

REPORT NO. 111-KAR-08-004

**SAFETY COMPLIANCE TESTING
FOR FMVSS 111**

**REARVIEW MIRRORS
(Other Than School Buses)**

**2008 CHEVROLET IMPALA LS
4-DOOR SEDAN**

NHTSA NO: C80102

**PREPARED BY:
KARCO ENGINEERING LLC.
9270 HOLLY ROAD
ADELANTO, CALIFORNIA 92301**



AUGUST 28, 2008

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
MAIL CODE: NVS-221
1200 NEW JERSEY AVE SE, ROOM W43-498
WASHINGTON, D.C. 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract DTNH22-06-C-00034.

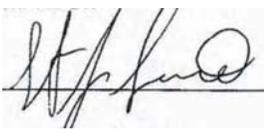
This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared by:  Date: August 27, 2008
Mr. Jonathan F. Williams, Test Engineer
KARCO Engineering, LLC.

Reviewed by:  Date: August 27, 2008
Mr. Michael L. Dunlap, Director of Operations
KARCO Engineering, LLC.

Approved by:  Date: August 27, 2008
Mr. Frank D. Richardson, Program Manager
KARCO Engineering, LLC.

FINAL REPORT ACCEPTED BY:

Accepted By: 

Acceptance Date: September 12, 2008

Technical Report Documentation Page

1. <i>Report No.</i> 111-KAR-08-004	2. <i>Government Accession No.</i>	3. <i>Recipient's Catalog No.</i>	
4. <i>Title and Subtitle</i> Final Report of FMVSS 111 Compliance Testing of 2G1WB58N889100388 Chevrolet Impala LS 4-Door Sedan NHTSA NO: C80102		5. <i>Report Date</i> August 28, 2008	
		6. <i>Performing Organization Code</i> KAR	
7. <i>Author(s)</i> Mr. Jonathan F. Williams, Test Engineer, KARCO Mr. Frank D. Richardson, Program Manager, KARCO		8. <i>Performing Organization Report No.</i> P28011-04	
9. <i>Performing Organization Name and Address</i> KARCO Engineering LLC. 9270 Holly Road Adelanto, California 92301		10. <i>Work unit No.</i>	
		11. <i>Contract or Grant No.</i> DTNH22-06-C-00034	
12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance Mail Code: NVS-221 1200 New Jersey Ave SE, Room W43-410 Washington, DC 20590		13. <i>Type of report and Period Covered</i> Final Report-	
		14. <i>Sponsoring Agency Code</i> NVS 221	
15. <i>Supplementary Notes</i>			
16. <i>Abstract</i> Compliance tests were conducted on the subject 2G1WB58N889100388 Chevrolet Impala LS 4-Door Sedan on August 1, 2008 through August 28, 2008 in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP111V-00 for the determination of FMVSS 111 compliance. There were no apparent test failures.			
17. <i>Key Words</i> Compliance Testing Safety Engineering FMVSS 111		18. <i>Distribution Statement</i> Copies of this report are available from: National Highway Traffic Safety Admin. Technical Information Services (TIS) Mail Code: NVS-221 1200 New Jersey Ave SE, Room W43-410 Washington, DC 20590	
19. <i>Security Classification (of this report)</i> UNCLASSIFIED	20. <i>Security Classification (of this page)</i> UNCLASSIFIED	21. <i>No. of Pages</i> 64	22. <i>Price</i>

Form DOT F1700.7 (8-72)

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Purpose of Compliance Test	1
2	Compliance Test Procedure and Data Summary	2
3	Test Data	5
<u>Appendix</u>		
A	Photographs	A
B	Data Plots	B
C	Test Equipment List and Calibration Information	C
D	Eyelipse Locations Supplied by Manufacturer	D

LIST OF PHOTOGRAPHS

<u>Figure</u>		<u>Page</u>
1	Left Front $\frac{3}{4}$ View	A-1
2	Left Side View	A-2
3	Right Rear $\frac{3}{4}$ View	A-3
4	Right Side View	A-4
5	Manufacturer's Label	A-5
6	Tire Placard	A-6
7	Driver Side Rearview Mirror and Mounting	A-7
8	Passenger Side Rearview Mirror and Mounting	A-8
9	Inside Rearview Mirror and Mounting	A-9
10	Test Set-up	A-10
11	Camera Set-up for Photographing Reference Board	A-11
12	Overall Set-up and Instrumentation for Mirror Break-Away Test	A-12
13	Close-Up of Mirror Break-Away Test	A-13
14	Reflection Test Set-up	A-14
15	Mirror Set-up for Area Measurement	A-15
16	Left Eye Field of View Test (Inside Mirror)	A-16
17	Reference Board for Inside Mirror, Left Eye (From Rear of Vehicle)	A-17
18	Right Eye Field of View Test (Inside Mirror)	A-18
19	Reference Board for Inside Mirror, Right Eye (From Rear of Vehicle)	A-19
20	Left Eye Field of View Test (Driver Side Mirror)	A-20
21	Right Eye Field of View Test (Driver Side Mirror)	A-21
22	Reference Board for Driver Side Mirror (From Rear of Vehicle)	A-22

LIST OF DATA PLOTS

<u>Figure</u>		<u>Page</u>
B-1	Force vs. Displacement and Displacement vs. Time $0^\circ/90^\circ$	B-1
B-2	Force vs. Displacement and Displacement vs. Time $45^\circ/90^\circ$	B-2
B-3	Force vs. Displacement and Displacement vs. Time $-45^\circ/90^\circ$	B-3
B-4	Force vs. Displacement and Displacement vs. Time $-45^\circ/45^\circ$	B-4
B-5	Force vs. Displacement and Displacement vs. Time $45^\circ/45^\circ$	B-5
B-6	Force vs. Displacement and Displacement vs. Time $45^\circ/-45^\circ$	B-6
B-7	Force vs. Displacement and Displacement vs. Time $-45^\circ/-45^\circ$	B-7

1. PURPOSE OF COMPLIANCE TEST

Tests were conducted on a 2008 Chevrolet Impala LS 4-Door Sedan, manufactured by Chevrolet Motor Company, to determine compliance with FMVSS 111, "Rearview Mirrors (Other than School Buses)". The purpose of this standard is to reduce the number of deaths and injuries that occur when the driver of a motor vehicle does not have a clear and reasonably unobstructed view to the rear.

All tests were conducted based on the current National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures, TP111V-00, dated October 28, 1999, and corresponding KARCO Engineering test procedure KTP-111, dated April 18, 2001. Detailed procedures for receiving, inspecting, testing and reporting of test results are described in the test procedures and are not repeated in this report.

This report is organized in sections containing pertinent test information and data tables as follows:

Section 1	Purpose of Compliance Test
Section 2	Compliance Test Procedure and Data Summary
Section 3	Test Results
Appendix A	Photographs
Appendix B	Data Plots
Appendix C	Test Equipment List and Calibration Information
Appendix D	Eyellipse Location Supplied By Manufacturer

2. COMPLIANCE TEST PROCEDURE AND DATA SUMMARY

A 2008 Chevrolet Impala LS 4-Door Sedan was subjected to FMVSS 111 compliance testing. The tests were conducted at KARCO Engineering LLC. in Adelanto, California on August 1, 2008 through August 28, 2008. Summary data is shown on page 24, Data Sheet No. 8. The following tests were performed:

- Inspection
- Mounting Adequacy Test
- Field-of-View Test, Inside Rearview Mirror
- Field-of-View Test, Driver's Side Outside Mirror
- Reflectance Test
- Breakaway Test
- Unit Magnification and Convex Mirror Tests

The tests were conducted per the FMVSS 111 test procedure. The significant aspects of the test procedure are described in the following paragraphs.

A. INSPECTION

Inspect the installation of the inside and outside rearview mirrors.

