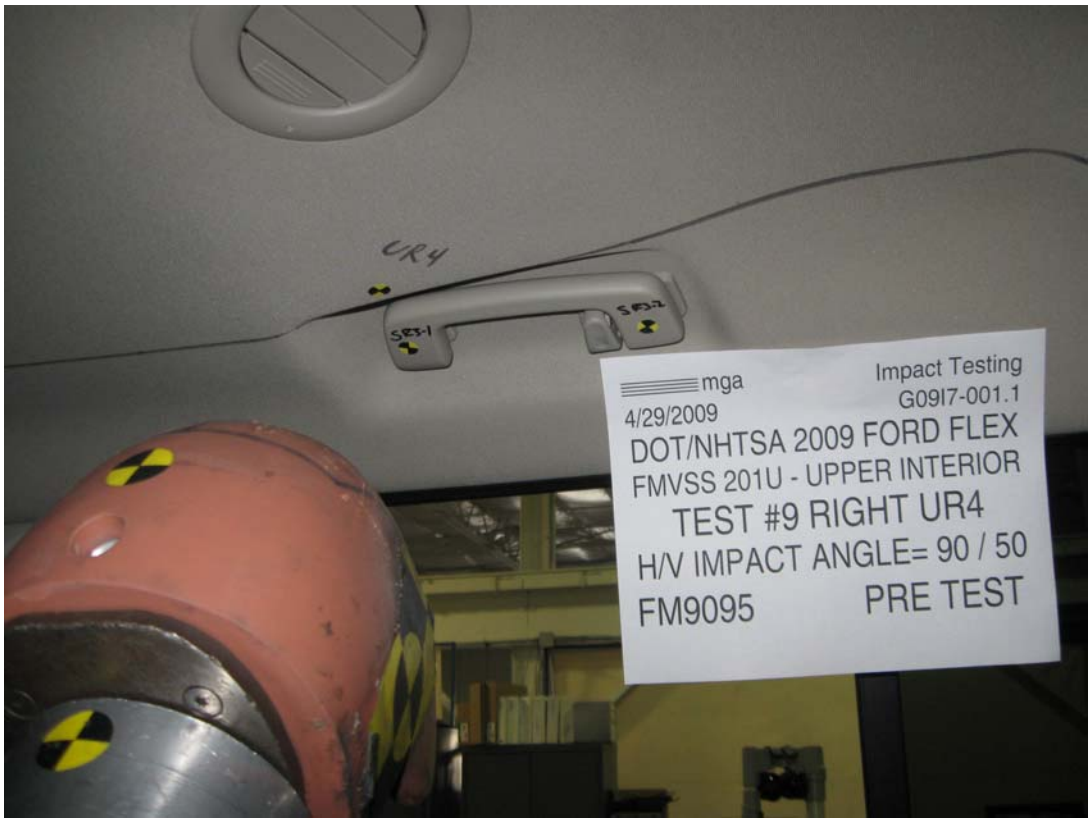

(peak = 10.5 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
-10
-12
0
5
10
15
20
25
30
35
TIME (msec)


(peak = 38.0 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
5
10
15
20
25
30
35
TIME (msec)

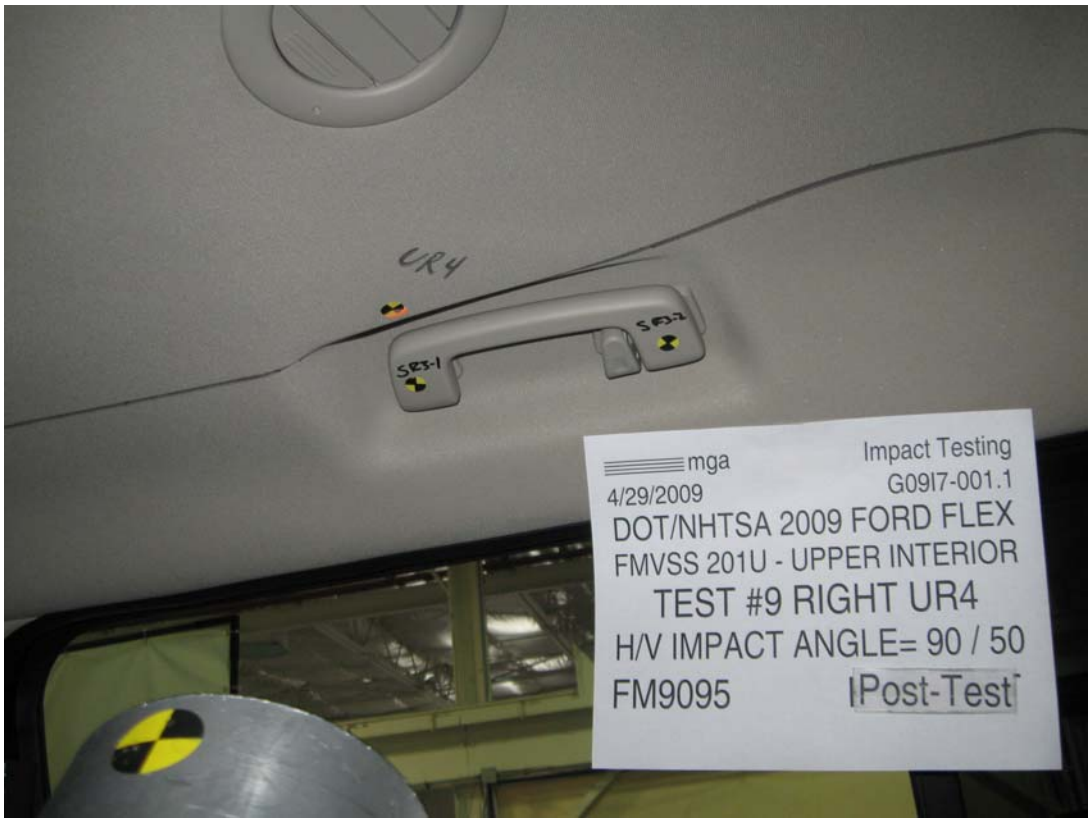

(peak = 24.2 kph)
Impact Velocity: 24.02 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 54.8 mm)
Displacement (mm)
55
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
35
TIME (msec)


UR4
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
FM9095
PRE TEST


UR4
SET-1
SET-2
mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
FM9095
PRE TEST


mga
4/29/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
FM9095
IPost-Test
C90204
FM9095
RIGHT UR4
H/V 90/50


UR4
SB3-1
SB3-2
mga
4/29/2009
Impact Testing
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
FM9095
IPost-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #9 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
FM9095
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#9

Target (Vehicle Side): UR4Right

Temperature:21.1C

MGA Test Reference No.:FM9095

Humidity:42.4%

Approach Horizontal Angles:90º

Time of Test:11:39:49 AM

Approach Vertical Angles:50º

FMH Serial No:[035]

Additional Description:Upper Roof at SR3-1

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
755	780	7.1	24.0	31	8 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

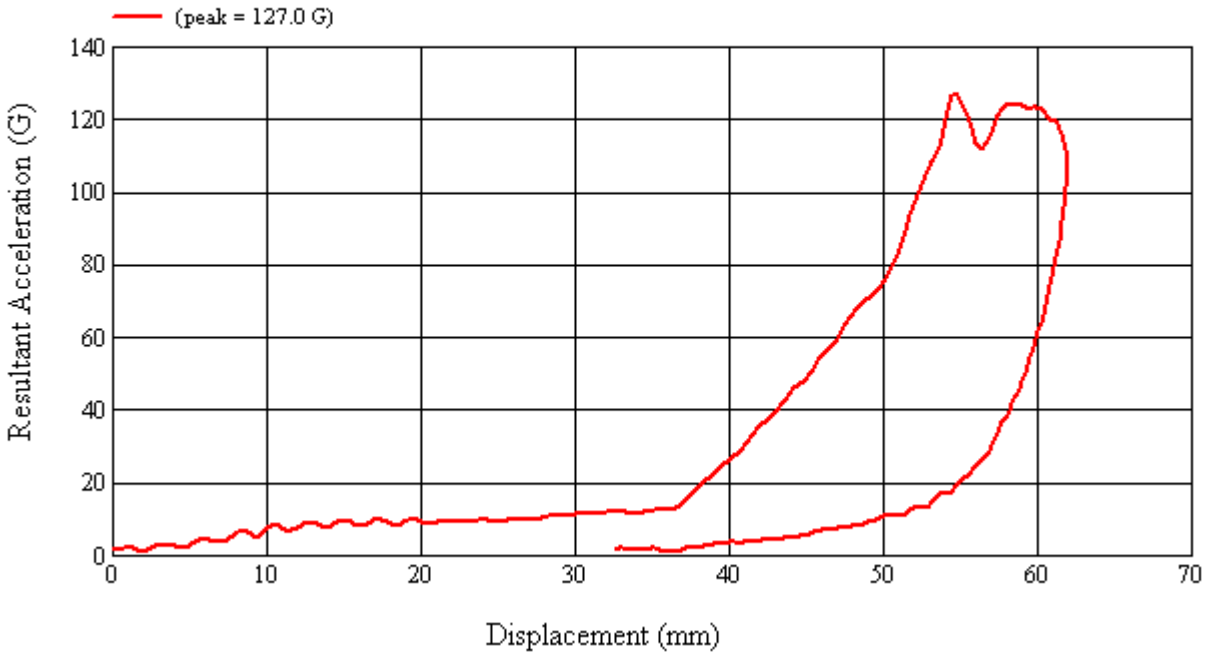
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

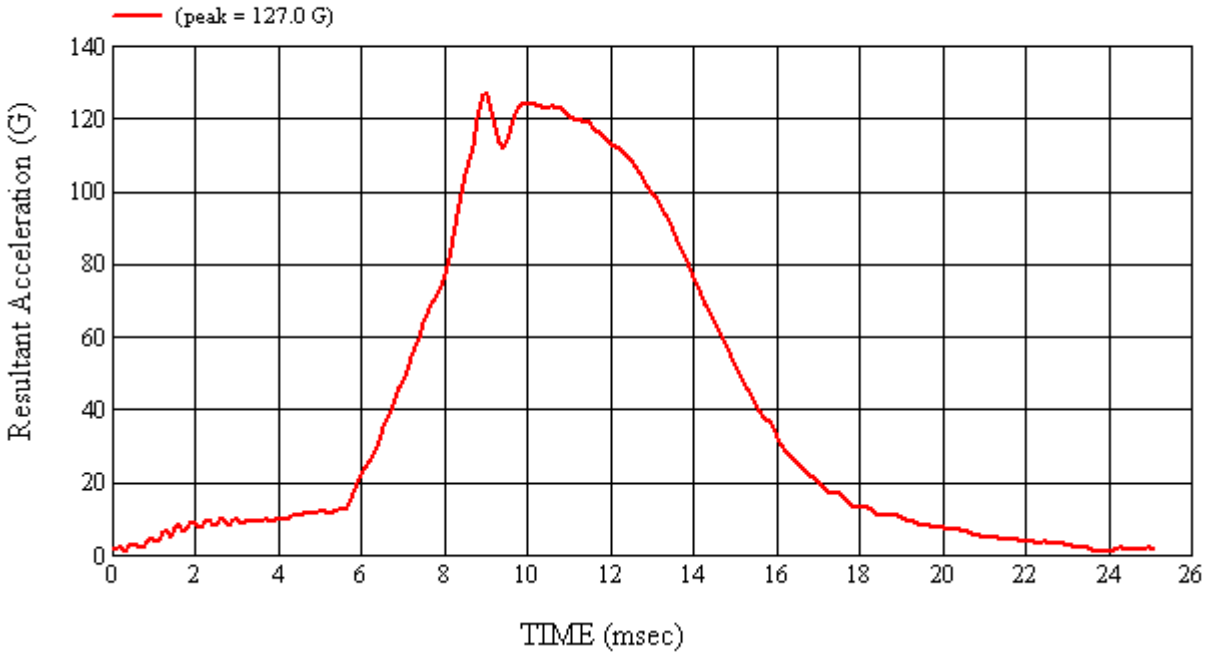
No damage observed

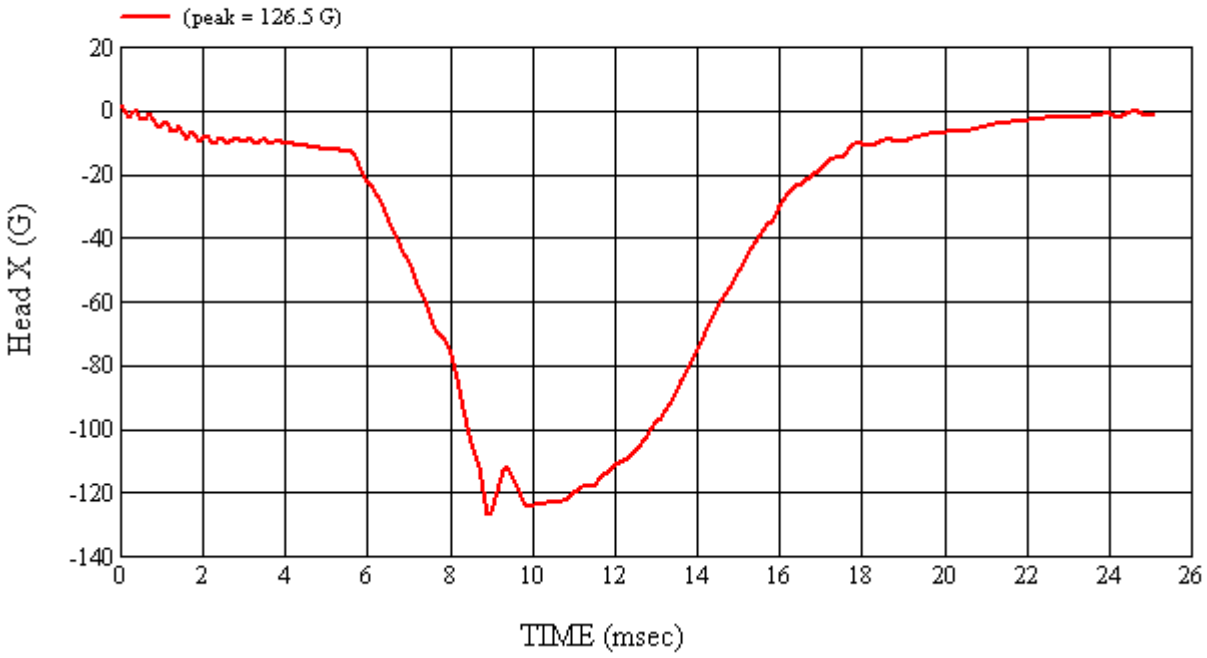
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

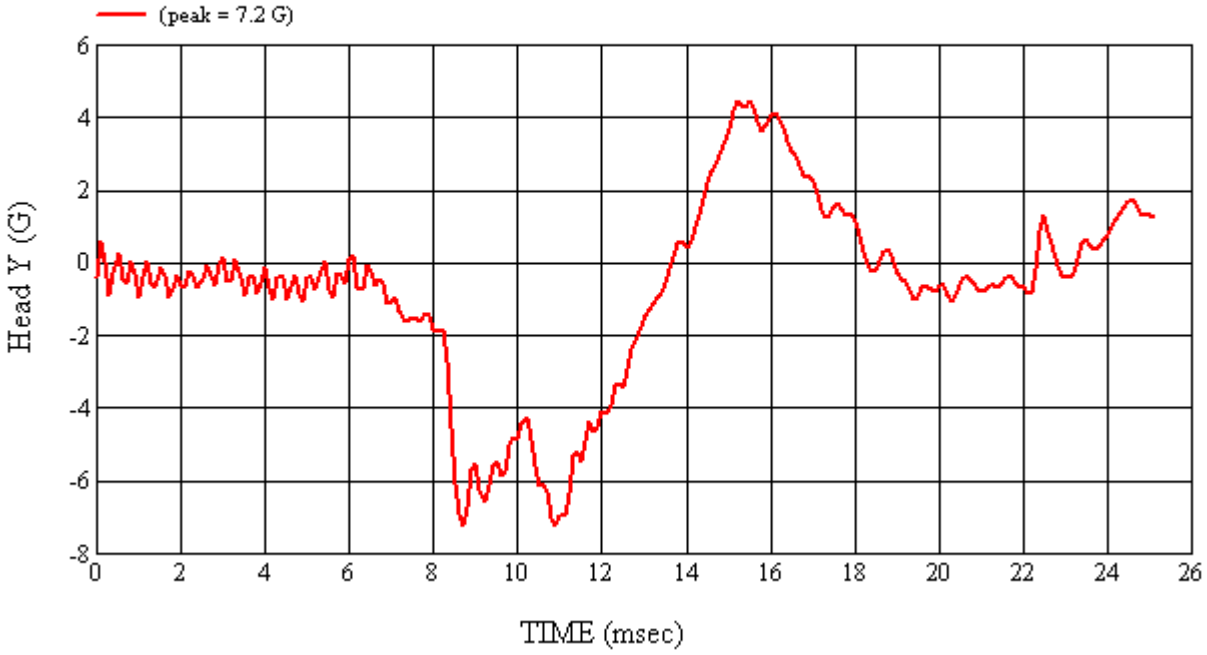
*Only necessary for NHTSA (Government) Compliance testing.