B. MOUNTING ADEQUACY TEST – ALL REARVIEW MIRRORS

B.1 INSIDE MIRROR (S5.1.2)

Determine that the mirror is securely mounted and determine the positive and negative angles of adjustment for both the vertical and horizontal directions.

B.2 OUTSIDE MIRROR(S) (S5.2.2 and S5.3)

Determine that the mirror(s) is (are) securely mounted. Determine that the driver's side mirror can be tilted in both horizontal and vertical directions from the driver's seated position. Determine that the passenger's side mirror is capable of adjustment by tilting in both the horizontal and vertical directions. Determine the positive and negative angles of adjustment for both horizontal and vertical directions for all outside mirrors. Determine that all outside mirrors are free of sharp points or edges that could contribute to pedestrian injury.

C. FIELD-OF-VIEW TEST – INSIDE REARVIEW MIRROR

C.1 REQUIREMENTS (S5.1.1)

The mirror shall provide a field of view with an included horizontal angle measured from the projected eye point of at least 20 degrees, and sufficient vertical angle to provide a view of a level road surface extending to the horizon beginning at a point not greater than 61m (200 feet) to the rear of the vehicle when the vehicle is occupied by the driver and four passengers or the designated occupant capacity, if less. The line of sight may be partially obscured by seated occupants or by head restraints.

Each car whose inside mirror does not meet the field of view requirements of S5.1.1 shall have an outside mirror of unit magnification or a convex mirror installed on the passenger's side. (S5.3)

D. FIELD-OF-VIEW TEST, DRIVER'S SIDE OUTSIDE REARVIEW MIRROR

D.1 REQUIREMENTS (S5.2)

Each passenger car shall have an outside mirror of unit magnification. The mirror shall provide the driver a view of a level road surface extending to the horizon from a line, perpendicular to a longitudinal plane tangent to the driver's side of the vehicle at the widest point, extending 2.4 meters (8 feet) out from the tangent plane 10.7 meters (35 feet) behind the driver's eyes, with the seat in the rearmost position. The line of sight may be partially obscured by rear body or fender contours. (S5.2.1)

Neither the mirror nor the mounting shall protrude farther than the widest part of the vehicle body except to the extent necessary to produce a field of view meeting or exceeding the requirements of S5.2.1. The mirror shall not be obscured by the un-wiped portion of the windshield. (S5.2.2)

E. REFLECTANCE TEST – ALL MIRRORS

E.1 REQUIREMENT (S11)

All single reflectance mirrors shall have an average reflectance of at least 35 percent. If a mirror is capable of multiple reflectance levels, the minimum reflectance level in the day mode shall be at least 35 percent and the minimum reflectance level in the night mode shall be at least 4 percent. The average reflectance of any mirror required by this standard shall be determined in accordance with SAE Recommended Practice J964, OCT 84.

F. BREAKAWAY TEST – INSIDE REARVIEW MIRROR

F.1 REQUIREMENTS (S5.1.2)

If the mirror is in the head impact area, the mounting shall deflect, collapse, or break away without leaving sharp edges when the reflective surface of the mirror is subjected to a force of 400 N (90 lb) in any forward direction that is not more than 45 degrees from the longitudinal direction.

G. UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

G.1 REQUIREMENTS FOR PASSENGER CARS (S5.3 and S5.4)

The driver's side rearview mirror and the inside rearview mirror shall be unit magnification. If the field-of-view requirements are not met with the inside rearview mirror then the passenger's side rearview mirror is required. It can be either unit magnification or convex.

If the passenger's side mirror is convex, the average radius of curvature shall be not less than 889 mm (35 inches) and not more than 1651 millimeters (65 inches) and shall not deviate from the average by more than plus or minus 12.5 percent. The convex mirror shall have permanently and indelibly marked at the lower edge of the mirror's reflective surface in letters not less than 4.8 mm (3/16 inch) nor more than 6.4 mm (0.25 inch) high the words, "**Objects in Mirror Are Closer Than They Appear.**"

3. TEST DATA

The results of FMVSS 111 compliance tests that were conducted on the 2008 Chevrolet Impala LS 4-Door Sedan on August 1, 2008 through August 28, 2008 to determine compliance with FMVSS 111, "Rearview Mirrors (other than School Buses)" are presented in this section.

DATA SHEET NO. 1
VEHICLE INSPECTION AND IDENTIFICATION

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.:	C80102
Make	Chevrolet
Model	Impala LS
Body Style	4-Door Sedan
Vin No.	2G1WB58N889100388
Color	Black
Delivery Date	7/28/2008
Odometer (Miles)	119
Dealer	N/A
Transmission	Automatic
Final Drive	Front
Type/No. Cyl.	V6
Engine Disp. (L)	3.5
Engine Placement	Transverse
Tire Press./ Max (Front)	300 kPa
Tire Press./ Max (Rear)	300 kPa
Recommended Tire Size	P225/60R16 S
Tire Size on vehicle	P225/60R16 S
Air Conditioning	Yes
Disc Brakes (Front)	Yes
Disc Brakes (Rear)	Yes

Anti-Lock Brakes	No
All Wheel Drive	No
Power Steering	Yes
Driver Front Airbag	Yes
Driver Side Airbag	No
Driver Head Airbag	No
Driver Curtain Airbag	Yes
Pass. Airbag	Yes
Pass. Side Airbag	No
Pass. Head Airbag	No
Pass. Curtain Airbag	Yes
Pre-Tensioners	No
Load Limiters	No
Bucket Seats	Yes
Cold Tire Press. (Front)	210 kPa
Cold Tire Press. (Rear)	210 kPa
Tilt Steering	Yes
Automatic Door Locks	Yes
Power Windows	Yes
Power Seats	Yes
Other	N/A

DATA FROM MANUFACTURER

Manufactured By	GENERAL MOTORS OF CANADA
Date of Manufacture	May-08

GVWR (kg)	2072
GAWR Front (kg)	1124
GAWR Rear (kg)	948

TEST VEHICLE ATTITUDES (mm)

ATTITUDE	LF	RF	LR	RR
As Delivered	742	741	762	755
As Tested	725	725	713	705
Rearview Mirror	1259			

DATA SHEET NO. 1... (Continued)

Vehicle Information			
Year:	2G1WB58N889100388	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	08/01/08	Temperature:	85°F

LEGEND: LE = Left Eye; RE = Right Eye; P = Neck Pivot Point, SRP = Seating Reference Point

COORDINATE SYSTEM:

- X = Longitudinal Dimension
- Y = Lateral Dimension
- Z = Vertical Dimension

Positive Values are as follows:

- X = Forward of Reference Point
- Y = Outboard of Reference Point (to driver's side)
- Z = Above Reference Point

Provide Reference Point or Body Fiduciary Point that dimensions below are measured from. (Point should be usable by laboratory personnel, i.e., center of an anchorage bolt, door jam latch, etc.).

COORDINATES	LEFT SIDE MIRROR			INSIDE MIRROR			RIGHT SIDE MIRROR			SRP
	P1	LE1	RE1	P2	LE2	RE2	P3	LE3	RE3	
X		-438	-416		-419	-441		N/A	N/A	
Y		-189	-250		-209	-270		N/A	N/A	
Z		832	832		833	833		N/A	N/A	
Mirror Mfr., Model And Part No.	VISIOCROP DG7,DK2 15866207, 15866245			GENTEX, MAGNA DONNELLY -UE1, UE1,DD6 25812208,15282731, 10345906			VISIOCROP DG7,DK2 15866207, 15866244			
SRP Travel and Eye-ellipse										

Reference Point – Front Outboard Seat Track Bolt Head.