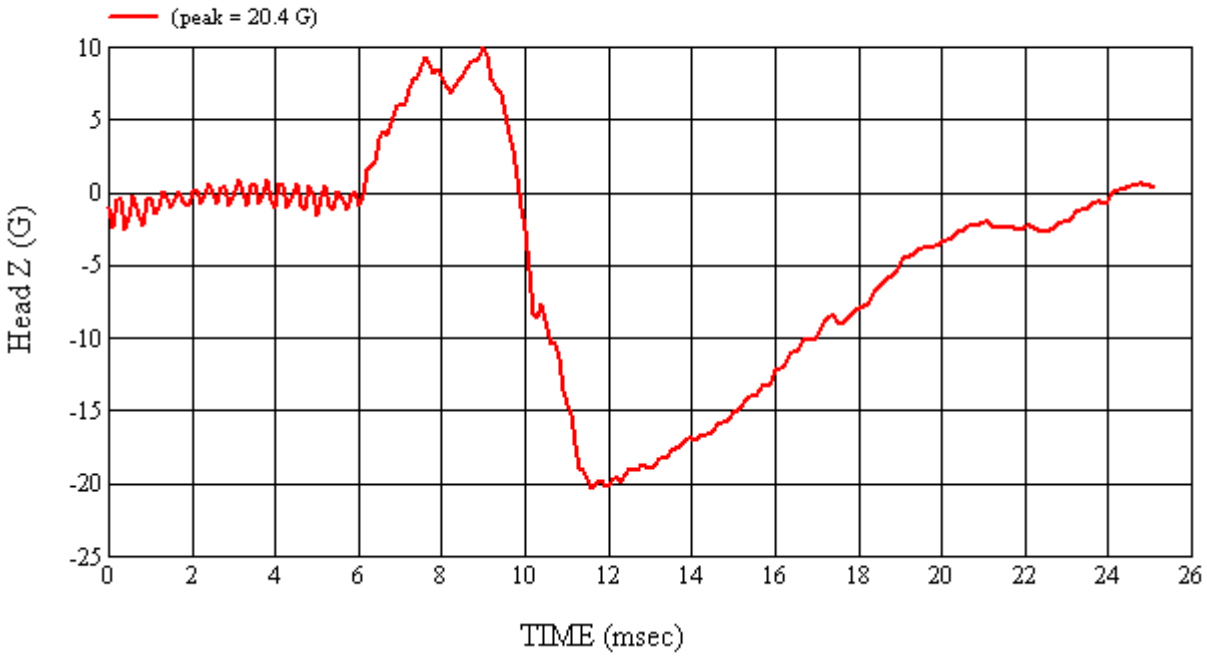
MGA Test #: FM9095 Target Location: UR4, Right Side Test Date: 4/29/2009

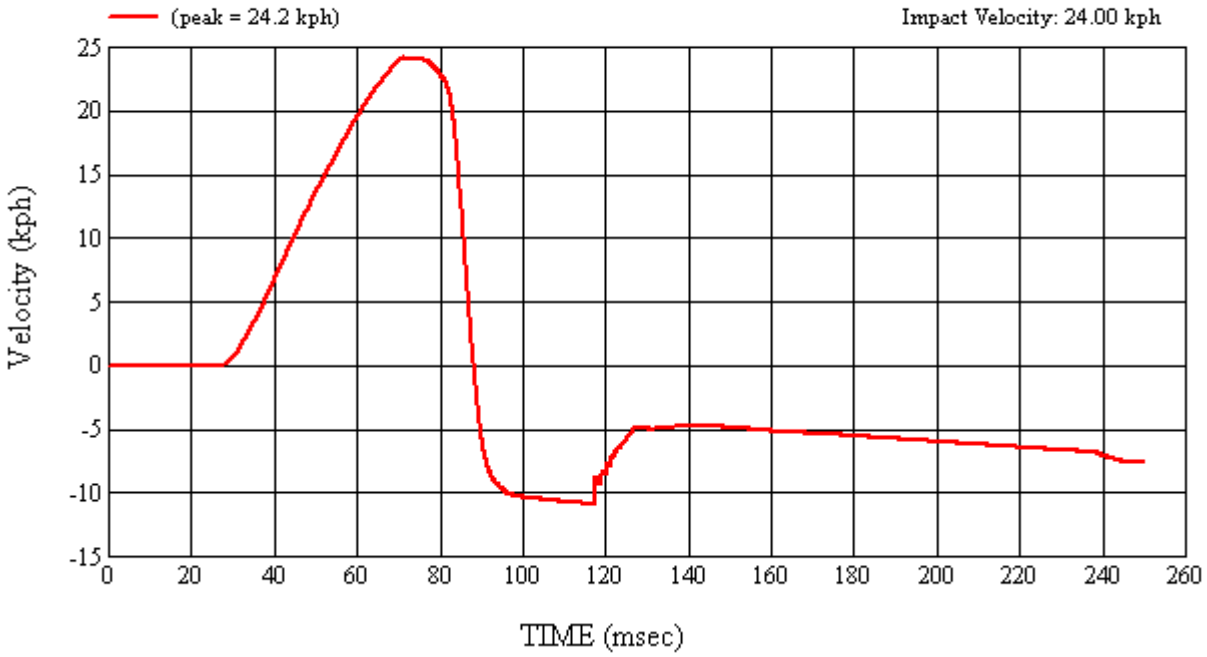


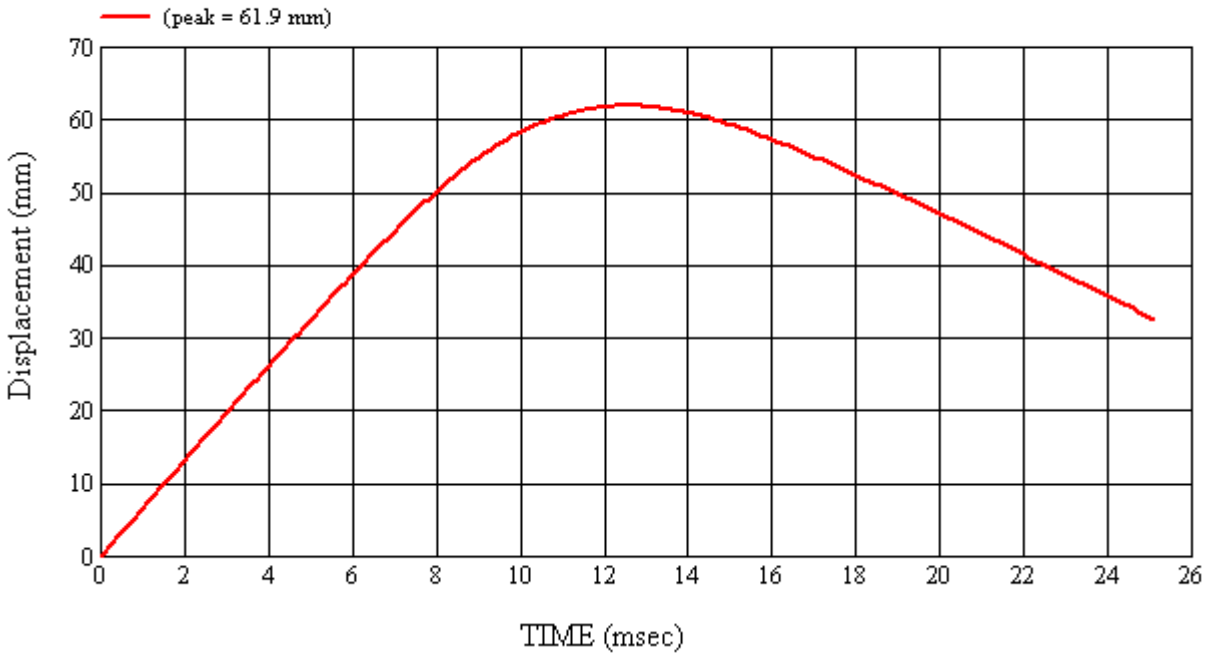



(peak = 126.5 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 7.2 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

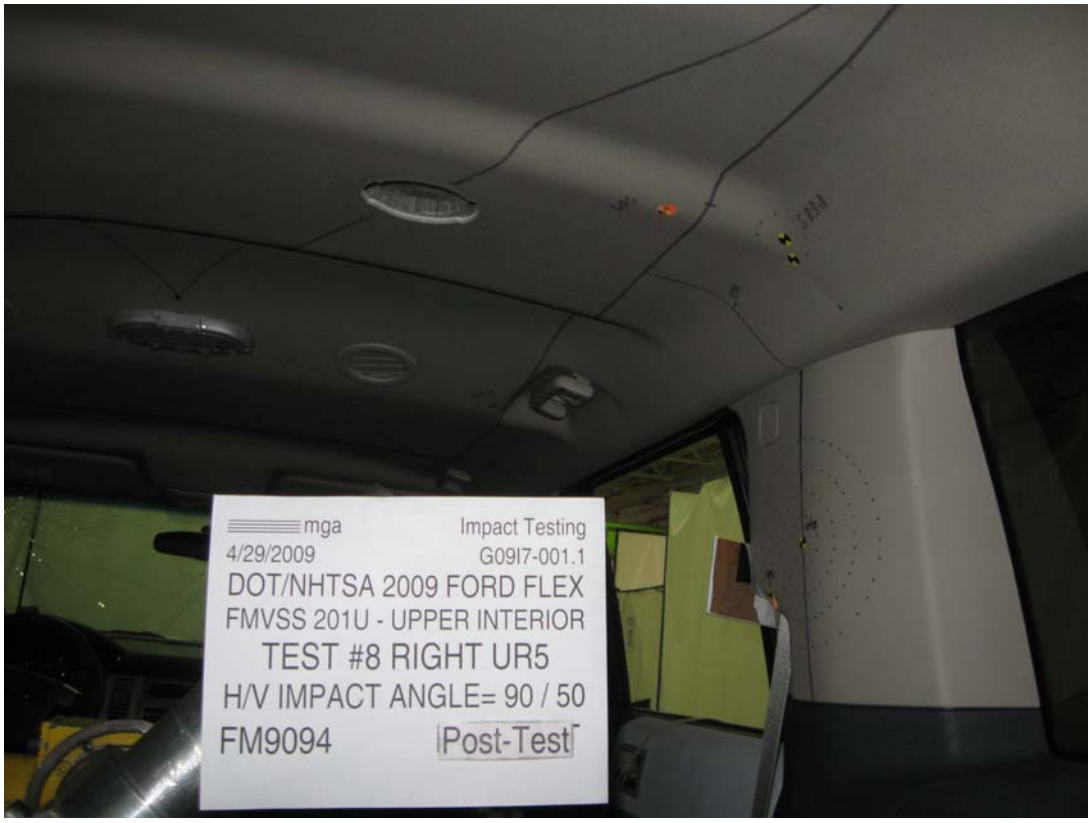

(peak = 20.4 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 24.00 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 = 61.9 mm)
Displacement (mm)
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT UR5
H/V IMPACT ANGLE= 90 / 50
FM9094
PRE TEST


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT UR5
H/V IMPACT ANGLE= 90 / 50
FM9094
PRE TEST


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT UR5
H/V IMPACT ANGLE= 90 / 50
FM9094
Post-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT UR5
H/V IMPACT ANGLE= 90 / 50
FM9094
Post-Test


mga
Impact Testing
4/29/2009
G09I7-001.1
DOT/NHTSA 2009 FORD FLEX
FMVSS 201U - UPPER INTERIOR
TEST #8 RIGHT UR5
H/V IMPACT ANGLE= 90 / 50
FM9094
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.1 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Ford Flex

GENERAL TEST PARAMETERS:

Test Number:#8

Target (Vehicle Side): UR5Right

Temperature:21.1C

MGA Test Reference No.:FM9094

Humidity:41.4%

Approach Horizontal Angles:90º

Time of Test:10:18:17 AM

Approach Vertical Angles:50º

FMH Serial No:[038]

Additional Description:Upper Roof at SR3-3

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
416	330	12.2	23.9	34	10 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.94	0.94

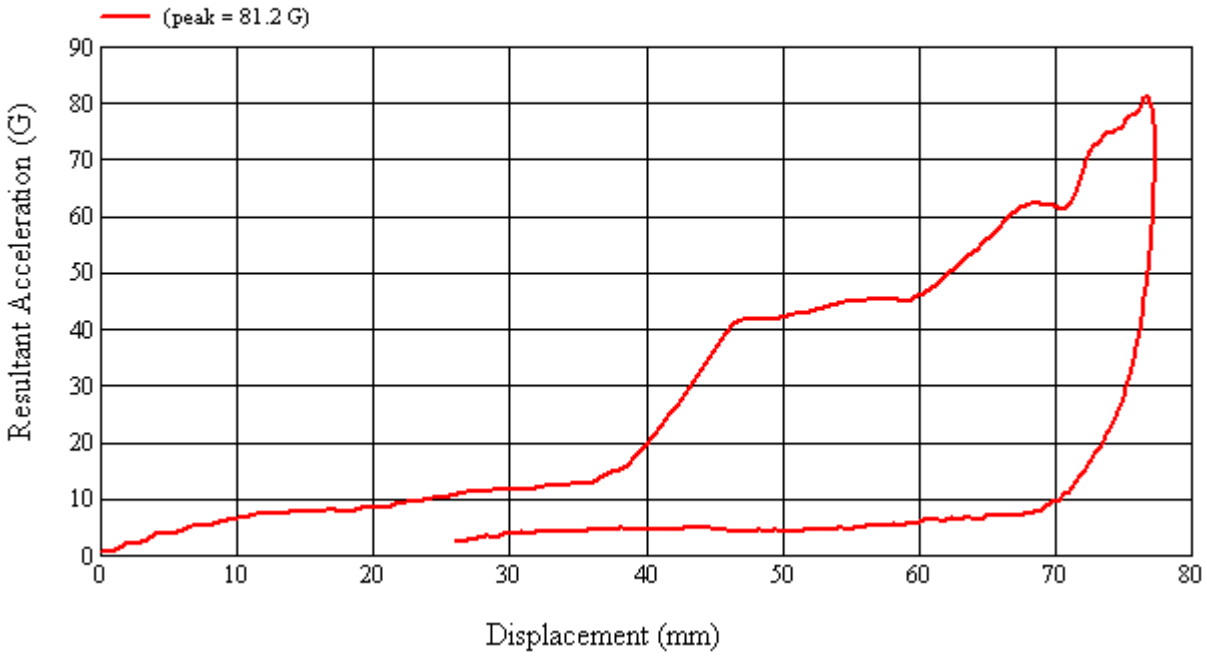
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

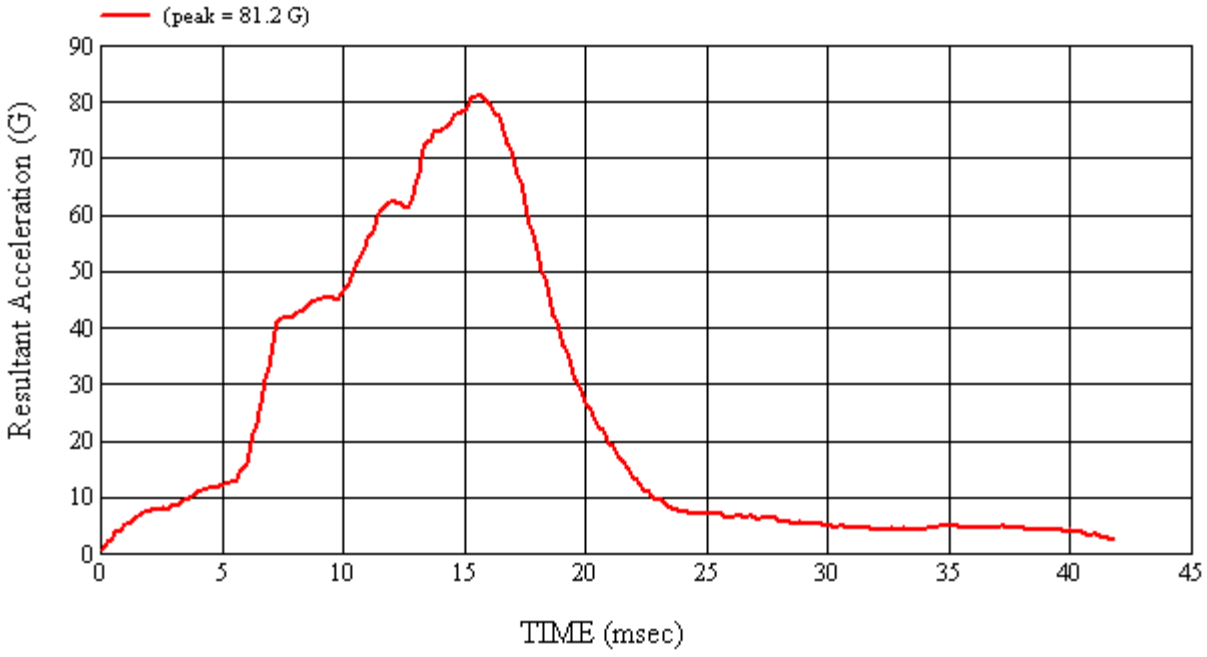
No damage observed

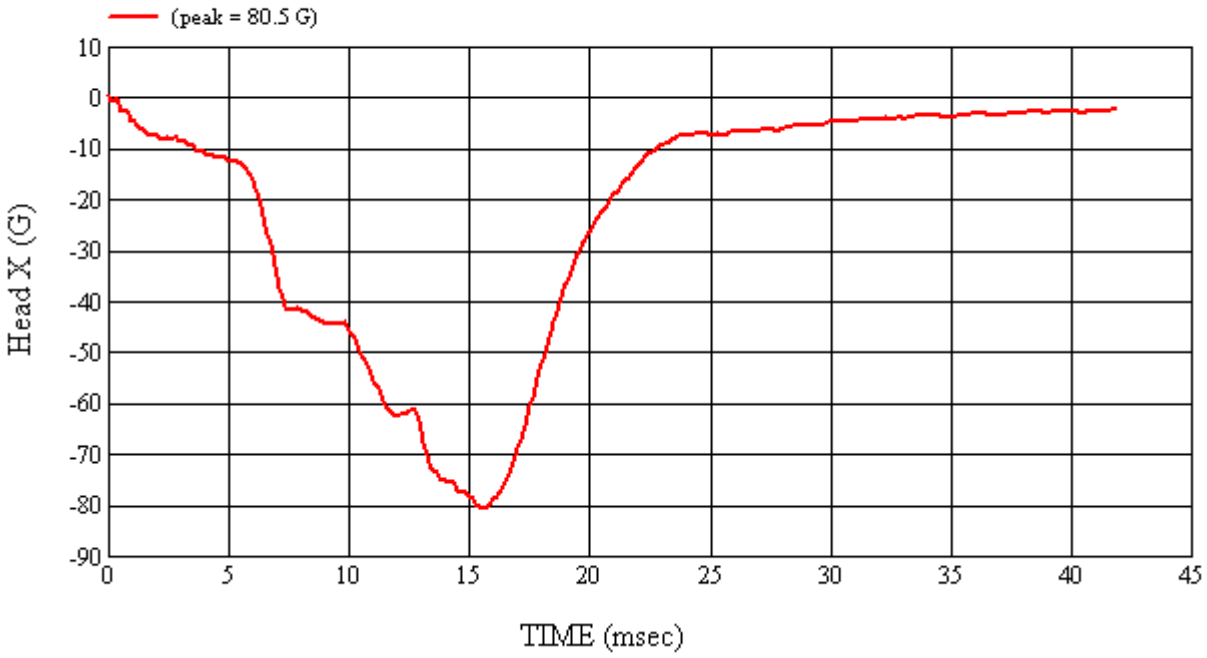
Recorded By:_____ Approved By*: _____ Date: 4/29/2009

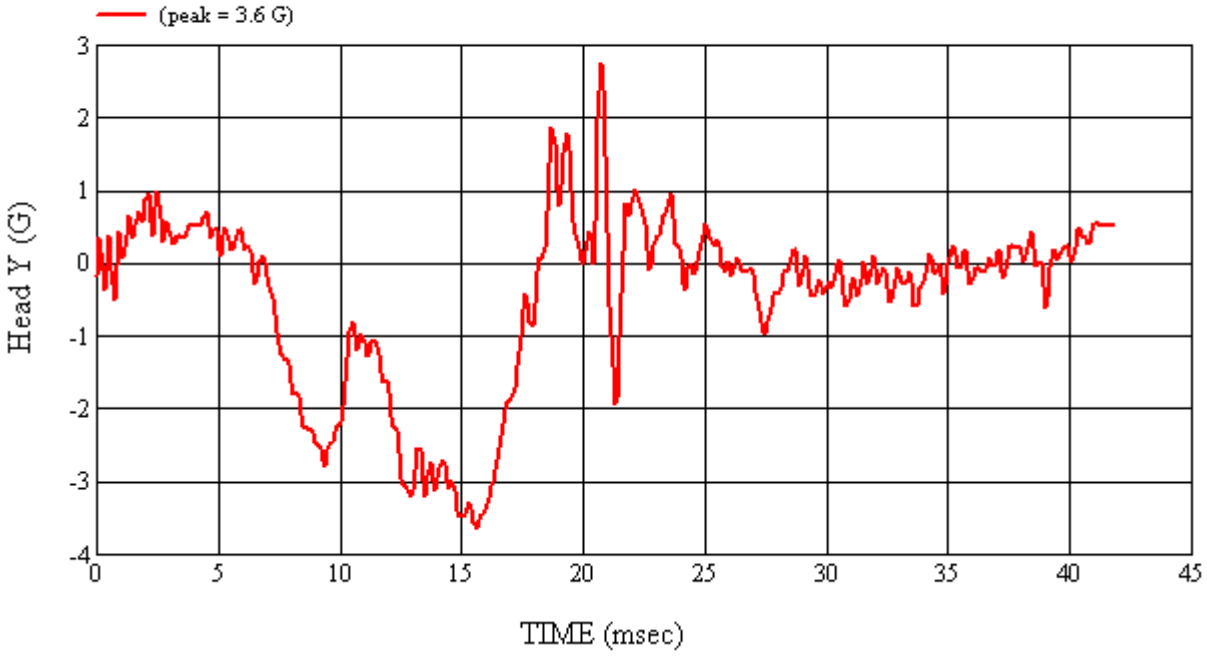
*Only necessary for NHTSA (Government) Compliance testing.