DATA SHEET NO. 2
MOUNTING AND TILTING ADEQUACY TEST

Vehicle Information			
Year:	2008	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	08/01/08	Temperature:	65°F

MIRROR MOUNTING PROVIDES A STABLE SUPPORT	PASS	FAIL	CONDITIONAL
INSIDE REARVIEW MIRROR	X		
DRIVER SIDE OUTSIDE MIRROR	X		
PASSENGER SIDE OUTSIDE MIRROR	X		

OUTSIDE MIRRORS FREE OF SHARP POINTS OR EDGES	PASS	FAIL
DRIVER SIDE OUTSIDE MIRROR	X	
PASSENGER SIDE OUTSIDE MIRROR	X	

MIRROR IS ADJUSTABLE VERTICALLY & HORIZONTALLY	PASS	FAIL	CONDITIONAL
INSIDE REARVIEW MIRROR	X		
DRIVER SIDE OUTSIDE MIRROR	X		
PASSENGER SIDE OUTSIDE MIRROR	X		

DRIVER'S OUTSIDE MIRROR ADJUSTABLE FROM THE DRIVER'S SEATED POSITION	PASS	FAIL
DRIVER SIDE OUTSIDE MIRROR	X	

MIRROR ADJUSTMENT ANGLE	V+	V-	H+	H-
INSIDE REARVIEW MIRROR	47.6°	-82.9°	70°	-73°
DRIVER SIDE OUTSIDE MIRROR	11.6°	-8.8°	26°	-7°
PASSENGER SIDE OUTSIDE MIRROR	12.8°	-8.4°	34°	-13°

THIS SECTION IS RESERVED FOR MPVs, TRUCKS AND BUSES, OTHER THAN SCHOOL BUSES, NOT CONFORMING TO PASSENGER CAR REQUIREMENTS

MIRROR PROVIDES A VIEW TO THE REAR ALONG BOTH SIDES OF THE VEHICLE	PASS	FAIL	CONDITIONAL
DRIVER SIDE OUTSIDE MIRROR	N/A		
PASSENGER SIDE OUTSIDE MIRROR	N/A		

TEST STATUS:	PASSED —	X	FAILED —	
--------------	----------	---	----------	--

RECORDED BY: JONATHAN WILLIAMS DATE: 008/28/08

APPROVED BY: MICHAEL L. DUNLAP DATE: 008/28/08

DATA SHEET NO. 3
FIELD OF VIEW TEST - INSIDE REARVIEW MIRROR

Vehicle Information			
Year:	2008	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	08/01/08	Temperature:	65°F

- E Distance from center of mirror to projected eye point location = 625.0 mm
- A Distance from rear of vehicle to projected eye point location = 3650.0 mm
- X1 Distance from rear of vehicle to field of view grid = 8101.0 mm
- Z1 Vertical distance to lowest point of field of view at distance X1 = 716.0 mm
- Z2 Height of center of mirror = 1259.0 mm
- X2 Distance from rear of vehicle where the road surface is first visible
 $X2 = [(Z2 \times X1) + (Z1 \times A)] / (Z2 - Z1) =$
(S111 REQUIREMENT = 61m maximum) 23595.9 mm (23.60 m)

EYE LOCATION	MONOCULAR DATA (ALR & ARL ARE ANGLES)			
	YL (mm)	YR (mm)	ALR (°)	ARL (°)
LEFT EYE POINT	YLL =1439	YRL =2249		10.8
RIGHT EYE POINT	YLR =2756	YRR = 1378	13.2	

CALCULATED HORIZONTAL AMBINOCULAR VIEW ANGLE (AB)

ANGLE AB = ANGLE ALR + ANGLE ARL

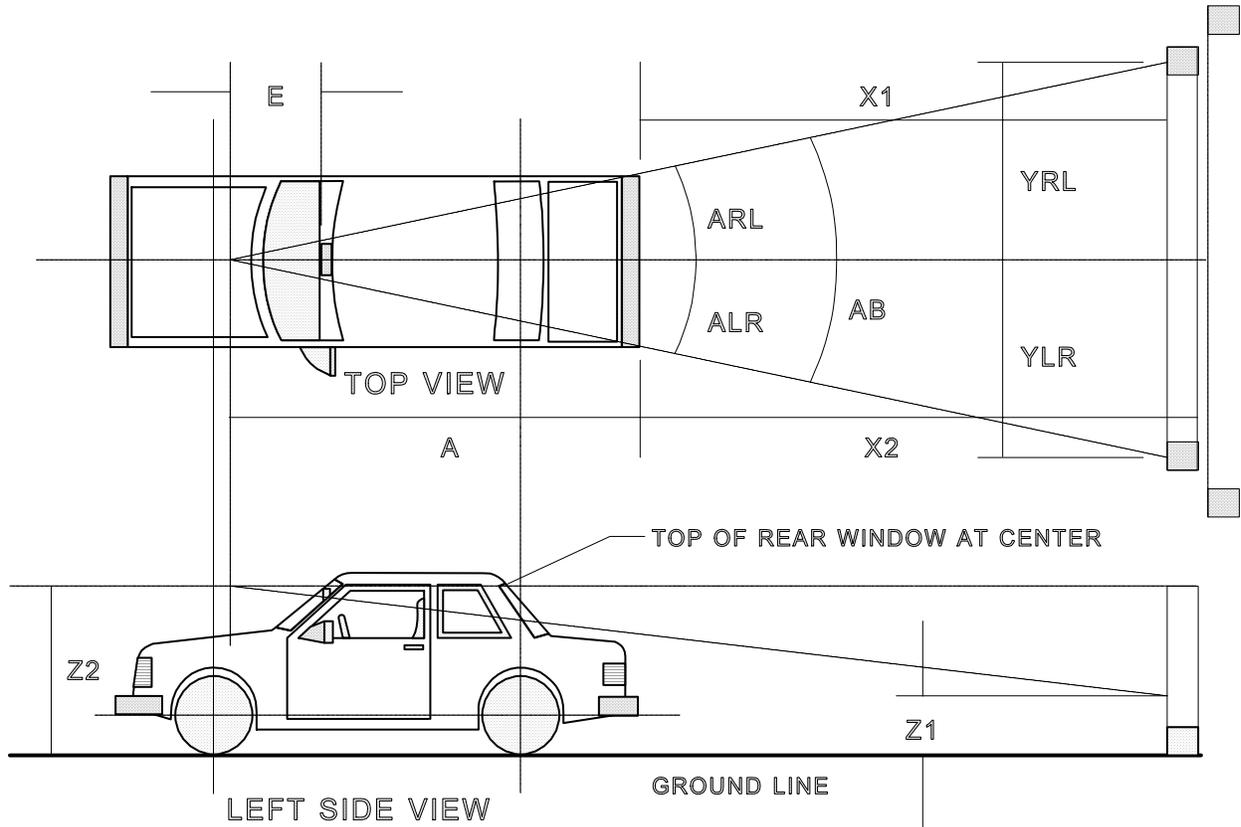
$ALR = \tan^{-1} [YLR / (X1 + A)]$ $ARL = \tan^{-1} [YRL / (X1 + A)]$

ANGLE AB = 24.0° (S111 REQUIREMENT = 20 degrees minimum)

TEST STATUS:	PASSED —	x	FAILED —	
--------------	----------	----------	----------	--

DATA SHEET NO. 3... (Continued)

INSIDE REARVIEW MIRROR FIELD OF VIEW
TEST GRID AND MARKER SETUP



DATA SHEET NO. 3... (Continued)

DRIVER SIDE MIRROR (S5.2)

MIRROR OBSCURED BY UNWIPED PORTION OF WINDSHIELD YES _____ NO **X**

HEIGHT OF TARGET DISC ON MIRROR **1043 mm**

DISTANCE OF TARGET DISC ON MIRROR FROM VEHICLE TANGENT PLANE **55 mm**

TARGET DISC LOCATION RELATIVE TO VEHICLE TANGENT PLANE **INBOARD**
(Inboard or Outboard)

ENTIRE TRIANGULAR TEST TARGET AREA ON SCREEN VISIBLE YES **X** NO _____

MIRROR PROTRUDES BEYOND VEHICLE TANGENT PLANE YES **X** NO _____

PROTRUSION REQUIRED TO MEET FIELD OF VIEW REQUIREMENT YES **X** NO _____

TEST STATUS:	PASSED —	X	FAILED —	
--------------	----------	----------	----------	--

PASSENGER SIDE MIRROR (S5.3 or MFG. OPTION)

PASSENGER SIDE MIRROR TYPE (convex or unit magnification) **CONVEX**

REMARKS:

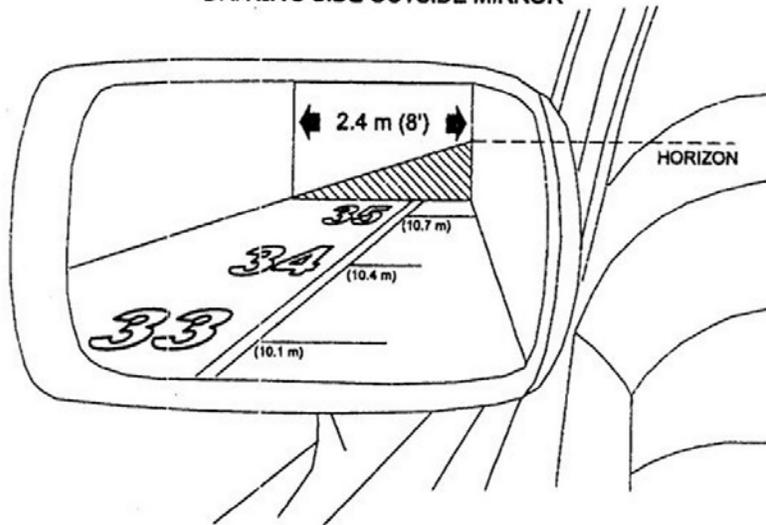
VEHICLE ATTITUDE AND GROUND LEVEL WERE RAISED 4" (101.6) TO PERFORM THE TEST.

RECORDED BY: **JONATHAN WILLIAMS** DATE: **008/28/08**

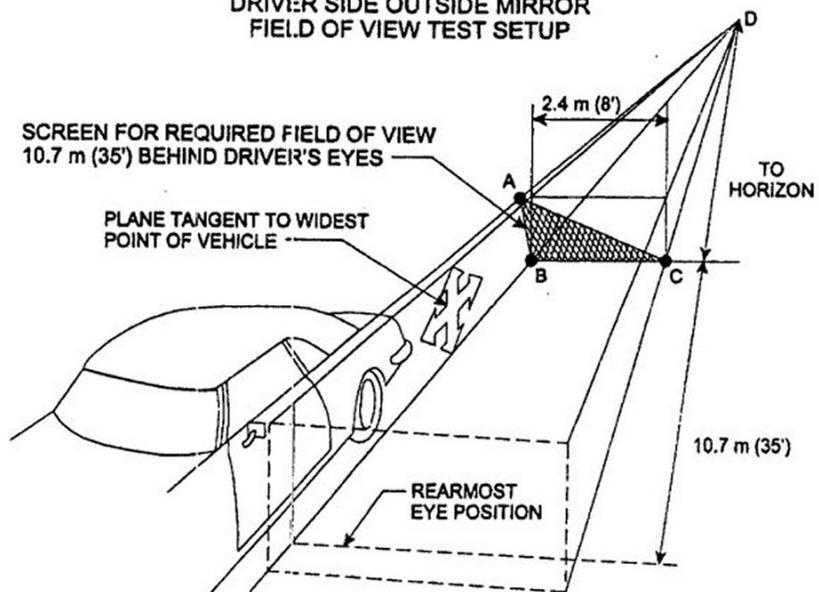
APPROVED BY: **MICHAEL L. DUNLAP** DATE: **008/28/08**

DATA SHEET NO. 3... (Continued)

REQUIRED FIELD OF VIEW AS SEEN IN DRIVER'S SIDE OUTSIDE MIRROR

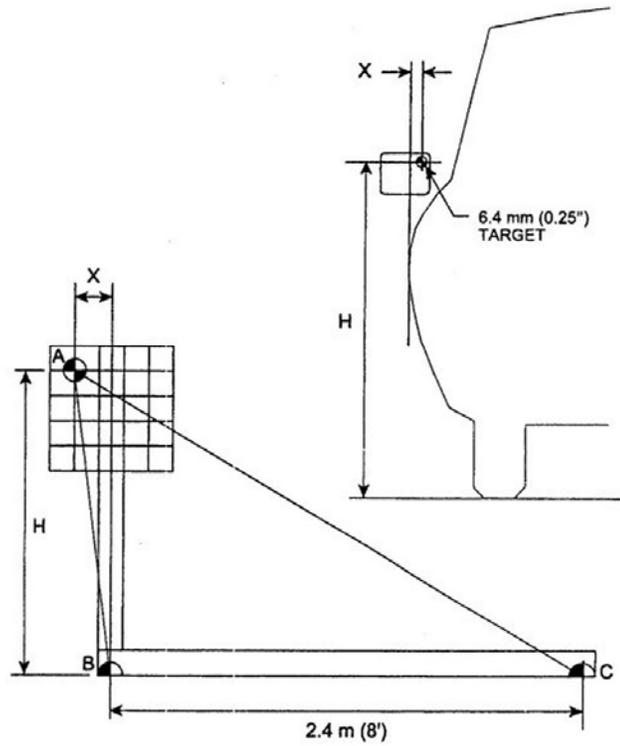


DRIVER SIDE OUTSIDE MIRROR FIELD OF VIEW TEST SETUP

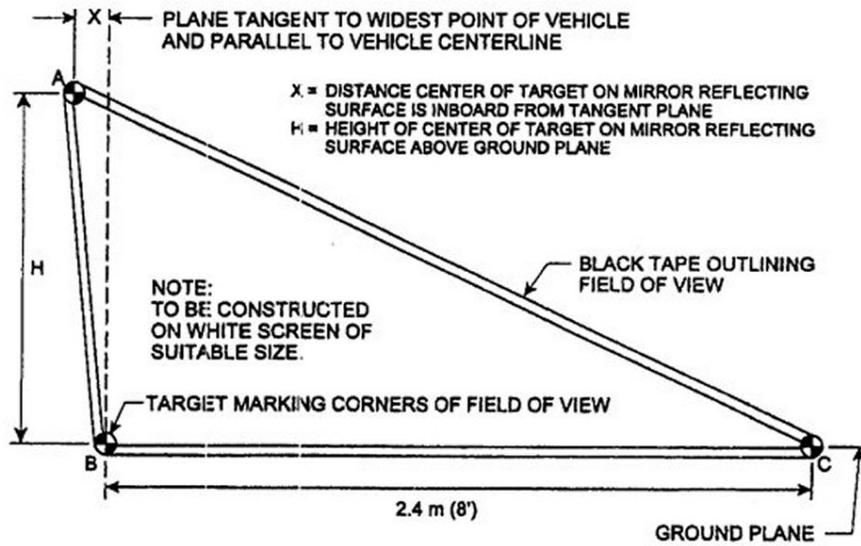


DATA SHEET NO. 3... (Continued)

DRIVER SIDE OUTSIDE MIRROR TARGET DISC LOCATION WITH X AND H DIMENSIONS



DRIVER SIDE OUTSIDE MIRROR REQUIRED FIELD OF VIEW TRIANGLE



**DATA SHEET NO. 4
REFLECTANCE TEST**

Vehicle Information			
Year:	2G1WB58N889100388	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	08/12/08	Temperature:	70°F

DESCRIPTION OF TEST APPARATUS: THE APPARATUS CONSISTS OF AN INCANDESCENT TUNGSTEN FILAMENT LAMP OPERATING AT A NOMINAL COLOR TEMPERATURE OF 2,856 K, COLLIMATING OPTICS, A SAMPLE HOLDER POSITIONED AT 25°, A SILICON PHOTOCCELL, AND A FLUKE 45 DUAL DISPLAY MULTIMETER (CALIBRATION DUE DATE 3-26-08). REFLECTANCE TESTS ARE CONDUCTED IN A 4'X6' WOODEN CABINET PAINTED FLAT BLACK. FOR CONVEX MIRROR A 6" INTEGRATING SPHERE WAS INCORPORATED INTO THE RECEIVER.