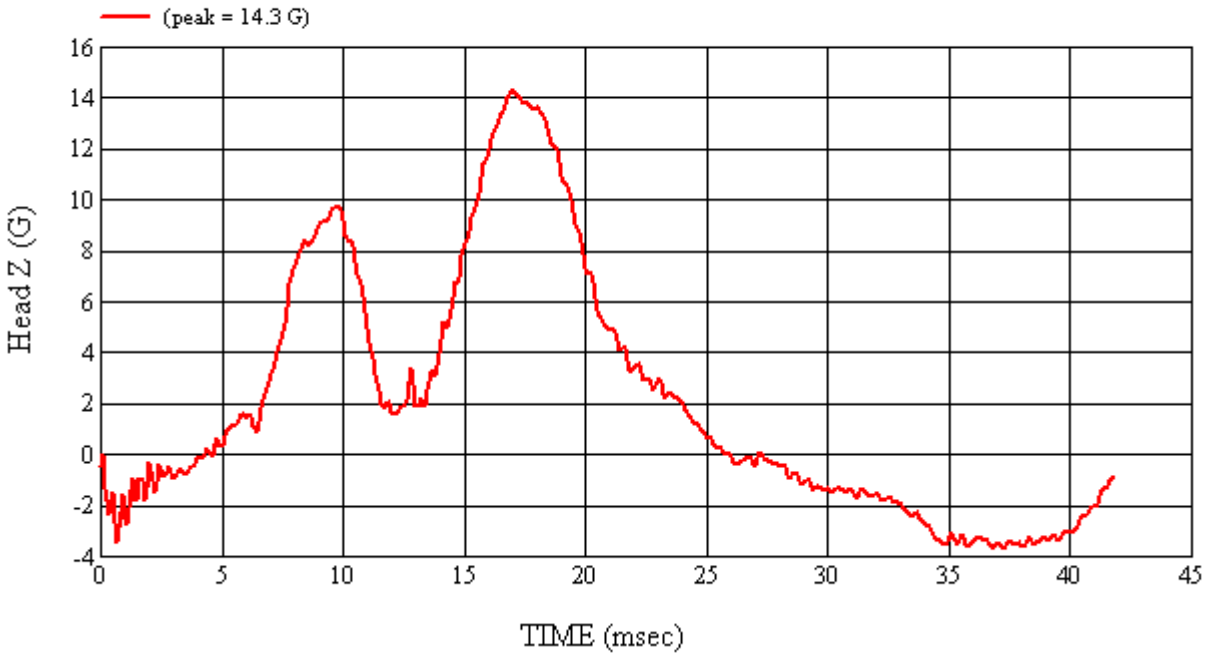
MGA Test #: FM9094 Target Location: UR5, Right Side Test Date: 4/29/2009

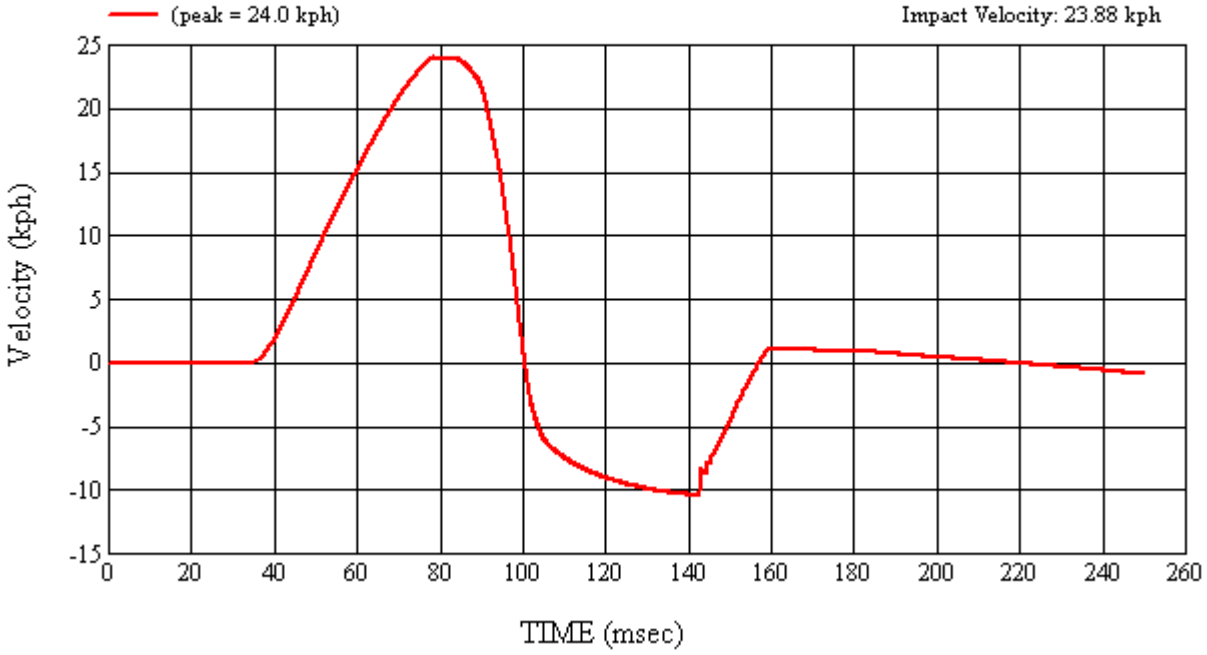


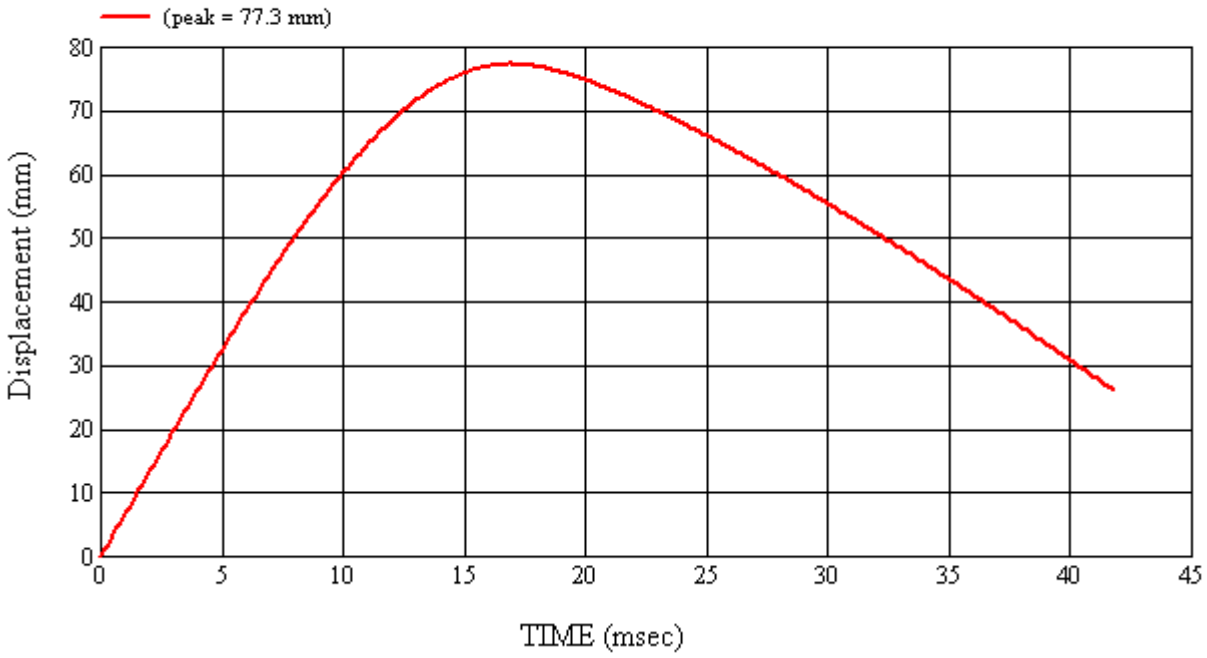



(peak = 80.5 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
5
10
15
20
25
30
35
40
45
TIME (msec)


(peak = 3.6 G)
Head Y (G)
3
2
1
0
-1
-2
-3
-4
0
5
10
15
20
25
30
35
40
45
TIME (msec)


(peak = 14.3 G)
Head Z (G)
16
14
12
10
8
6
4
2
0
-2
-4
0
5
10
15
20
25
30
35
40
45
TIME (msec)


(peak = 24.0 kph)
Impact Velocity: 23.88 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 = 77.3 mm)
Displacement (mm)
TIME (msec)
0
10
20
30
40
50
60
70
80
0
5
10
15
20
25
30
35
40
45

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	MODEL #	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
*Digital Inclinometer	Mitutoyo	PRO 360 (MGA00730)	Set Angle of FMH/Targeting	0.1°	Annual
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	Record Event	N/A	N/A
*FARO™	Faro Technologies	S08059801273	Targeting	0.1 mm	Annual
Measuring Devices: - Tape Measure - Plumb Bobs - Digital Protractor	 Stanley N/A Mitutoyo	 TPM906 -- MGA00730	 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	MGA00081	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	4/27/2009	9.90	22.3	62.0	232.3	2.0	Yes
Post	#035	5/4/2009	9.90	20.7	41.1	240.1	7.4	Yes
Pre	#037	4/27/2009	9.96	22.3	62.0	253.0	3.1	Yes
Post	#037	5/4/2009	9.96	20.7	41.1	251.1	3.2	Yes
Pre	#038	4/27/2009	9.90	22.3	62.0	246.2	13.5	Yes
Post	#038	5/4/2009	9.90	20.7	41.1	248.9	9.5	Yes

4-1 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 4/27/2009 CALIBRATION TIME: 4:40:17 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.3
Relative Humidity	10% to 70%	62.0
Peak Resultant Acceleration	225 G's to 275 G's	232.3
Peak Lateral Acceleration	15 G's Maximum	2.0
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION

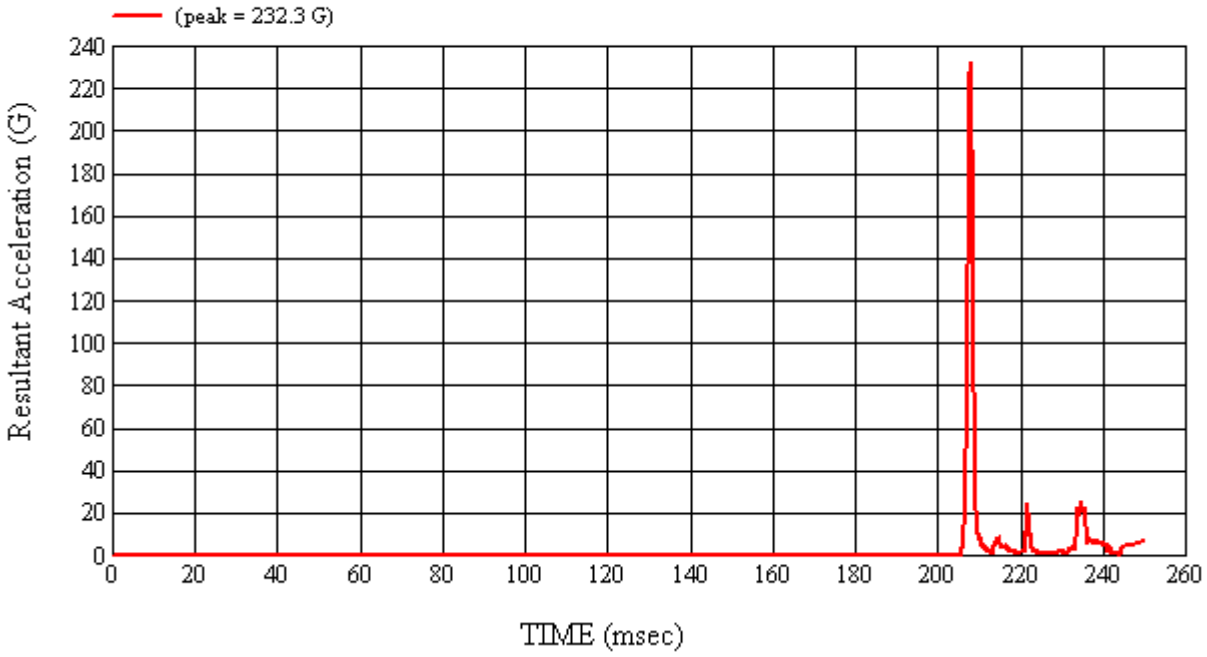
HEAD ACCELEROMETERS

Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J35919	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J22664	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35924	03/02/09	09/02/09

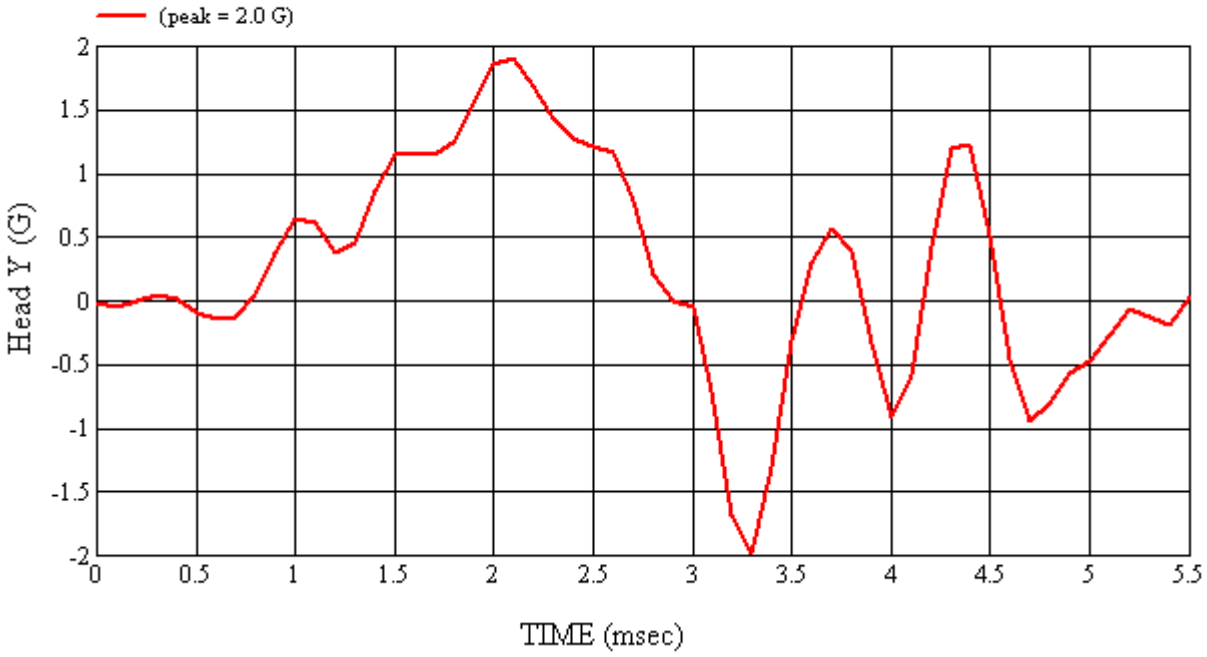
REMARKS:

RECORDED BY: _____ DATE: 4/27/2009

APPROVED BY: _____



Head 035 (Pre) Calibration #H35009



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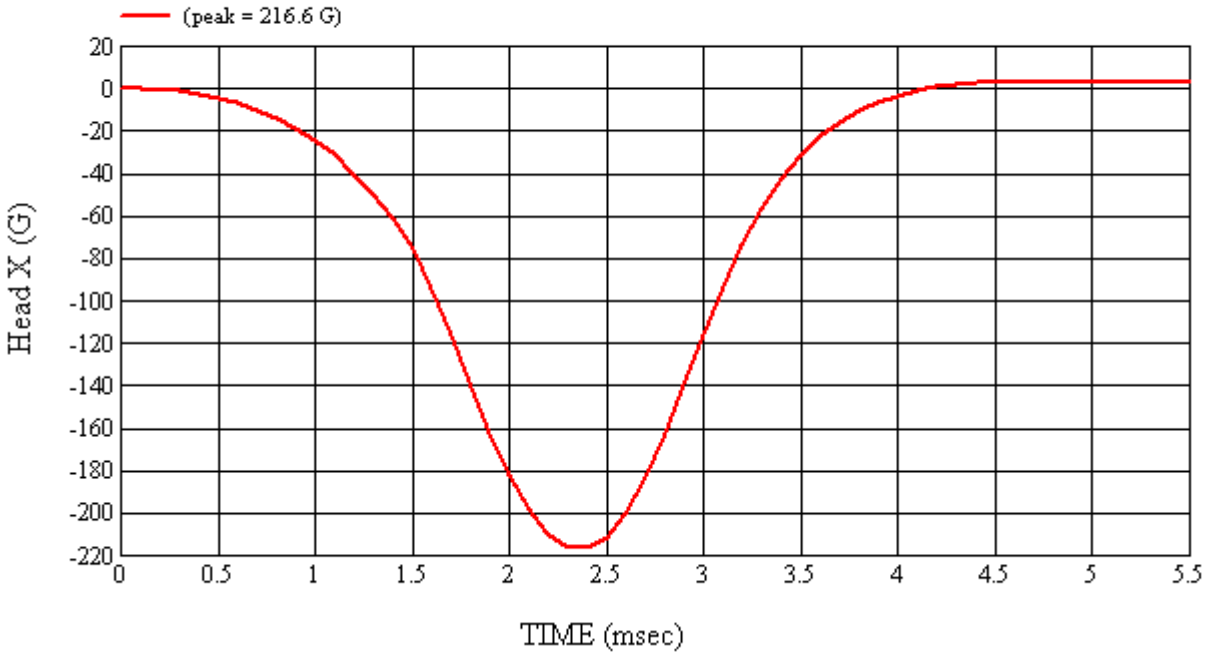

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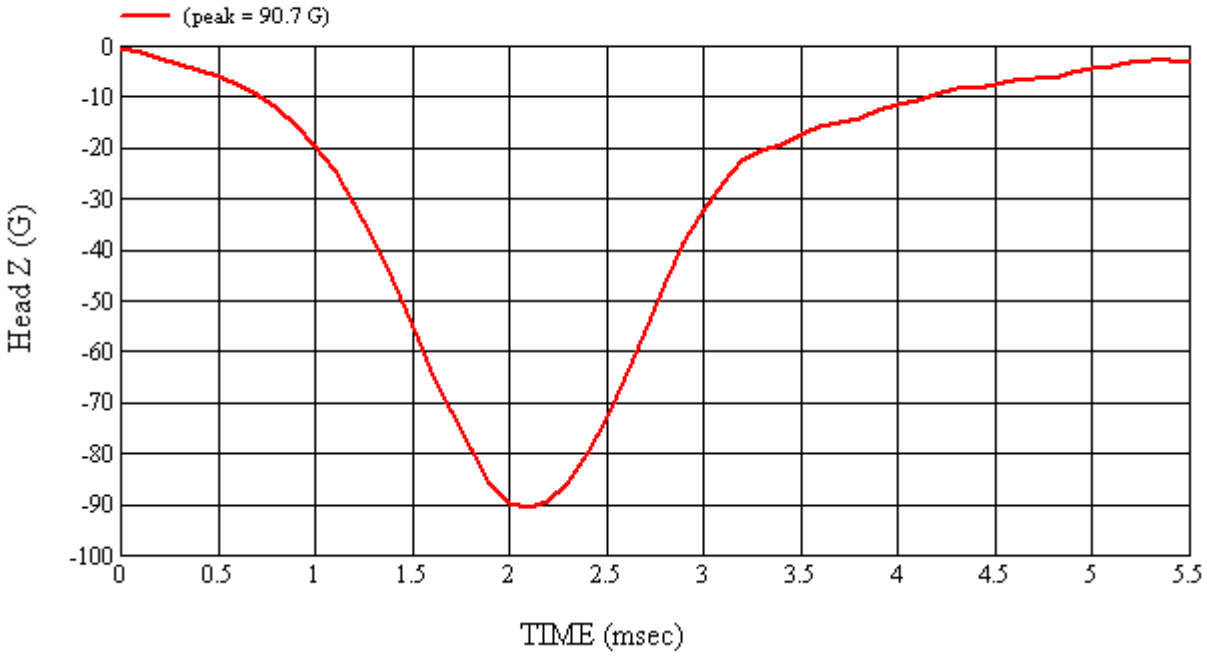


Head 035 (Pre) Calibration #H35009

4-2 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 5/4/2009 CALIBRATION TIME: 9:55:58 AM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	20.7
Relative Humidity	10% to 70%	41.1
Peak Resultant Acceleration	225 G's to 275 G's	240.1
Peak Lateral Acceleration	15 G's Maximum	7.4
Unimodal Acceleration Curve	YES	YES

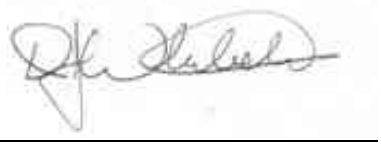
FMH INSTRUMENTATION

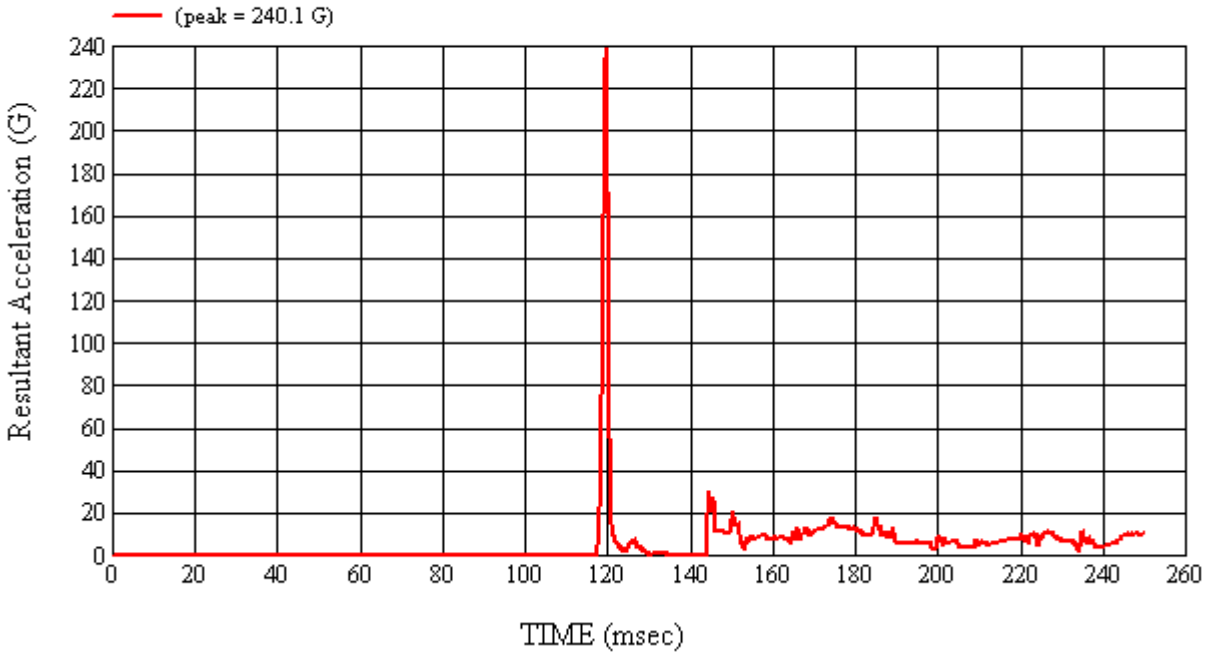
HEAD ACCELEROMETERS

Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J35919	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J22664	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35924	03/02/09	09/02/09

REMARKS:

RECORDED BY:  DATE: 5/4/2009

APPROVED BY: 



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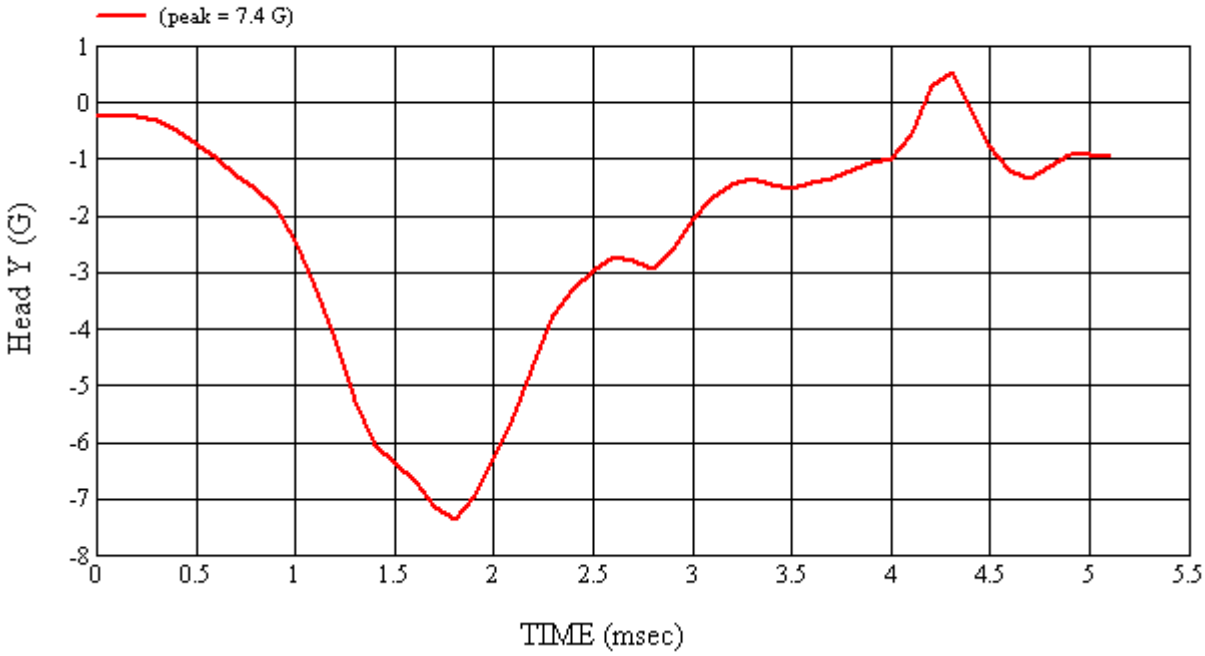

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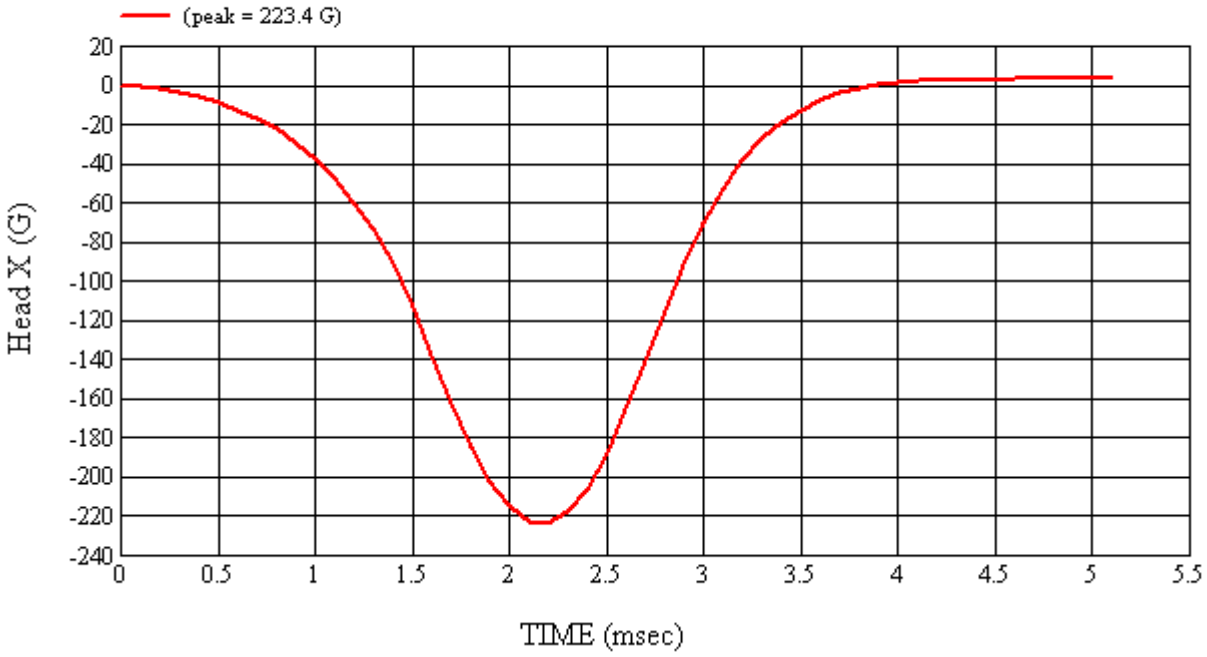

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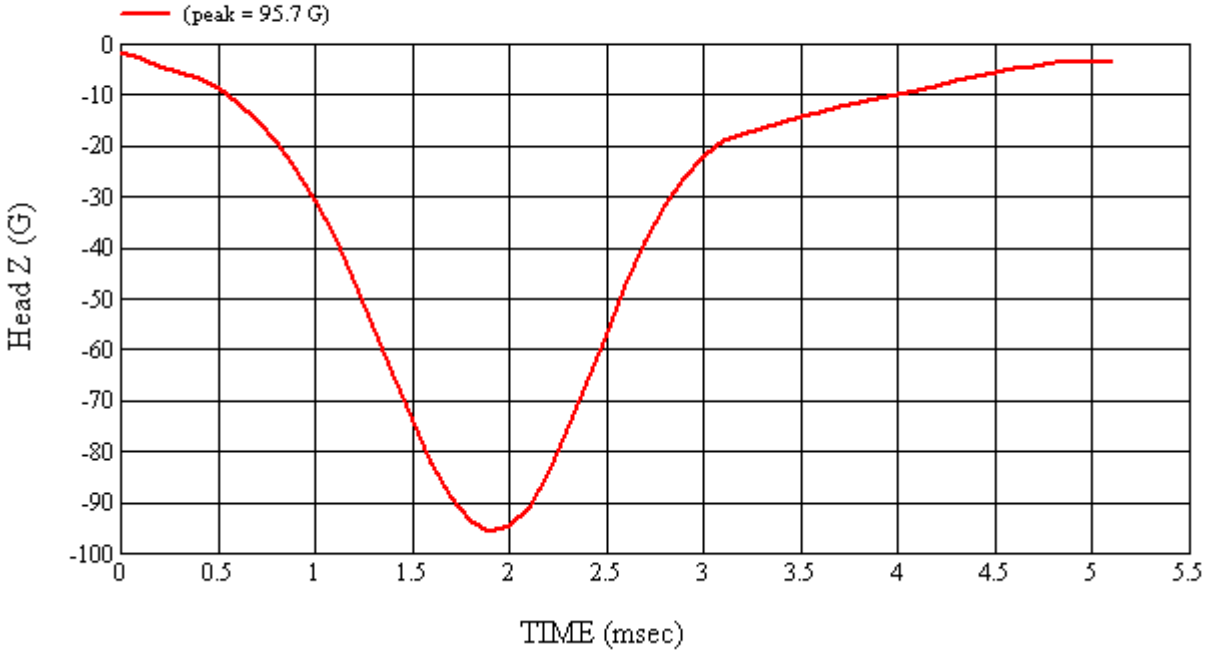


Head 035 (Post) Calibration #H35010

4-3 Pre-Test Calibration

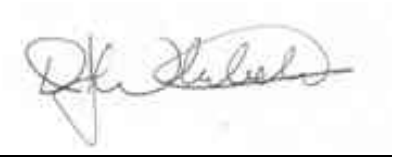
HEAD DROP TEST SUMMARY
PART 572L

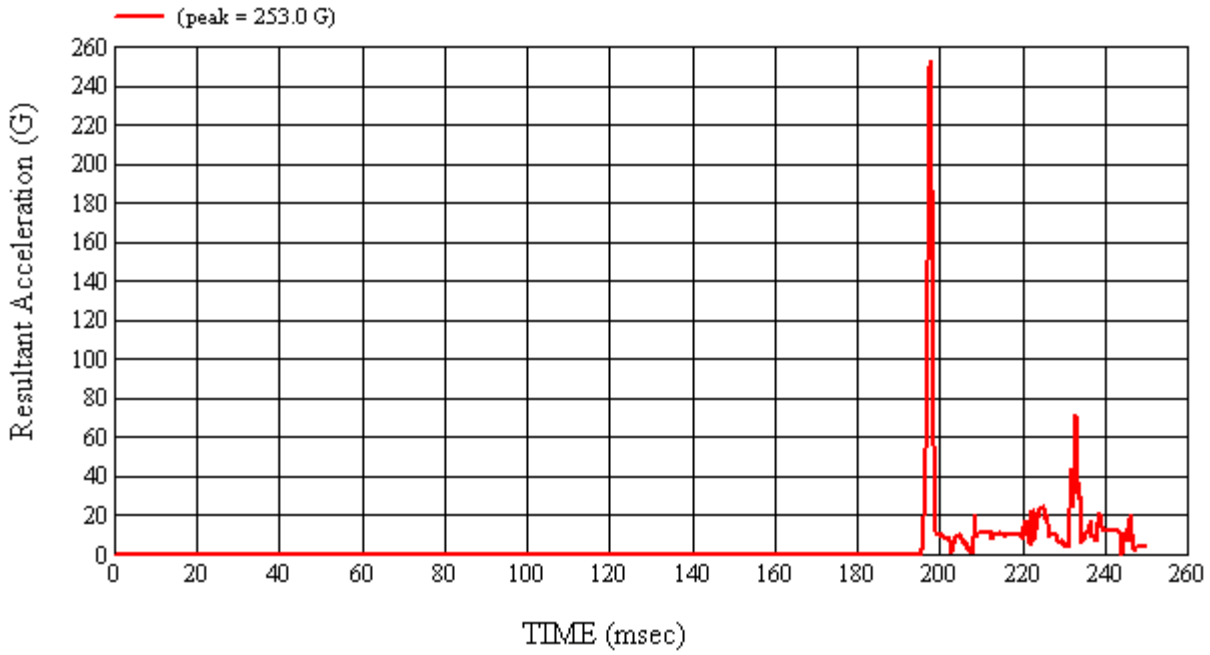
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 4/27/2009 CALIBRATION TIME: 4:51:10 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	22.3
Relative Humidity	10% to 70%	62.0
Peak Resultant Acceleration	225 G's to 275 G's	253.0
Peak Lateral Acceleration	15 G's Maximum	3.1
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	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J14103	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35800	03/02/09	09/02/09