MIRROR DESCRIPTION: **INTERIOR DAY/NIGHT REARVIEW MIRROR**

VOLTAGE READING FROM CALIBRATION (Average Value): 280.0 mV

VOLTAGE READING FROM LIGHT REFLECTED BY DAY MIRROR (Average Value): 269.0 mV

REFLECTOMETER VOLTAGE READINGS		
	DAY MIRROR	NIGHT MIRROR
TEST NO. 1	269 mV	174 mV
TEST NO. 2	269 mV	174 mV
TEST NO. 3	269 mV	174 mV
TEST NO. 4	269 mV	174 mV
TEST NO. 5	269 mV	174 mV

REFLECTANCE (Day) = Voltage (Refl)/Voltage (Cal) = 0.961 x 100 = 96.1 percent
(Min. Required = 35%)

VOLTAGE READING FROM CALIBRATION (Average Value) = 280 mV

VOLTAGE READING FROM LIGHT REFLECTED BY NIGHT MIRROR (Average Value): 174 mV

REFLECTANCE (Night) = Voltage (Refl)/Voltage (Cal) = 0.621 x 100 = 62.1 percent
(Min. Required = 4%)

NOTE: If meter reading directly in percent is used, record only percent

DATA SHEET NO. 4... (Continued)

MIRROR DESCRIPTION: **DRIVER SIDE OUTSIDE MIRROR.**

VOLTAGE READING FROM CALIBRATION (Average Value): 280.0 mV

VOLTAGE READING FROM LIGHT REFLECTED BY DAY MIRROR (Average Value): 269.0 mV

REFLECTOMETER VOLTAGE READINGS	
TEST NO. 1	269 mV
TEST NO. 2	269 mV
TEST NO. 3	269 mV
TEST NO. 4	269 mV
TEST NO. 5	269 mV

REFLECTANCE (Day) = Voltage (Refl)/Voltage (Cal) = 0. .961 x 100 = 96.1 percent
(Min. Required = 35%)

NOTE: If meter reading directly in percent is used, record only percent

TEST STATUS:	PASSED —	X	FAILED —	
--------------	----------	----------	----------	--

RECORDED BY: JONATHAN WILLIAMS DATE: 008/28/08

APPROVED BY: MICHAEL L. DUNLAP DATE: 008/28/08

DATA SHEET NO. 4... (Continued)

MIRROR DESCRIPTION: **PASSENGER SIDE OUTSIDE MIRROR.**

VOLTAGE READING FROM CALIBRATION (Average Value): 342 mV

VOLTAGE READING FROM LIGHT REFLECTED BY DAY MIRROR (Average Value): 342 mV

REFLECTOMETER VOLTAGE READINGS	
TEST NO. 1	342 mV
TEST NO. 2	342 mV
TEST NO. 3	342 mV
TEST NO. 4	342 mV
TEST NO. 5	342 mV

REFLECTANCE (Day) = Voltage (Refl)/Voltage (Cal) = 0. 1.000 x 100 = 100.0 percent

REFERANCE MIRROR VALUE 93.4 X 100.0 (reflectance value) = 93.4%
(Min. Required = 35%)

NOTE: If meter reading directly in percent is used, record only percent

TEST STATUS:	PASSED —	N/A	FAILED —	
--------------	----------	------------	----------	--

DATA SHEET NO. 5
BREAKAWAY TEST - INSIDE REARVIEW MIRROR

Vehicle Information			
Year:	2008	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	08/28/08	Temperature:	81°F

MOUNTING OF MIRROR (INSIDE) DESCRIPTION: TAB GLUED TO WINDSHIELD. MIRROR BASE SLIPS OVER BASE AND HELD IN PLACE WITH SPRING CLIP.

(Requirement: the mirror shall deflect, collapse or break away when it is subjected to a force of 400 N or less)

TEST NO.	LOAD DIRECTION VERTICAL/HORIZONTAL	MAXIMUM FORCE (N)	DISPLACEMENT (MM)	PASS	FAIL
1	0-90 DEGREES	166.2	8.1	X	
2	+45/90 DEGREES	40.6	9.3	X	
3	-45/90 DEGREES	126.9	12.3	X	
4	-45/+45 DEGREES	95.8	30.1	X	
5	+45/+45 DEGREES	38.6	8.0	X	
6	+45/-45 DEGREES	97.4	35.6	X	
7	-45/-45 DEGREES	80.7	29.2	X	

REMARKS:

DATA SHEET NO. 5... (Continued)

BREAKAWAY TEST - INSIDE REARVIEW MIRROR FAILURE TYPE – DESCRIPTION:

FAILURE TYPE – DESCRIPTION:

NONE

TEST STATUS:	PASSED —	X	FAILED —	
--------------	----------	----------	----------	--

REMARKS:

RECORDED BY: **JONATHAN WILLIAMS**

DATE: **008/28/08**

APPROVED BY: **MICHAEL L. DUNLAP**

DATE: **008/28/08**

DATA SHEET NO. 6
UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

Vehicle Information			
Year:	2008	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	08/13/08	Temperature:	70°F

DRIVER'S SIDE & INSIDE REARVIEW MIRRORS:

DRIVER SIDE MIRROR	
TEST POSITION	DIAL READINGS
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0

INSIDE MIRROR	
TEST POSITION	DIAL READINGS
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0

All dial indicator readings for unit magnification mirrors must be zero.

DATA SHEET NO. 6... (Continued)
UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

PASSENGER SIDE REARVIEW MIRROR:

CONVERSION TABLE FROM SPHEROMETER DIAL
 READING TO RADIUS OF CURVATURE

TEST POSITION	DIAL READINGS (inches) Passenger	RADIUS OF CURVATURE (mm)	DEVIATION BETWEEN THE AVERAGE RADIUS OF CURVATURE AND THE TEST POSITION RADIUS OF CURVATURE (mm)	PERCENT DEVIATION FROM THE AVERAGE RADIUS OF CURVATURE
1	0.0048	1488.4	41.7	2.9
2	0.0051	1400.1	46.6	3.2
3	0.0050	1428.5	18.2	1.3
4	0.0050	1428.5	18.2	1.3
5	0.0049	1458.6	11.9	0.8
6	0.0050	1428.5	18.2	1.3
7	0.0050	1428.5	18.2	1.3
8	0.0049	1458.6	11.9	0.8
9	0.0048	1488.4	41.7	2.7
10	0.0049	1458.6	11.9	0.8
Average Radius of Curvature		1446.7	Greatest Percent Deviation	3.2

REMARKS:

DATA SHEET NO. 6... (Continued)

UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

PASSENGER'S SIDE REARVIEW MIRROR

IF CONVEX, ARE THERE ANY DISCONTINUITIES IN THE SLOPE OF THE MIRROR SURFACE YES ___ NO X

IF CONVEX, ARE THE WORDS, "OBJECTS IN THE MIRROR ARE CLOSER THAN THEY APPEAR" PRESENT YES X NO ___

IF CONVEX, MEASURE LETTER HEIGHT OF WORDS 5.0 mm

IF CONVEX, LETTERS ARE NOT < 4.8 mm OR > 6.4 mm HIGH YES X NO ___

IF CONVEX, RADIUS OF CURVATURE NOT < 889 mm OR > 1651 mm YES X NO ___

IF CONVEX, THE GREATEST PERCENT DEVIATION FROM AVERAGE RADIUS OF CURVATURE IS $\pm 12.5\%$ YES X NO ___

IF UNIT MAGNIFICATION, ALL DIAL READINGS ARE ZERO ± 0 . YES X NO ___

NOTE: PASSENGER MIRROR NOT REQUIRED

TEST STATUS:	PASSED —	X	FAILED —	
--------------	----------	----------	----------	--

RECORDED BY: JONATHAN WILLIAMS DATE: 008/28/08

APPROVED BY: MICHAEL L. DUNLAP DATE: 008/28/08

DATA SHEET NO. 8
TEST SUMMARY-FMVSS 111-REARVIEW MIRRORS

Vehicle Information			
Year:	2008	Make	Chevrolet
Model:	Impala LS	Body Style	4-Door Sedan
NHTSA No:	C80102	VIN	2G1WB58N889100388
Test Date:	008/28/08	Temperature:	N/A

PASSENGER VEHICLE TESTING:

OUTSIDE DRIVER SIDE MIRROR	PASS	FAIL	COMMENTS
STABLE SUPPORT	X		
DOES NOT PROTRUDE BEYOND VEHICLE BODY	X		
NOT OBSCURED BY UNWIPED PORTION OF WINDSHIELD	X		
ADJUSTABLE BY TILTING	X		
ADJUSTABLE FROM DRIVER SEAT	X		
FREE OF SHARP EDGES	X		
FIELD-OF-VIEW	X		
REFLECTANCE	X		
UNIT MAGNIFICATION	X		

INSIDE REARVIEW MIRROR	PASS	FAIL	COMMENTS
STABLE SUPPORT	X		
ADJUSTABLE BY TILTING	X		
FIELD-OF-VIEW	X		
REFLECTANCE	X		
BREAK AWAY	X		
UNIT MAGNIFICATION	X		

OUTSIDE PASSENGER MIRROR*	PASS	FAIL	COMMENTS
STABLE SUPPORT	X		
ADJUSTABLE BY TILTING	X		
FREE OF SHARP EDGES	X		
UNIT OR CONVEX			Convex
LABELING	X		
REFLECTANCE	X		

*MIRROR NOT REQUIRED

APPENDIX A
PHOTOGRAPHS



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 1: LEFT FRONT $\frac{3}{4}$ VIEW



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 2: LEFT SIDE VIEW



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 3: RIGHT REAR ¾ VIEW



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 4: RIGHT SIDE VIEW



MFD BY GENERAL MOTORS OF CANADA LTD.

DATE	GVWR	GAWR FRT	GAWR RR
05/07	2072 KG 4568 LB	1124 KG 2478 LB	948 KG 2090 LB

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

2G1WB58N889100388

TYPE: PASS CAR

2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 5: MANUFACTURER'S LABEL



TIRE AND LOADING INFORMATION

SEATING CAPACITY | TOTAL 5 | FRONT 2 | REAR 3

The combined weight of occupants and cargo should never exceed 428 kg or 944 lbs.

TIRE	ORIGINAL SIZE	COLD TIRE PRESSURE
FRONT	P225/60R16 S	210 kPa, 30 PSI
REAR	P225/60R16 S	210 kPa, 30 PSI
SPARE	T125/70D16 M	420 kPa, 60 PSI

SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION

2G1WB58N889100388

2008 CHEVROLET IMPALA LS
 NHTSA NO. C80102
 FMVSS NO. 111

FIGURE 6:TIRE PLACARD



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 7: DRIVER SIDE REARVIEW MIRROR AND MOUNTING



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 8: PASSENGER SIDE REARVIEW MIRROR AND MOUNTING



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 9: INSIDE REARVIEW MIRROR AND MOUNTING



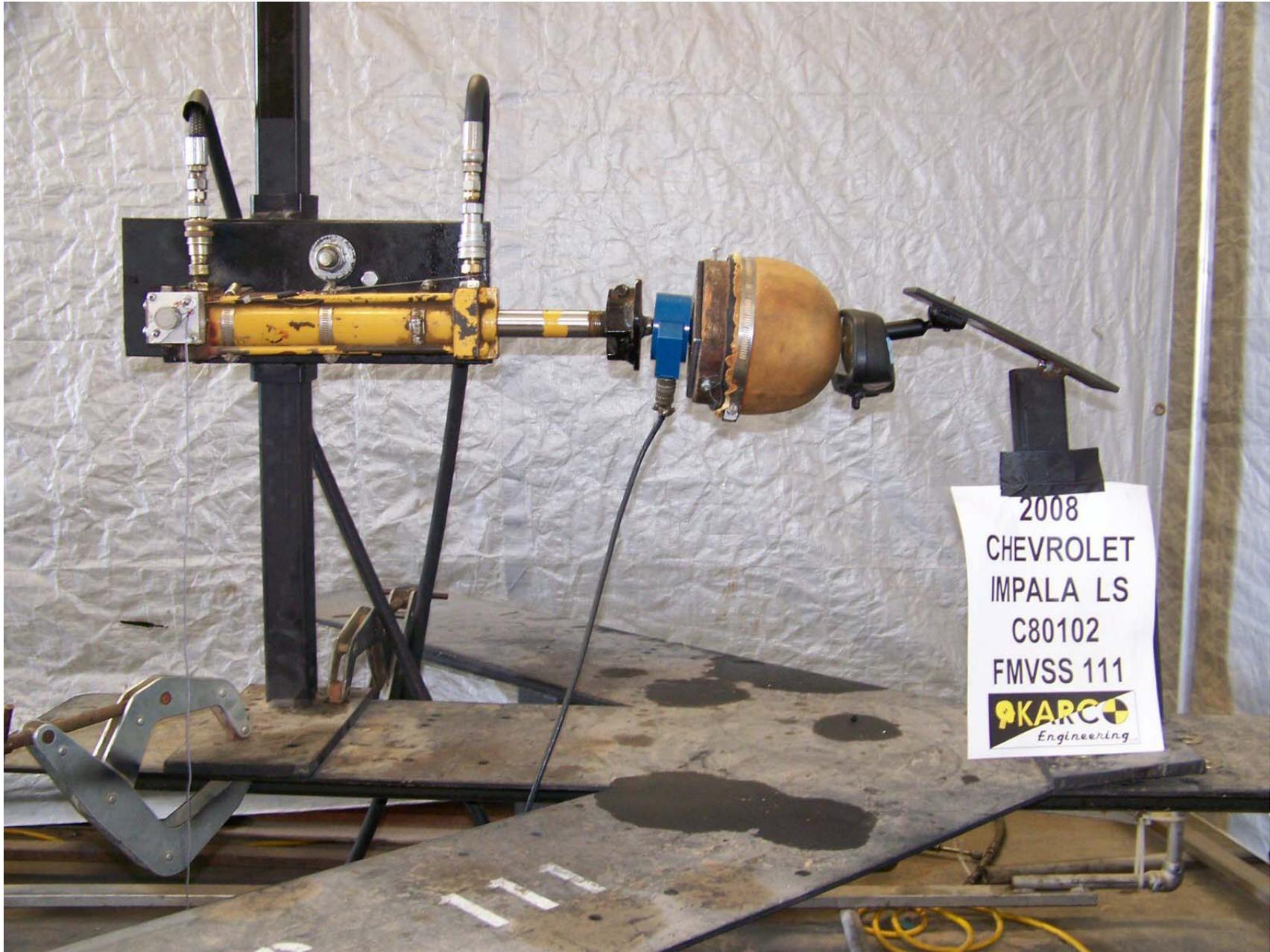
2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 10:TEST SET-UP



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 11:CAMERA SET-UP FOR PHOTOGRAPHING REFERENCE BOARD



2008 CHEVROLET IMPALA LS FIGURE 12: OVERALL SET-UP AND INSTRUMENTATION FOR MIRROR BREAK- AWAY TEST
NHTSA NO. C80102
FMVSS NO. 111