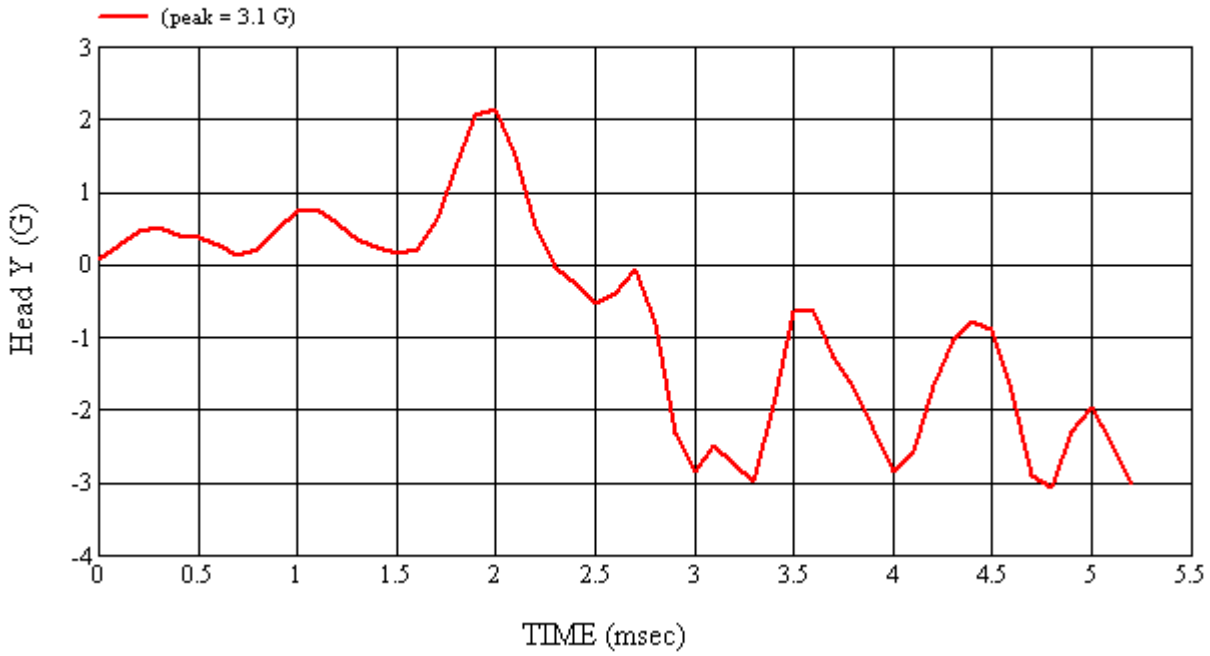
REMARKS:

RECORDED BY:  DATE: 4/27/2009

APPROVED BY: 



Head 037 (Pre) Calibration #H37009



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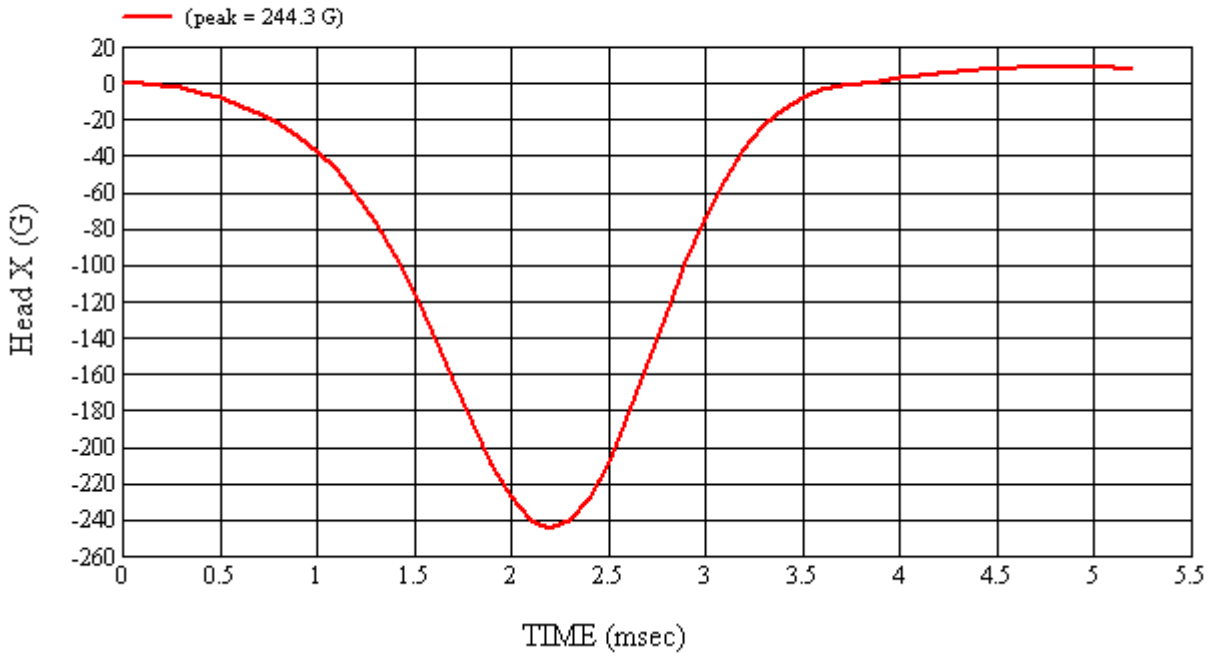

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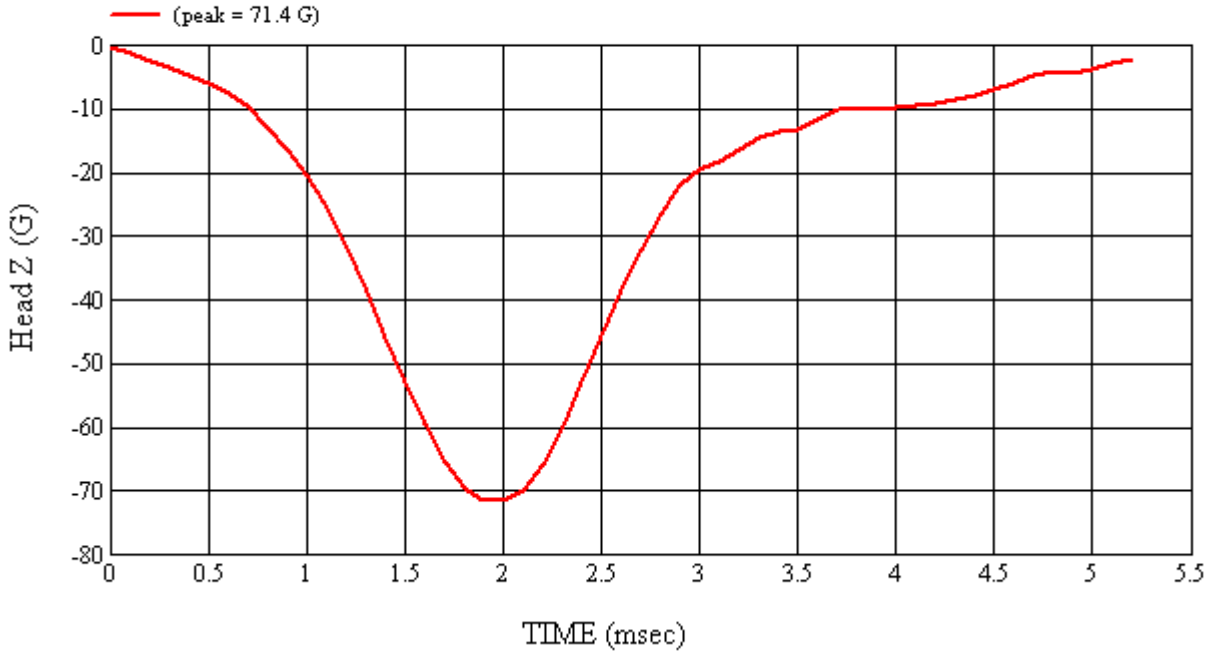


Head 037 (Pre) Calibration #H37009

4-4 Post-Test Calibration

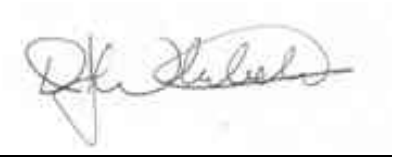
HEAD DROP TEST SUMMARY
PART 572L

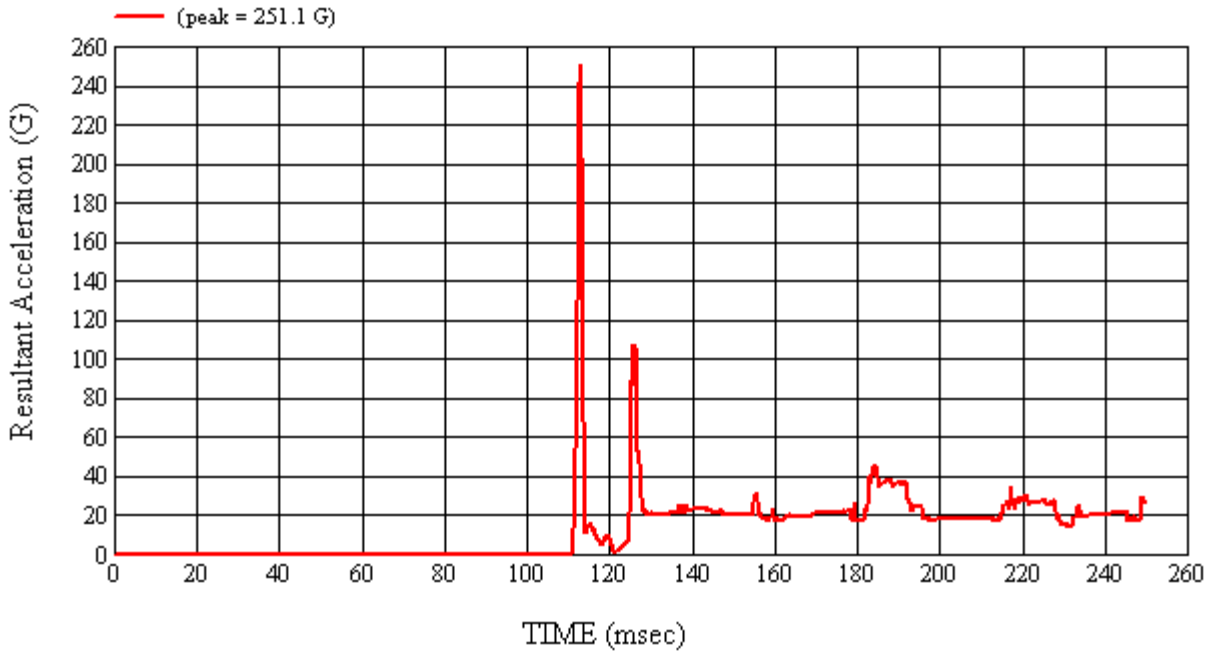
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 5/4/2009 CALIBRATION TIME: 10:13:13 AM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	20.7
Relative Humidity	10% to 70%	41.1
Peak Resultant Acceleration	225 G's to 275 G's	251.1
Peak Lateral Acceleration	15 G's Maximum	3.2
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	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J14103	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35800	03/02/09	09/02/09

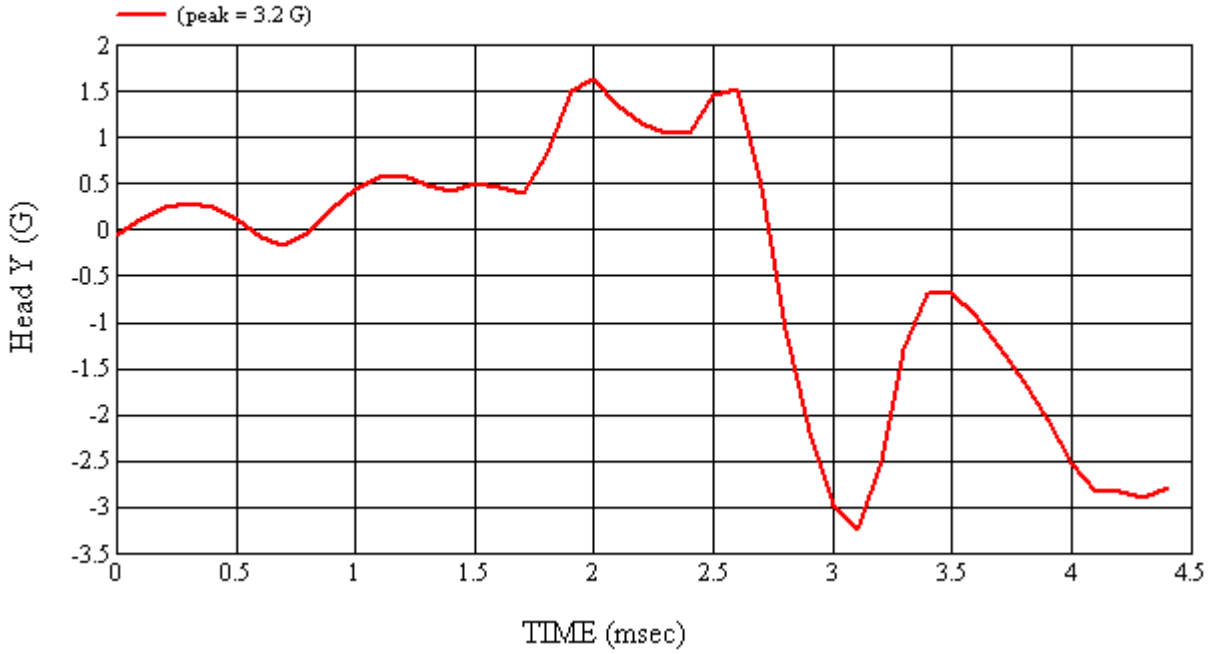
REMARKS:

RECORDED BY:  DATE: 5/4/2009

APPROVED BY: 



Head 037 (Post) Calibration #H37010



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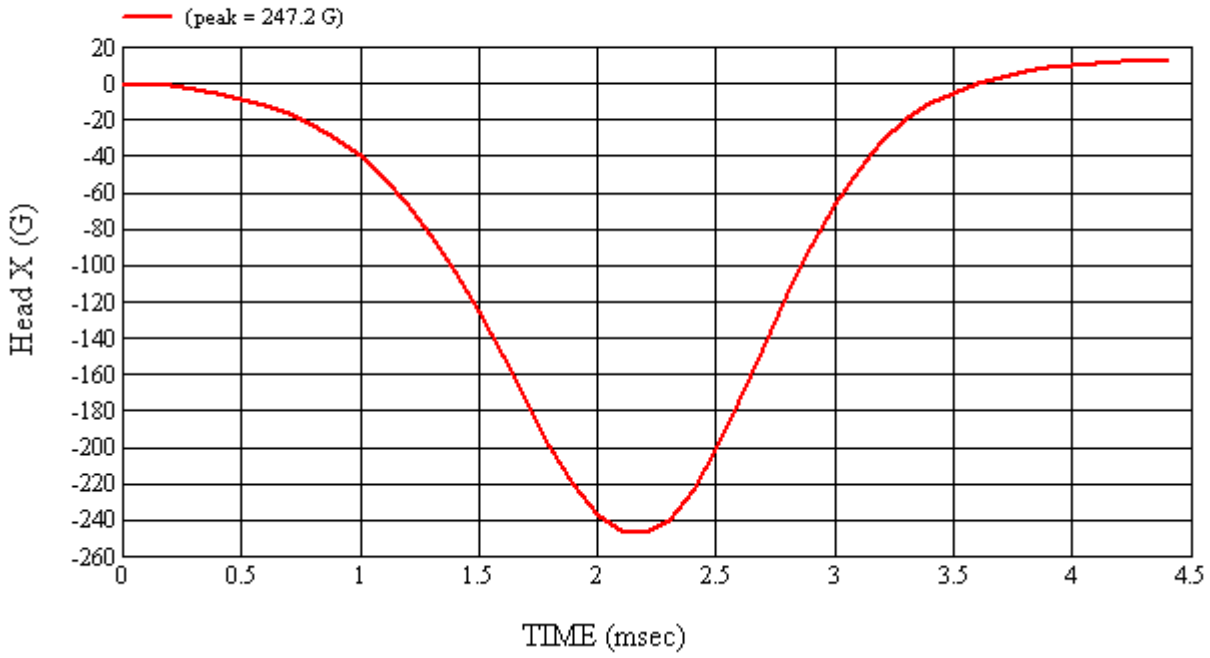

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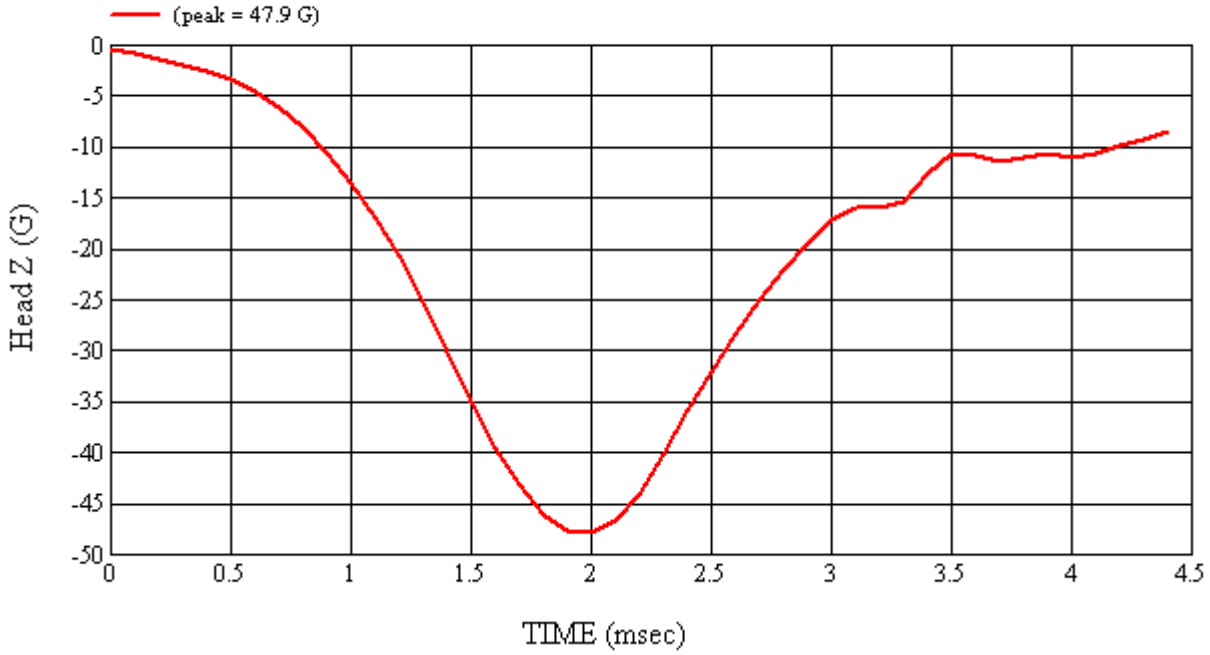


Head 037 (Post) Calibration #H37010

4-5 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

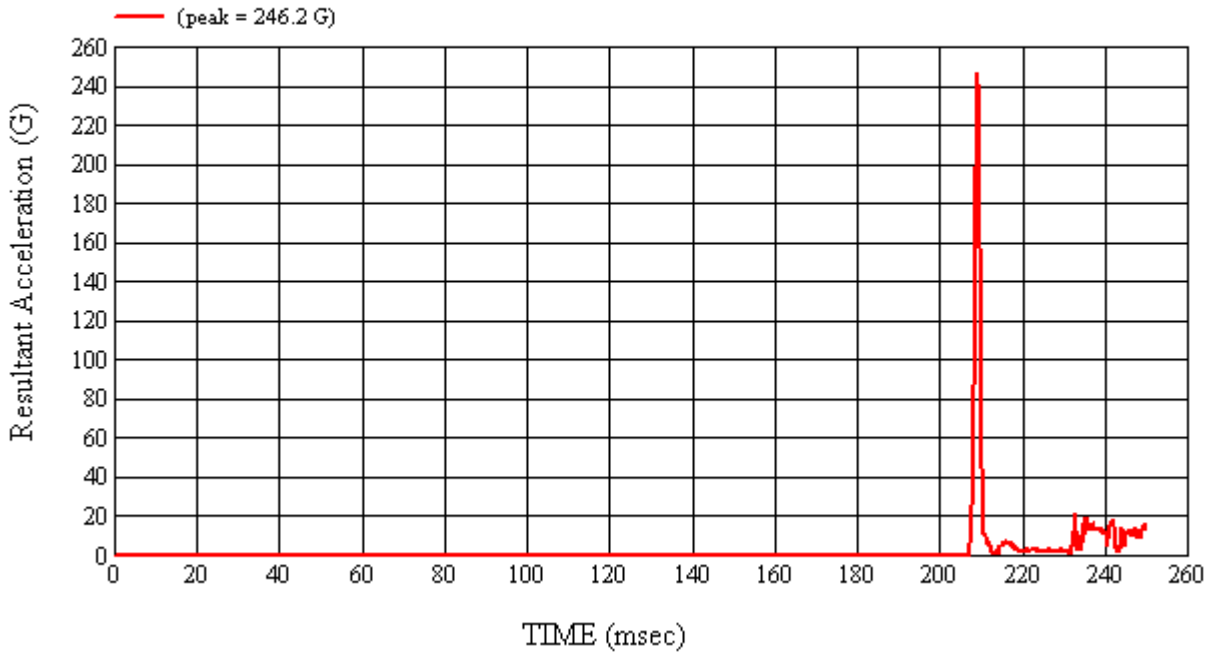
HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 4/27/2009 CALIBRATION TIME: 5:06:18 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.3
Relative Humidity	10% to 70%	62.0
Peak Resultant Acceleration	225 G's to 275 G's	246.2
Peak Lateral Acceleration	15 G's Maximum	13.5
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	04/17/09	10/17/09
2	ENDEVCO	7264-2000	J36197	04/17/09	10/17/09
3	ENDEVCO	7264-2000	J36353	04/17/09	10/17/09

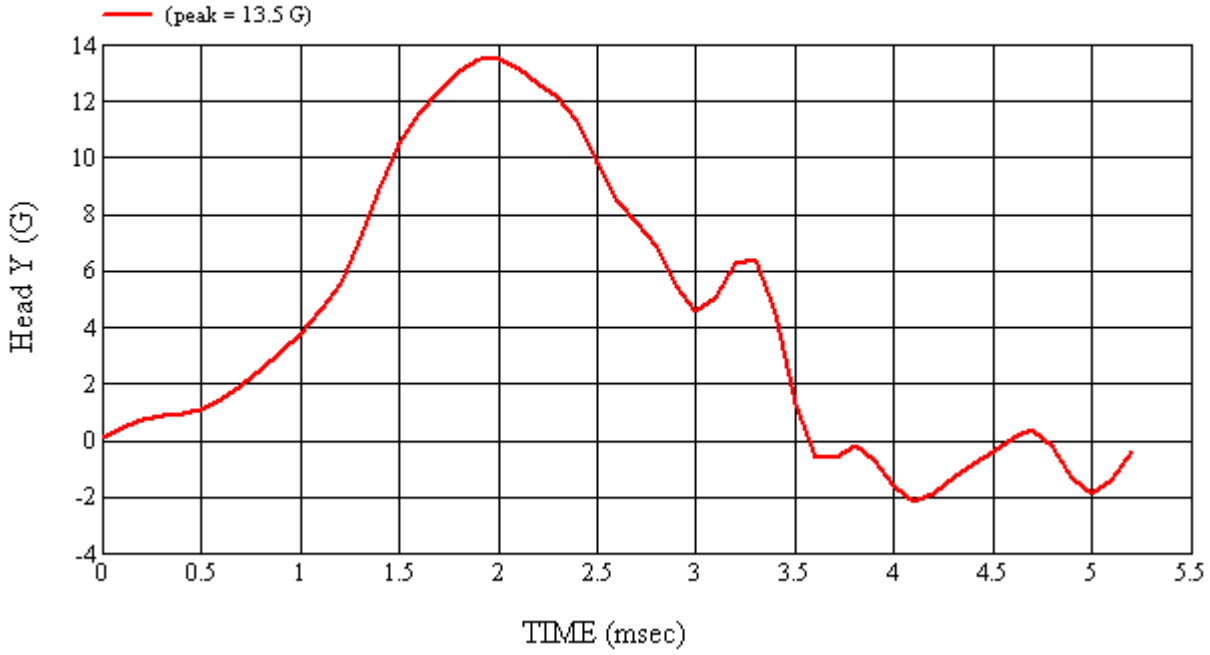
REMARKS:

ECORDED BY: _____ DATE: __4/27/2009____

PPROVED BY: _____



Head 038 (Pre) Calibration #H38009



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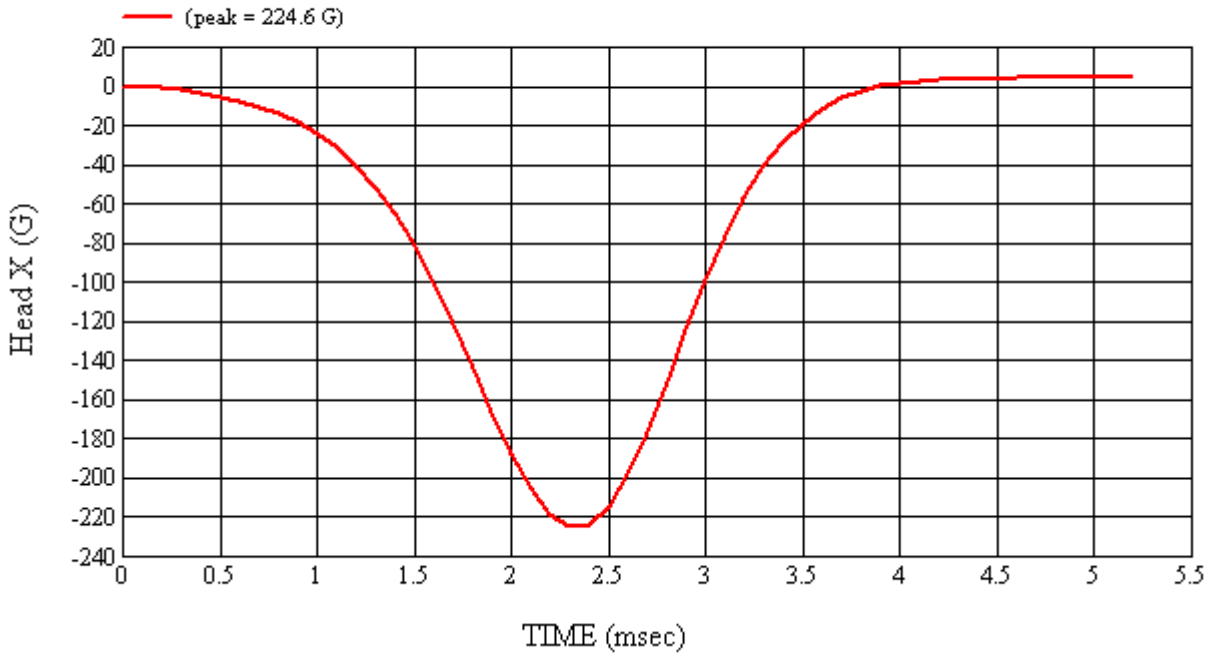

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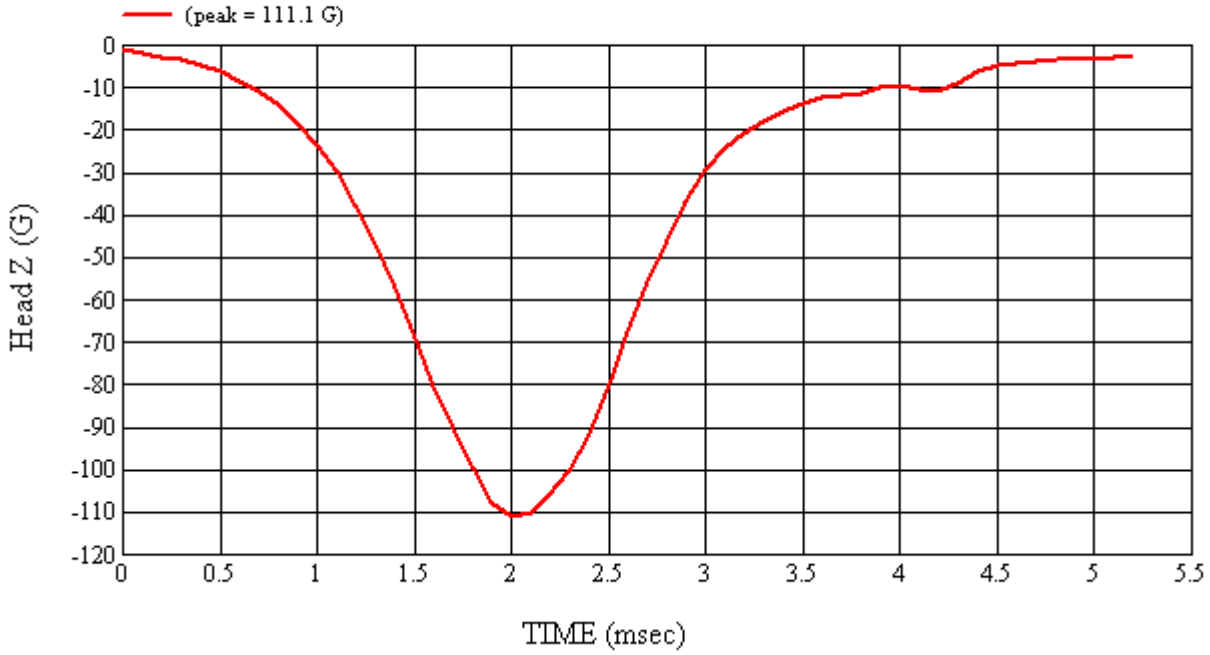


Head 038 (Pre) Calibration #H38009

4-6 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

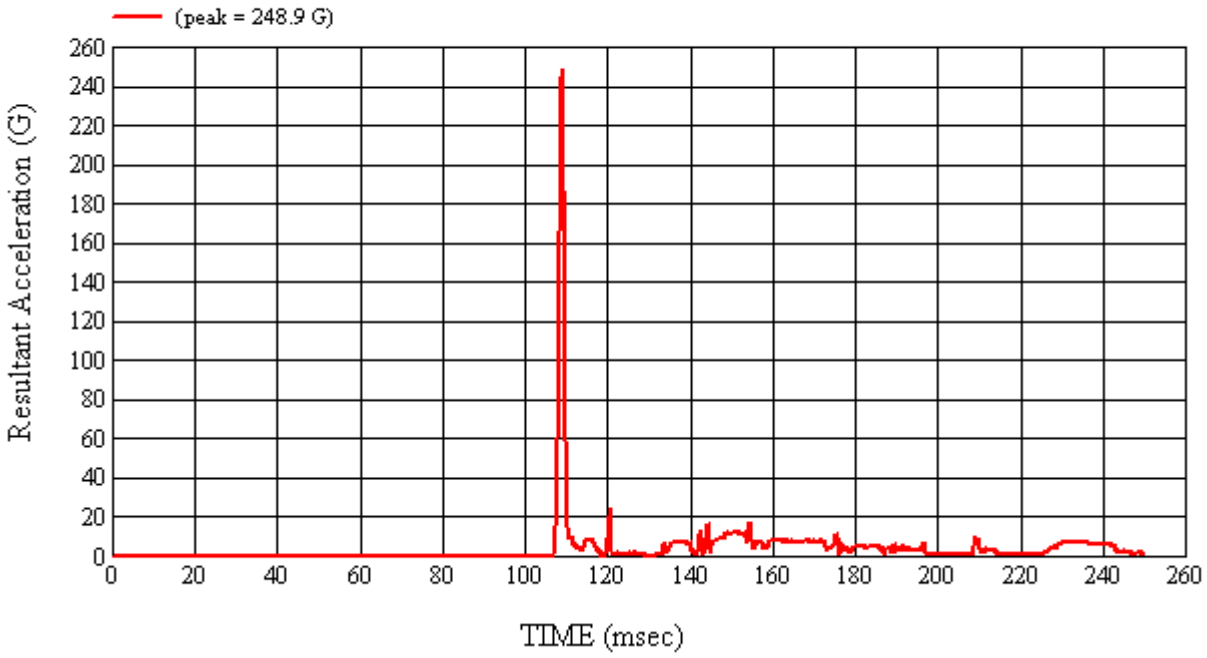
HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 5/4/2009 CALIBRATION TIME: 10:44:31 AM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	20.7
Relative Humidity	10% to 70%	41.1
Peak Resultant Acceleration	225 G's to 275 G's	248.9
Peak Lateral Acceleration	15 G's Maximum	9.5
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	04/17/09	10/17/09
2	ENDEVCO	7264-2000	J36197	04/17/09	10/17/09
3	ENDEVCO	7264-2000	J36353	04/17/09	10/17/09

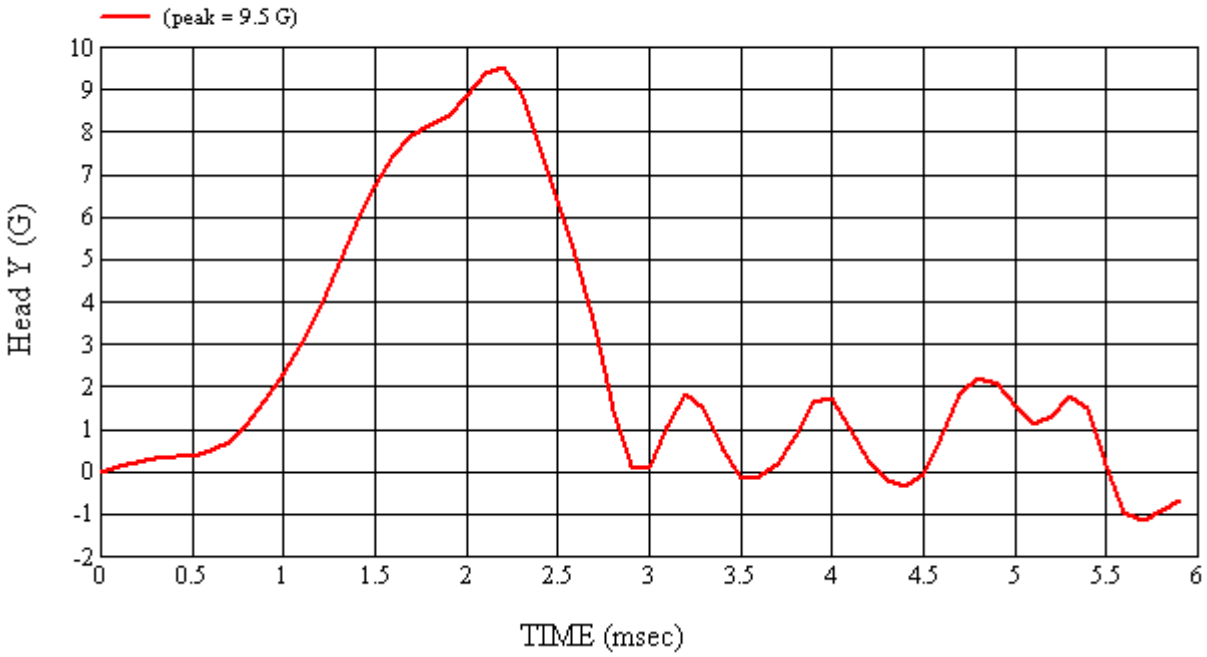
REMARKS:

ECORDED BY: _____ DATE: __5/4/2009____

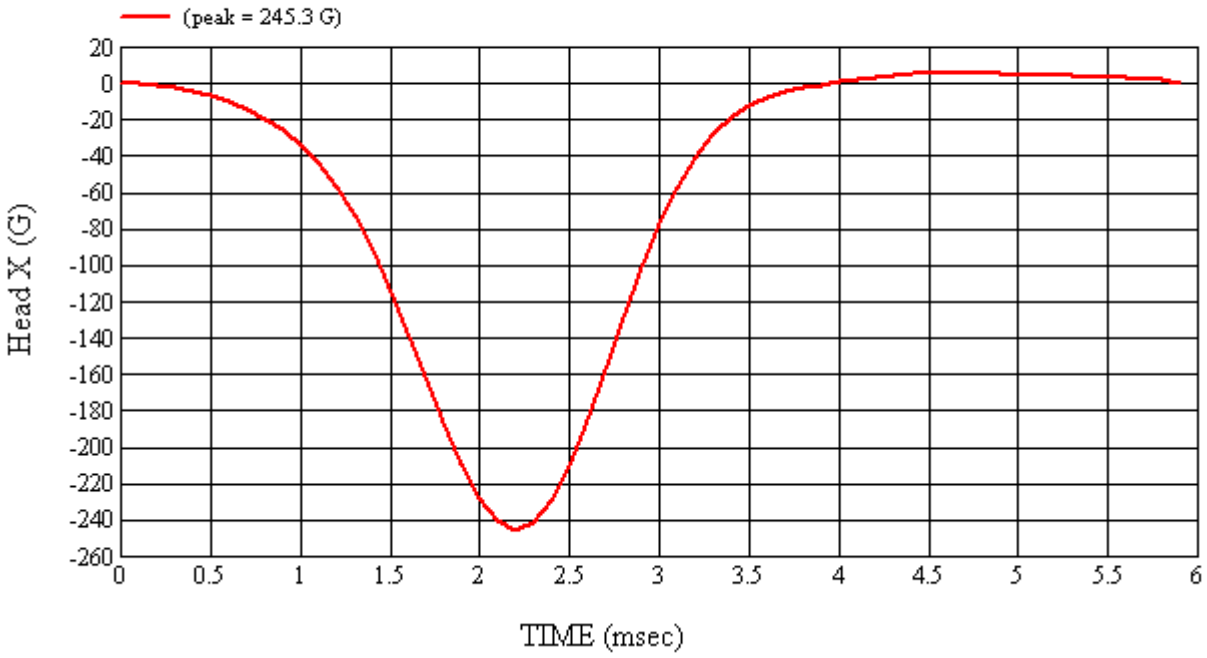
PPROVED BY: _____APPROVED BY:



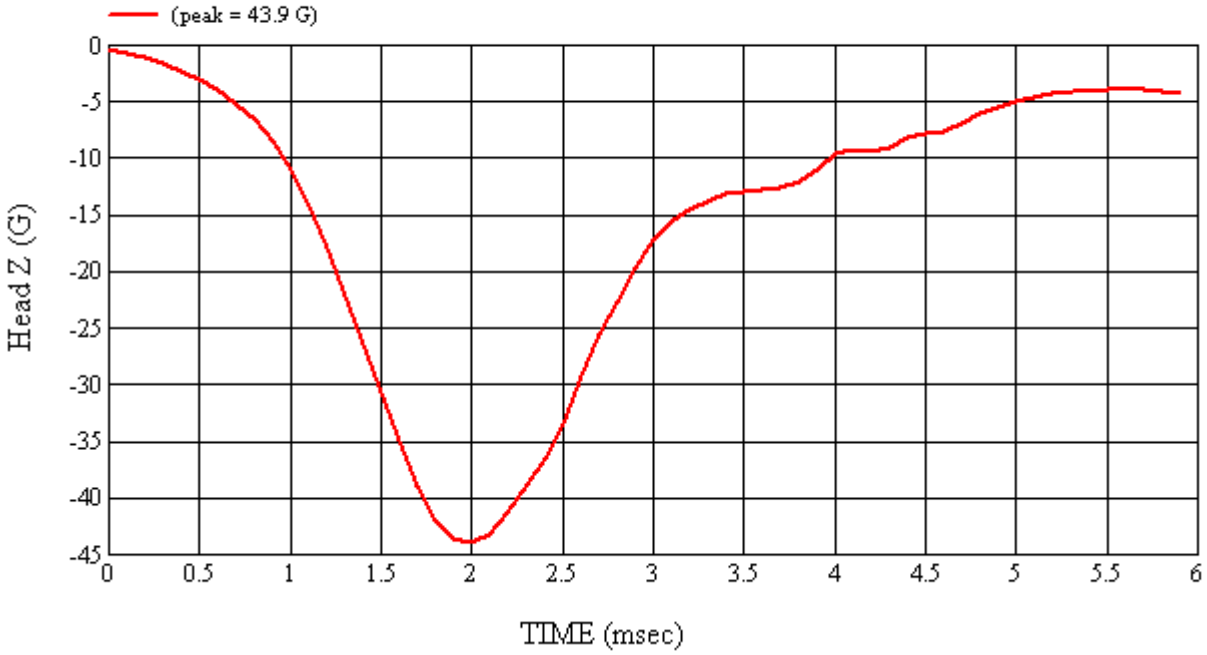
Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010

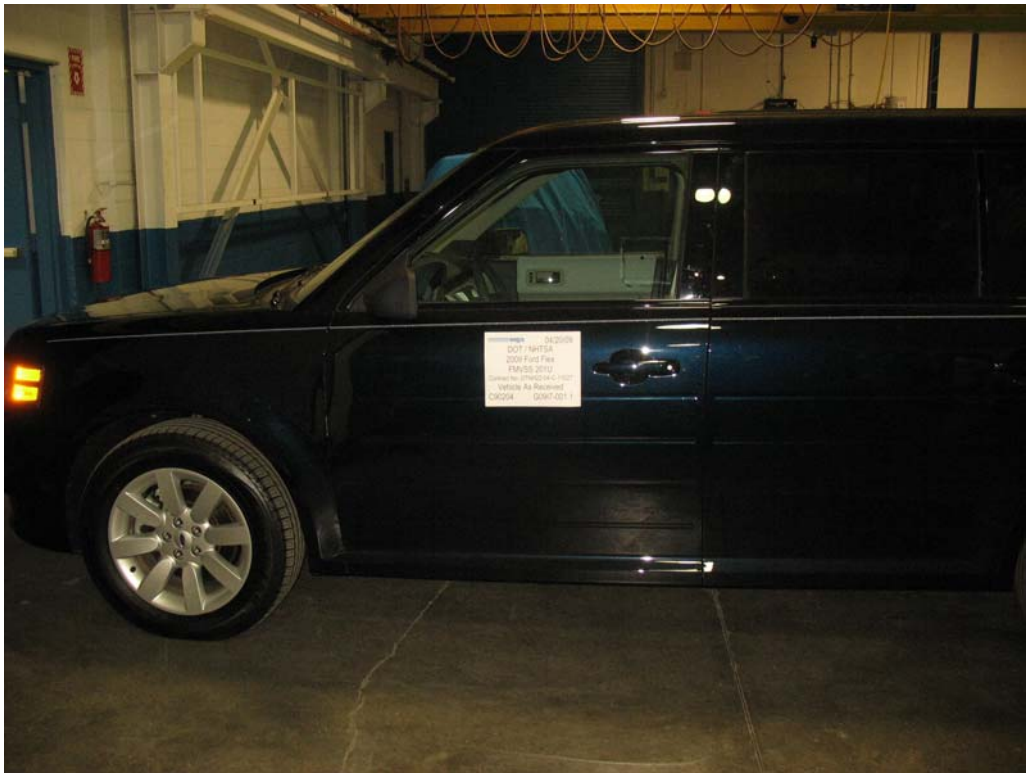


Head 038 (Post) Calibration #H38010

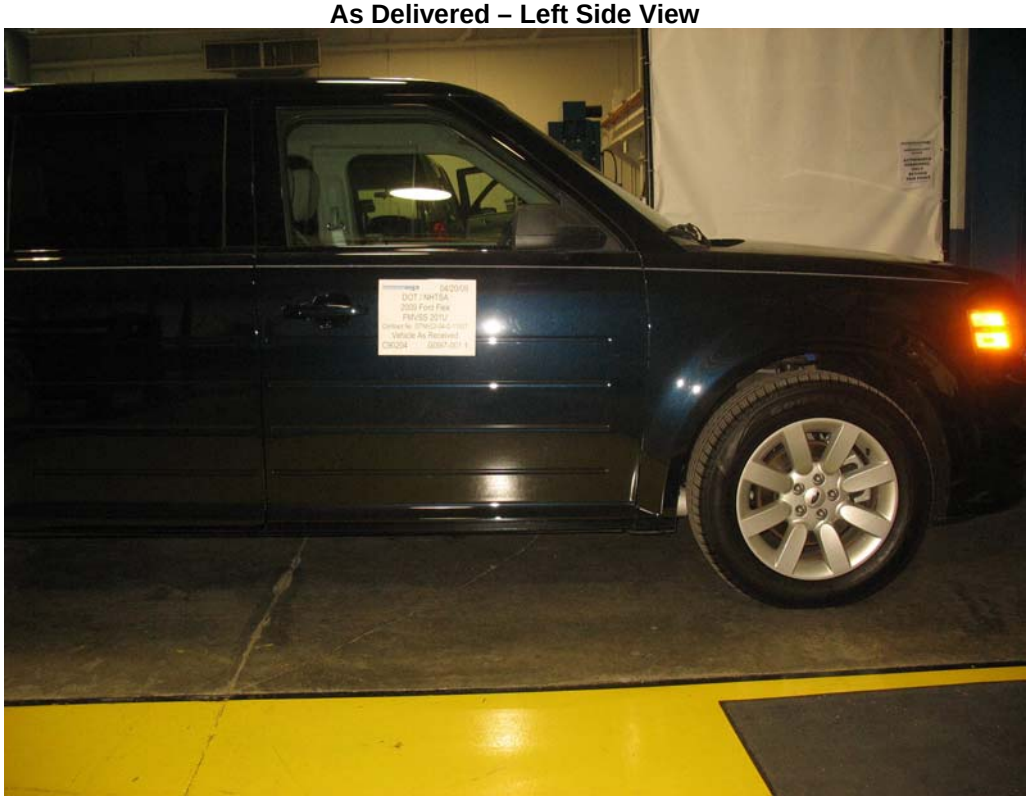


Head 038 (Post) Calibration #H38010

5.0 PHOTOGRAPHS



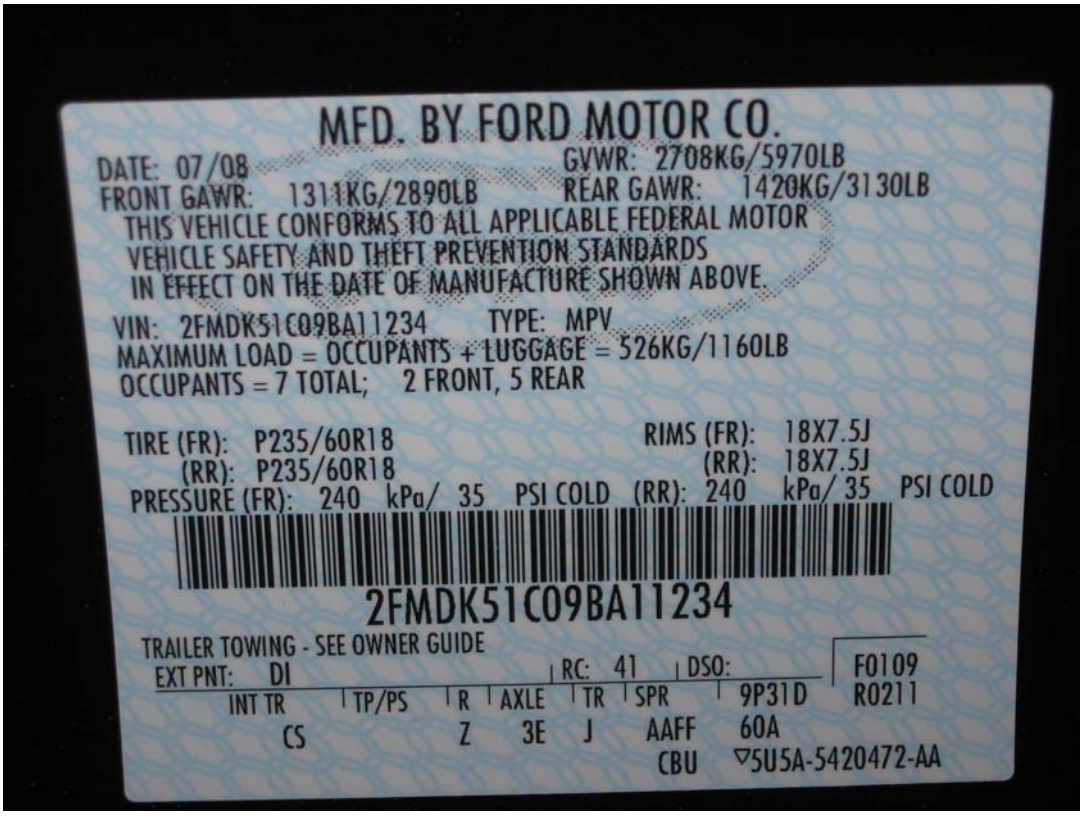
As Delivered – Left Side View



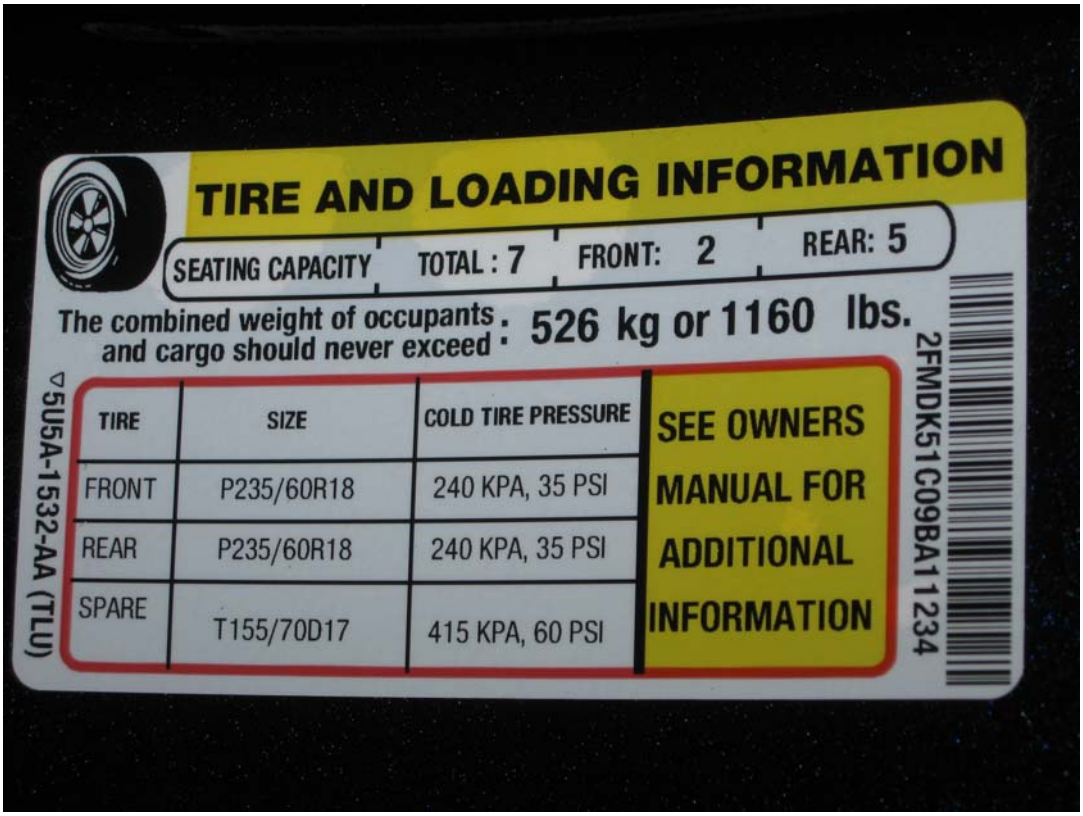
As Delivered – Right Side View

As Delivered – ¾ Front View From Left Side

As Delivered – ¾ Front View From Right Side



As Delivered – Vehicle's Certification Label



As Delivered – Vehicle's Tire Information Label

Pre-Test Component Photographs


mga
04/28/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Pre-Test Component
G09I7-001.1


mga
04/28/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Pre-Test Component
G09I7-001.1


04/28/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Pre-Test Component
G09I7-001.1


RH
04/28/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Pre-Test Component
G09I7-001.1


mga
04/28/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Pre-Test Component
G09I7-001.1


mga
04/28/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Pre-Test Component
G09I7-001.1

Post-Test Component Photographs


mga
04/30/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Post-Test Component
G09I7-001.1


mga
04/30/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Post-Test Component
G09I7-001.1

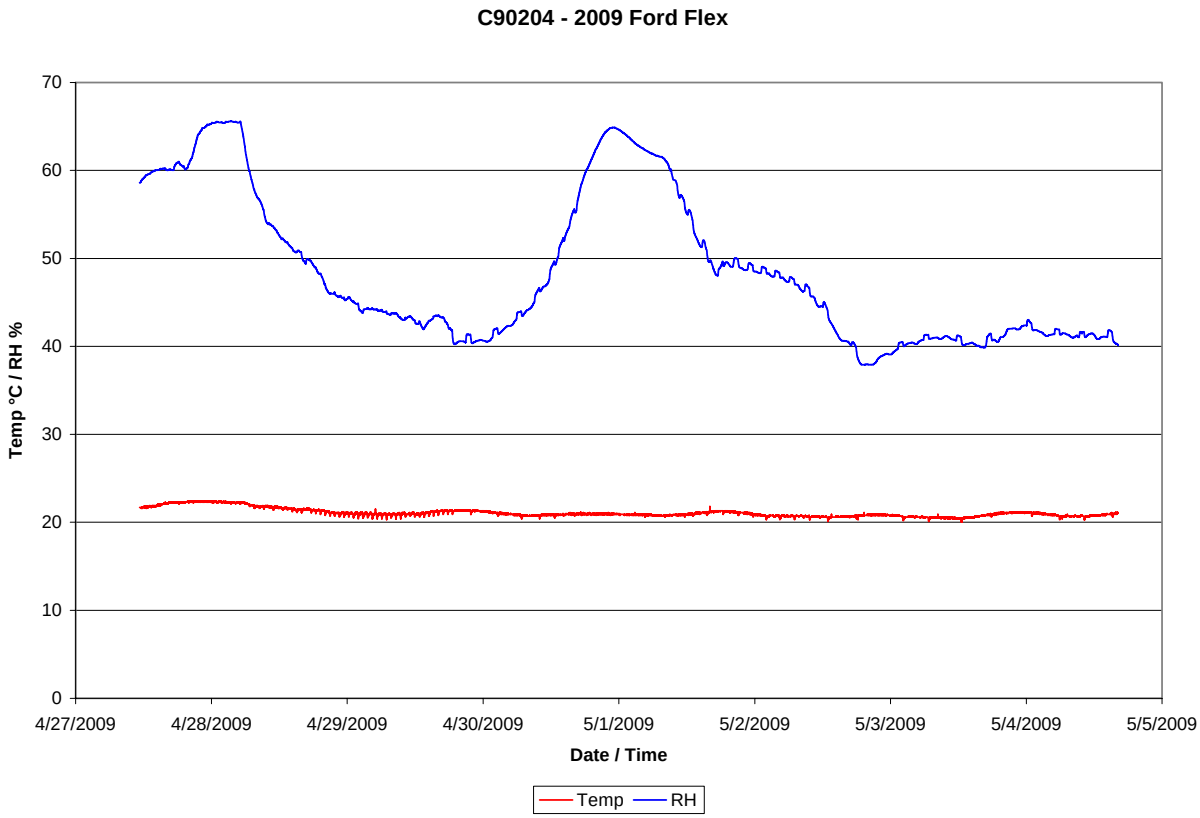

RH
RP1
RP2
mga
04/30/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Post-Test Component
G09I7-001.1


RH
RP2
mga
04/30/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Post-Test Component
G09I7-001.1


mga
04/30/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Post-Test Component
G09I7-001.1


mga
04/30/09
DOT / NHTSA
2009 Ford Flex
FMVSS 201U - Head Impacts
NHTSA# C90204
Post-Test Component
G09I7-001.1

Appendix A – Temperature Trace



Appendix B – Calibration Certificates

Calibration Certificate

Part Description: Silver
Certification Date: 08/26/08
Serial#: S08-05-98-01273
Single Point (Max-Min/2) Specification: S08-05 .076mm (.0030")
Certificate#: S0127339686
Volumetric (Max Deviation) Specification: S08-05 +/-.108mm (+/-.0042")
Temperature: See attached data

Measurement Standards Traceability

Ball Bar Kit	Asset Number: 543	Calibration Date: 07/08/08	*SI Traceability: METAS-L20080708AB1
Thermometer	Asset Number: TQ023	Calibration Date: 02/19/08	*SI Traceability: NVLAP-A7C20031

*The artifact above has 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. Expanded measurement uncertainty is 3.9 + 5.9X micrometers, where X=measured value in meters. Uncertainty is expressed at approximately a 95% Level of Confidence using k=2.00.