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 13:CLOSE-UP OF MIRROR BREAK- AWAY TEST



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 14: REFLECTION TEST SET-UP



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 15: MIRROR SET-UP FOR AREA MEASUREMENT



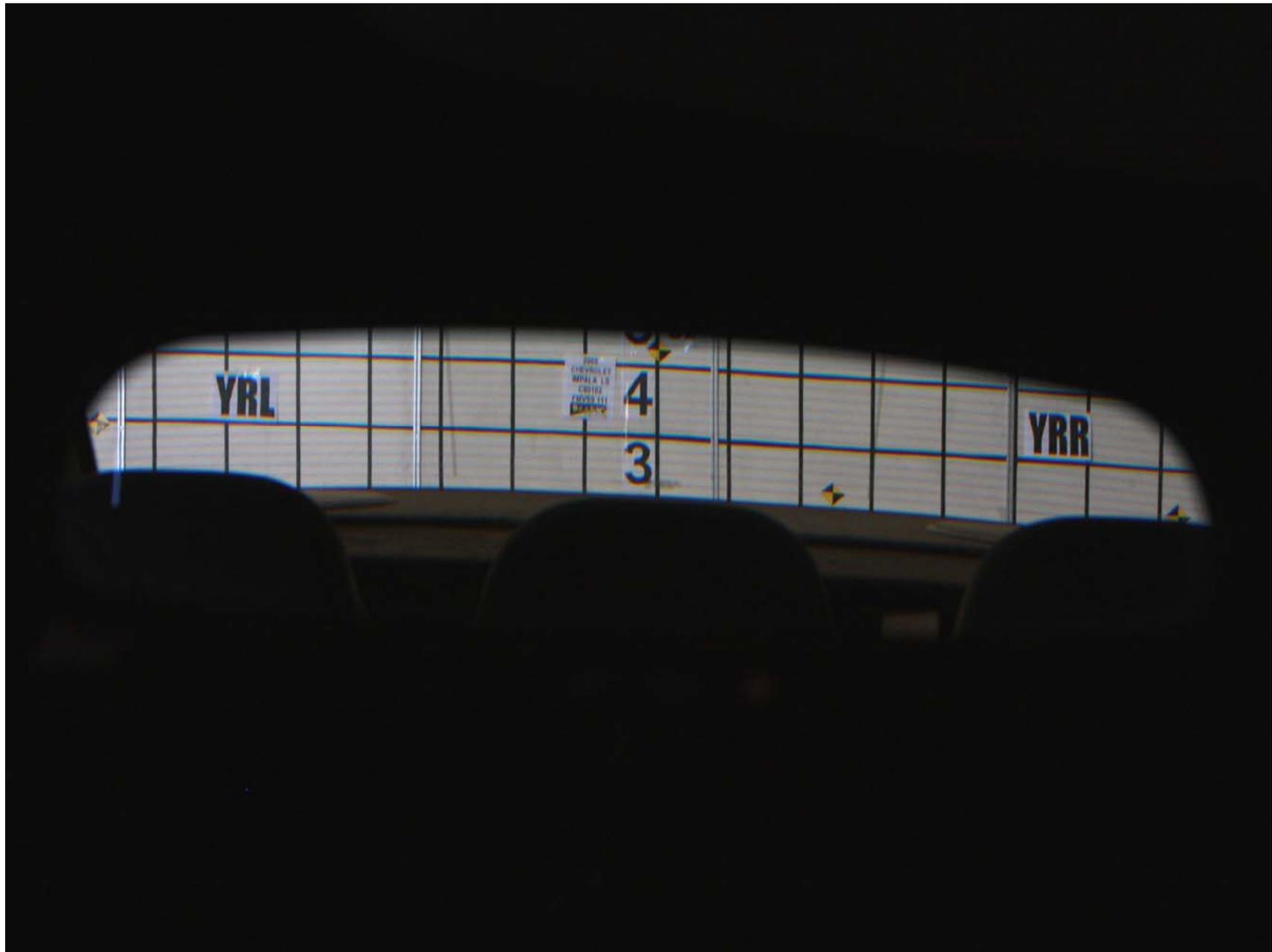
2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 16:LEFT EYE FIELD OF VIEW TEST (INSIDE MIRROR)



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 17:REFERENCE BOARD FOR INSIDE MIRROR, LEFT EYE



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 18:RIGHT EYE FIELD OF VIEW TEST (INSIDE MIRROR)



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 19:REFERENCE BOARD FOR INSIDE MIRROR, RIGHT EYE



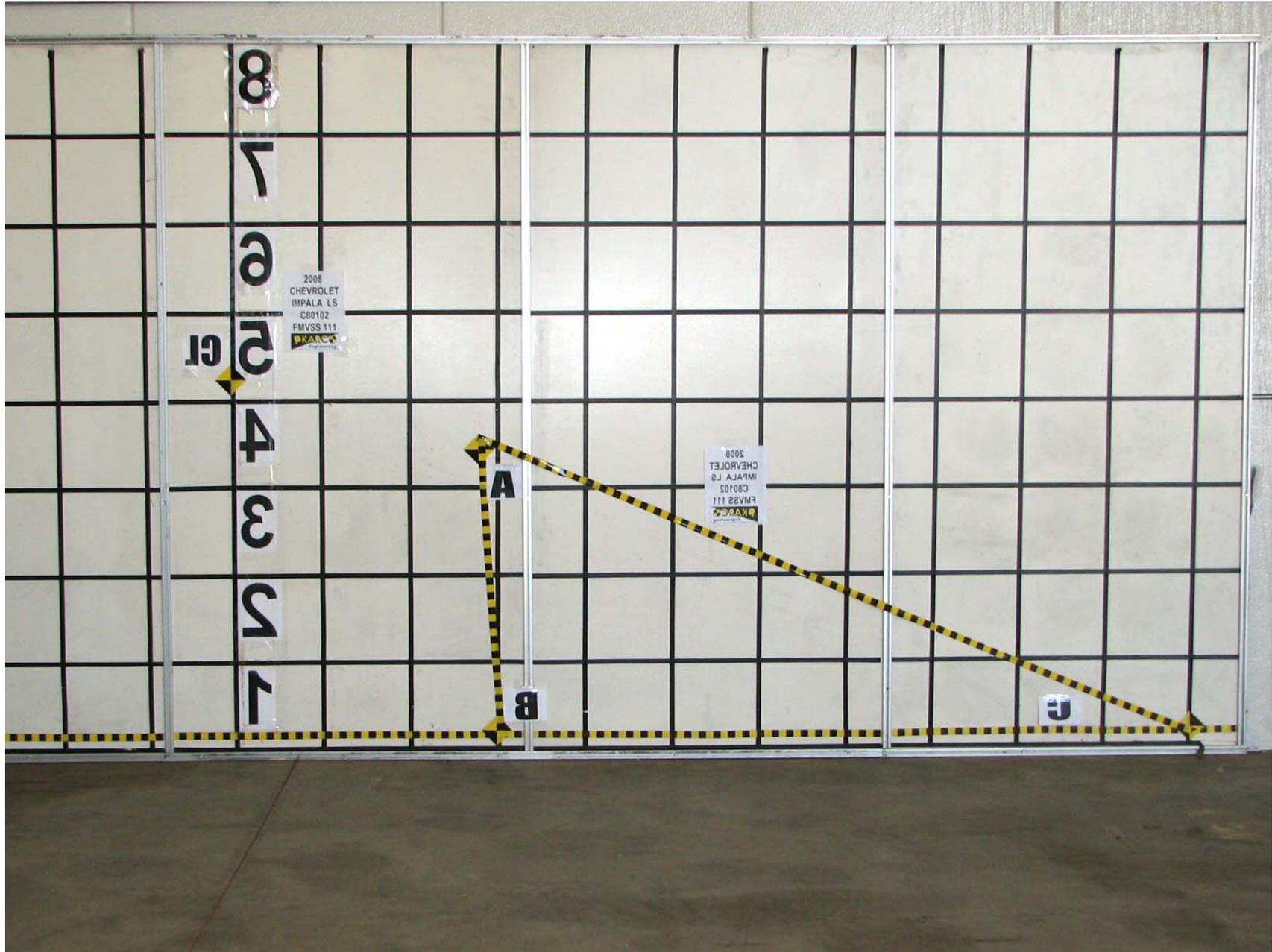
2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