Certification 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 and certification conforms to procedures developed in accordance with ASME B89.4.22-2004.

Instrument condition as received:
Inoperative

Instrument condition outgoing:
Within specifications

Technician: Arnold Torres Date: 8/26/08

This certificate shall not be reproduced, except in full, without permission of FARO Technologies, Inc.
The results of this certificate relate only to the items calibrated or tested.

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

125 Technology Park
Lake Mary, FL 32746
USA

@ 9/2/08

FARO®

Page 1 of 6

LABORATORY ACCREDITATION BUREAU
ISO/IEC 17025 Accredited

Revised: March 15, 2008

f:\control\records\05manufa\partspec\XH08-0495 ens Rev1 RevDate: 12/08/04

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: SWANSON
S/N: MGA00798
Calibration Date: 1/15/09

Subject Tape Measure
Brand: TPM 906 Stanley
S/N: TPM 906
Calibration Date: 1/23/09

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

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

Date: 1/23/2009 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.

MetroCal inc.

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: **59696**
Certificate Number: **080604806**
Page: **1 of 1**

Gauge Number: **MGA00730**
Gauge Desc: **Digital Protractor**
Manufacturer: **Mitutoyo**
Model Number: **N/A**
Serial Number: **N/A**

Customer PO: **A070681**
Last Calibration: **N/A**
Calibration Date: **6/4/08**
Next Calibration: **6/4/09**

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# 105	6/12/07	6/12/08	821/273187-06	0.0015°
DoAll Sine Bar ID#1879	12/31/07	12/31/08	Cert# 071231399	0.0015°

Results:

As Found Readings

Units	Nominal	Actual	Deviation
Decimal Deg.	5.00	5.0	0.00
	10.00	10.1	0.10
	20.00	20.0	0.00
Tolerance	30.00	30.0	0.00
± 0.1°	40.00	40.0	0.00

Reference Level Check: Within ± 0.1 degrees

As Left Readings

Nominal	Actual	Deviation
5.00	5.0	0.00
10.00	10.1	0.10
20.00	20.0	0.00
30.00	30.0	0.00
40.00	40.0	0.00

Reference Level Check: Within ± 0.1 degrees

Comments: Environmental conditions during calibration: 68 °F, 41% RH.

Issued: 6/5/08

Shannon Shoemaker/bjk
Calibration Technician

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

6/6/08

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: 0001591:1212069510

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

Calibration Location: **In House**

Equipment Calibrated

Manufacturer:	Dickson	Date Received:	05/08/2008
Description:	Temp/Humidity Recorder	Date Calibrated:	05/29/2008
Model Number:	FH125	Calibration Due Date:	05/29/2009
Serial Number:	06163263	Calibration Procedure:	CP0001
Asset Number:	MGA00152	Revision:	
Received Status:	Good	Performed By:	C. Atkinson

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

Notes:

Ambient Calibration Conditions

Ambient Temperature: 21 °C Relative Humidity: 40 % RH Barometric Pressure: 988 mbar

Calibration Equipment Used

Asset Number:	Manufacturer:	Model:	Serial:	Cal Due:
RMS042	Fluke/Hart	1502A	A6C537	15 Feb 2009
RMS043	Hart Scientific	5614	778109	15 Feb 2009
RMS045	Vaisala	HMP76	C0630009	04 Jun 2008

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: 5/29/08
6/2/08

Calibration Data

MFG/MODEL: **Dickson / FH125**

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

Location: **Schober Cal Lab (MGA Research)**

Date Calibrated: **05/29/08**

Certificate No.: **0001591:1212069510**

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					
	20.9° C	19.1° C	20.5° C		22.7° C
	-0.4° C	-2.2° C	-0.6° C		1.4° C
Channel 2 (RH @ 21° C)					
	41.0 %rh	39.0 %rh	40.5 %rh		43.0 %rh
	98.8 %rh	96.8 %rh	98.8 %rh		100.8 %rh
Calibration Performed By: C. Atkinson					

Temperature Measurement Uncertainty Utemp = 0.46°C Uhumidity = 1.6 %RH

MetroCal inc.

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: **60394**
Certificate Number: **080711801**
Page: **1 of 1**

Gauge Number: **MGA00081**
Gauge Desc: **0 to 20lb x 0.01lb Digital Scale**
Manufacturer: **Detecto**
Model Number: **AP-20**
Serial Number: **E33603-0213**

Customer PO: **A070765**
Last Calibration: **7/9/07**
Calibration Date: **7/11/08**
Next Calibration: **7/11/09**

As Found Condition: **In Tolerance**

As Left Condition: **In Tolerance**

MetroCal Inc. maintains reference standards of measurement which traceable to the National Institute of Standards and Technology, or other authorized National Standards. Calibration was performed in accordance with MetroCal's Procedure No. CP-042 and the relevant sections of the manufacturers manual. This Calibration complies with the 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	8/10/06	8/10/08	MI-04-06-8325	+/-0.001% of Load

Results:
Tolerance used: ± 0.02

Units: lbs **TI Division/Increment:** 0.01

	As Found				As Left		
Weight Test	**Nominal**	**Indication**	**Deviation**		**Nominal**	**Indication**	**Deviation**
0-25% fs	5	5.00	0.00		5	5.00	0.00
26-50% fs	10	9.99	-0.01		10	9.99	-0.01
51-75% fs	15	14.99	-0.01		15	14.99	-0.01
76-100% fs	20	19.99	-0.01		20	19.99	-0.01
Shift Test:	Pass			**Shift Test:**	Pass		
Half Load Test:	Pass			**Half Load Test:**	Pass		

Comments: Environmental conditions during calibration: 68 °F, 46 % RH.

Issued: 7/15/08

Shannon Shoemaker/bjk
Calibration Technician

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

7/17/08

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: MGA Research *Cert#* 08-4587 *Temp/Humidity:* 70-20
Location of Calibration: 2839 Elliott Ave. Troy MI 48083
Calibration Date: 6/15/2008 *Cal Due:* 7-09 *Condition of Item:* Good
Equipment Make: Intercomp *Model:* SWD Deluxe *Serial/ID:* 26032389
Capacity single pad capacity 2200 x 1lb

Applied Test Wt	*Before Adustment*	*Tolerance*	*In-Tolerance Y/N*	*After Adjustment*	*In-Tolerance Y/N*	*Unc .5lb*	
100lb	100lb	1lb	y	n/a	n/a	.5lb	RR
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	
100lb	101lb	1lb	y	n/a	n/a	.5lb	LR
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	
100lb	100lb	1lb	y	n/a	n/a	.5lb	RF
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	
100lb	100lb	1lb	y	n/a	n/a	.5lb	LF
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	

shift test

Platform #1 *Platform #2* *Platform #3*
☑ Pass ☐ Pass ☐ Pass
☐ Fail ☐ Fail ☐ Fail

Tests performed: ☑ Repeatability ☑ Linearl☐ Sensitivity ☑ Discrimination

Technician COMMENTS/ System passes all tests.

Test wts used Our test weights s/n on file.

☑ Scale Certified ☐ Scale Rejected

Sterling Scale Service Rep: ED **Date:** 6/12/2008 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

QA 6/19/08

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

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

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] 100K SHUNT	95.6
Linearity:[2]	0.99981
New vs Old Sensitivit (% Difference)	-0.4
Temperature:	69.9 ^{O}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026030
Calibrated By:	Thomas Miller

Signature: Thom D Miller

Approved by: David Winkelbauer

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 #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

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

Calibration Date:	3/2/2009
New DLR(Units:G'S) 100K SHUNT [1]	94.3
Linearity: [2]	0.99958
New vs Old Sensitivit (% Difference)	-0.5
Temperature:	69.9 ^{O}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026381
Calibrated By:	Thomas Miller

Signature: Thomas D Miller

Approved by: David Winkelbauer

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 #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

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

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] **100K SHUNT**	92.8
Linearity:[2]	0.99935
New vs Old Sensitivit (% Difference)	-0.4
Temperature:	69.9 °F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026815
Calibrated By:	Thomas Miller

Signature: ______________

Approved by: ______________

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 #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

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

Calibration Date:	3/2/2009
New DLR(Units:G'S) 100K SHUNT [1]	115.9
Linearity: [2]	0.99947
New vs Old Sensitivit (% Difference)	-0.7
Temperature:	69.9 ^{o}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.021450
Calibrated By:	Thomas Miller

Signature: Thomas D Miller

Approved by: David Winbellbauer

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.

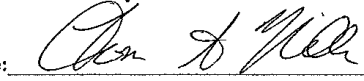
MGA Research Corporation-Calibration Certificate

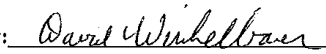
ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

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

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] 100K SHUNT	93.7
Linearity:[2]	0.99893
New vs Old Sensitivit (% Difference)	-0.9
Temperature:	69.9 ^{o}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026528
Calibrated By:	Thomas Miller

Signature: 

Approved by: 

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 #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

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

Calibration Date:	3/2/2009
New DLR(Units:G'S)[1] 100K SHUNT	97.1
Linearity:[2]	0.99893
New vs Old Sensitivit (% Difference)	-0.5
Temperature:	69.9 °F
Humidity:	38 %
Sensitivity (mV/V/G):	0.025575
Calibrated By:	Thomas Miller

Signature: ____________________

Approved by: ____________________

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:	7/24/2008
Calibrated By:	PCB

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

Calibration Date:	4/17/2009
New DLR(Units:G'S) 100K SHUNT [1]	94.0
Linearity: [2]	0.99977
New vs Old Sensitivity (% Difference)	2.0
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.02647
Calibrated By:	Chris Collins

Signature: Chris Collins

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:	7/24/2008
Calibrated By:	PCB

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

Calibration Date:	4/17/2009
New DLR(Units:G'S) 100K SHUNT [1]	106.3
Linearity: [2]	0.99945
New vs Old Sensitivity (% Difference)	2.1
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.023407
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:	7/24/2008
Calibrated By:	PCB

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

Calibration Date:	4/17/2009
New DLR(Units:G'S) 100K SHUNT [1]	97.5
Linearity: [2]	0.99962
New vs Old Sensitivity (% Difference)	1.4
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.025512
Calibrated By:	Chris Collins

Signature: Chris Collins

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.

Dynamic Technology, Inc.

Certificate of Calibration

Certificate #: 125456001 T

Calibration Laboratory
Certificate #: 1022.01

Acct #:	090100
Customer:	MGA Research Corporation
Shipper #:	
Address:	5000 Warren Road Burlington, WI, 53105
Contact:	Jessica Gall
PO #:	03-08-0741

Manufacturer:	PCB
Model:	484B06
Description:	Power Unit
Serial Number:	00001458
Asset Number:	
Barcode:	

As Received	As Returned	Action Taken		
In Tolerance X	In Tolerance X	Full Calibration X	**Cal Date:**	09/18/2008
Out of Tolerance	Out of Tolerance	Special Calibration	**Due Date:**	03/18/2009
Malfunctioning	Malfunctioning	Oper. Verification	**Temperature:**	73.00 deg. F
Operational	Operational	Adjusted	**Humidity:**	36.00 %
Damaged	N/A	Repaired	**Baro. Press.:**	
N/A		Charted	**Procedure:**	DCN 05156
		Returned As Is	**Reference:**	manufacturer's manual

Incoming Remarks:
Replacement for unit on WO#124720006 In case with connector cable/power cord and accelerometer in case

Technical Remarks:
Uncertainty data to follow.

Calibration Standards Utilized

Cert. #	Manufacturer	Model #	Description	Cal Date	Due Date
108256017	TMS	9155C	Accelerometer Calibration W	02/18/2008	02/18/2009
108256027	PCB	442A102	Signal Conditioner	01/10/2008	01/10/2009

System Instrumentation Includes

ID	Manufacturer	Model	Description	Serial Number
84592	PCB	Q353B01	Accelerometer	84592

The above identified unit was calibrated in our laboratory at the address shown below.

Technician Name/Date: Joseph Leonard, 09/18/2008 Signatory: Mary Stanley QA Approved:

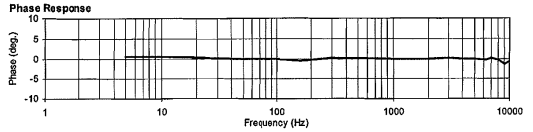
1200 N. Old US 23, PO Box 559, Hartland, MI 48353-0559 (810) 225-4601 FAX (810) 225-4602

JAG

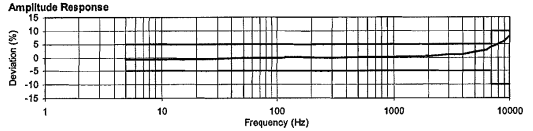
~Report of Calibration~

Sensor Information		Calibration Data			Transducer Specifications		
Model Number	484B06/Q353B01	Sensitivity @ Ref. Freq.:	20.28	mV/g	Range:	250.00	+/- g
Serial Number	1458/84592	Phase @ Ref. Freq.:	-0.06	deg.	Resolution:	0.0000	g
Manufacturer:	PCB	Test Level:	1.00	g	Temp Range:	-54 to 121	°C
ID Number:	1458/84592					-65 to 250	°F
Description:	ICP® Accelerometer				Axis:	Uniaxial	

Phase Response



Amplitude Response



Data Table

Frequency (Hz)	Sen(mV/g)	Phase (deg)
5.00	20.140	0.63
10.00	20.109	0.47
30.00	20.212	0.18
50.00	20.226	-0.07
100.00	20.281	-0.06
159.00	20.287	-0.44
300.00	20.254	0.04
500.00	20.325	0.03
1000.00	20.309	-0.10
2000.00	20.409	-0.16
3000.00	20.483	0.12
4000.00	20.498	-0.05
5000.00	20.672	-0.11
6300.00	20.825	-0.29
7000.00	21.059	0.14
8000.00	21.295	-0.25
9000.00	21.512	-1.27
10000.00	21.912	-0.67

Notes

Back-to-Back Comparison Calibration

This calibration was performed with TMS 9155c Calibration Workstation version 3.9.0

Calibration is NIST Traceable through project number 822/271196.

Customer	User Notes
090100	125456001 T

Unit Condition		Lab Conditions		
As Found:	In Tolerance	Temperature:	23.89	°C
As Left:	In Tolerance		75.00	°F
		Humidity:	36.00	%

Approval Information
Technician: J Leonard

Dynamic Technology, Inc.
1200 N. Old US 23 (PH) 810.225.4601
P.O. Box 559 (FX) 810.225.4602
Hartland, MI
48353-0559 www.dynamictechnology.com

~ *Calibration Certificate* ~

Per ISO 16063-21

Model Number: 352C03

Serial Number: 95980

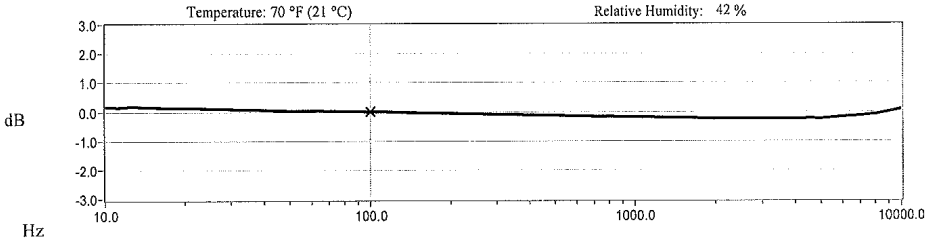
Description: ICP® Accelerometer Method: Back-to-Back Comparison (AT401-3)

Manufacturer: PCB

Calibration Data

Sensitivity @ 100.0 Hz	**10.11**	**mV/g**	Output Bias	11.4	VDC
	(1.031	**mV/m/s²)**	Transverse Sensitivity	0.6	%
Discharge Time Constant	1.7	seconds	Resonant Frequency	57.2	kHz

Sensitivity Plot



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
10.0	1.9	300.0	-1.1	7000.0	-1.7
15.0	1.7	500.0	-1.6	10000.0	0.9
30.0	1.0	1000.0	-2.3		
50.0	0.3	3000.0	-3.0		
REF. FREQ.	0.0	5000.0	-2.9		

Mounting Surface: Stainless Steel w/Silicone Grease Coating Fastener: Stud Mount Fixture Orientation: Vertical
Acceleration Level (rms)[1]: 10.0 g (98.1 m/s²)
[1]The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude: Acceleration Level (g) = 0.010 x (freq)².
[2]The gravitational constant used for calculations by the calibration system is: 1 g = 9.80665 m/s².

Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

Notes

1. Calibration is NIST Traceable thru Project 822/274086 and PTB Traceable thru Project 1060.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 5-9 Hz; +/- 2.0%, 10-99 Hz; +/- 1.5%, 100-1999 Hz; +/- 1.0%, 2-10 kHz; +/- 2.5%.

Technician: Susan Lyon Date: 07/31/08

ACCREDITED
CALIBRATION CERT #1862.02

PCB PIEZOTRONICS
VIBRATION DIVISION
Headquarters: 3425 Walden Avenue, Depew, NY 14043
Calibration Performed at: 10869 Highway 903, Halifax, NC 27839
TEL: 888-684-0013 · FAX: 716-685-3886 · www.pcb.com

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