FIGURE 20:LEFT EYE FIELD OF VIEW TEST (DRIVER SIDE MIRROR)



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

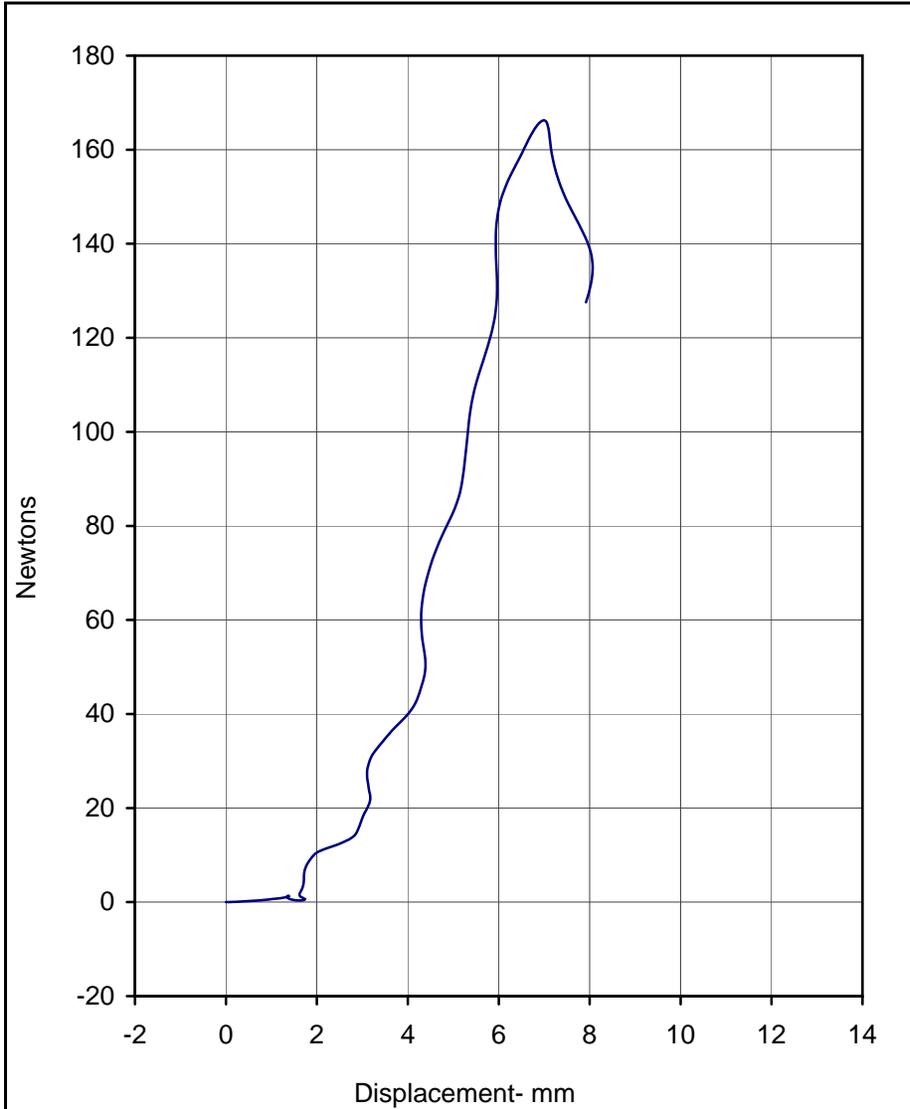
FIGURE 21:RIGHT EYE FIELD OF VIEW TEST (DRIVER SIDE MIRROR)



2008 CHEVROLET IMPALA LS
NHTSA NO. C80102
FMVSS NO. 111

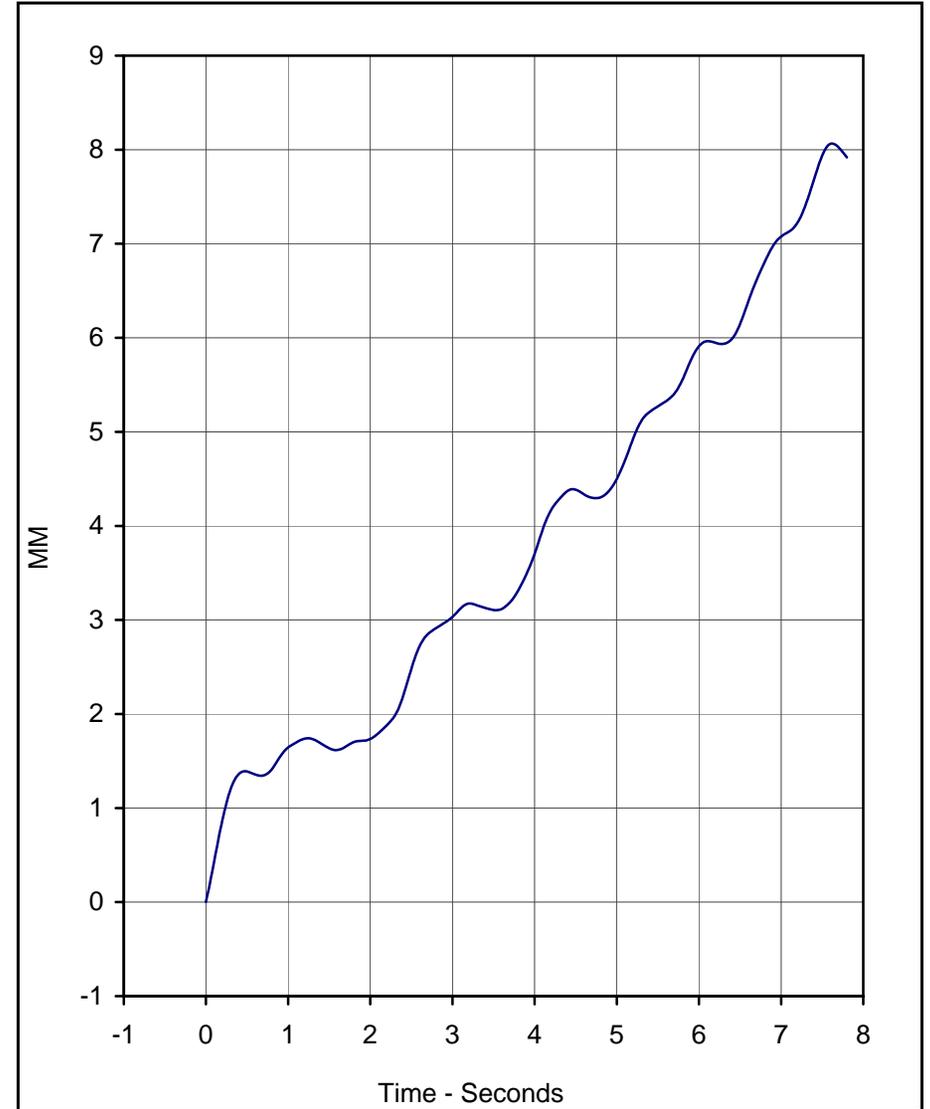
FIGURE 22:REFERENCE BOARD FOR DRIVER SIDE MIRROR

APPENDIX B
DATA PLOTS



Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	166.2	7.0	1



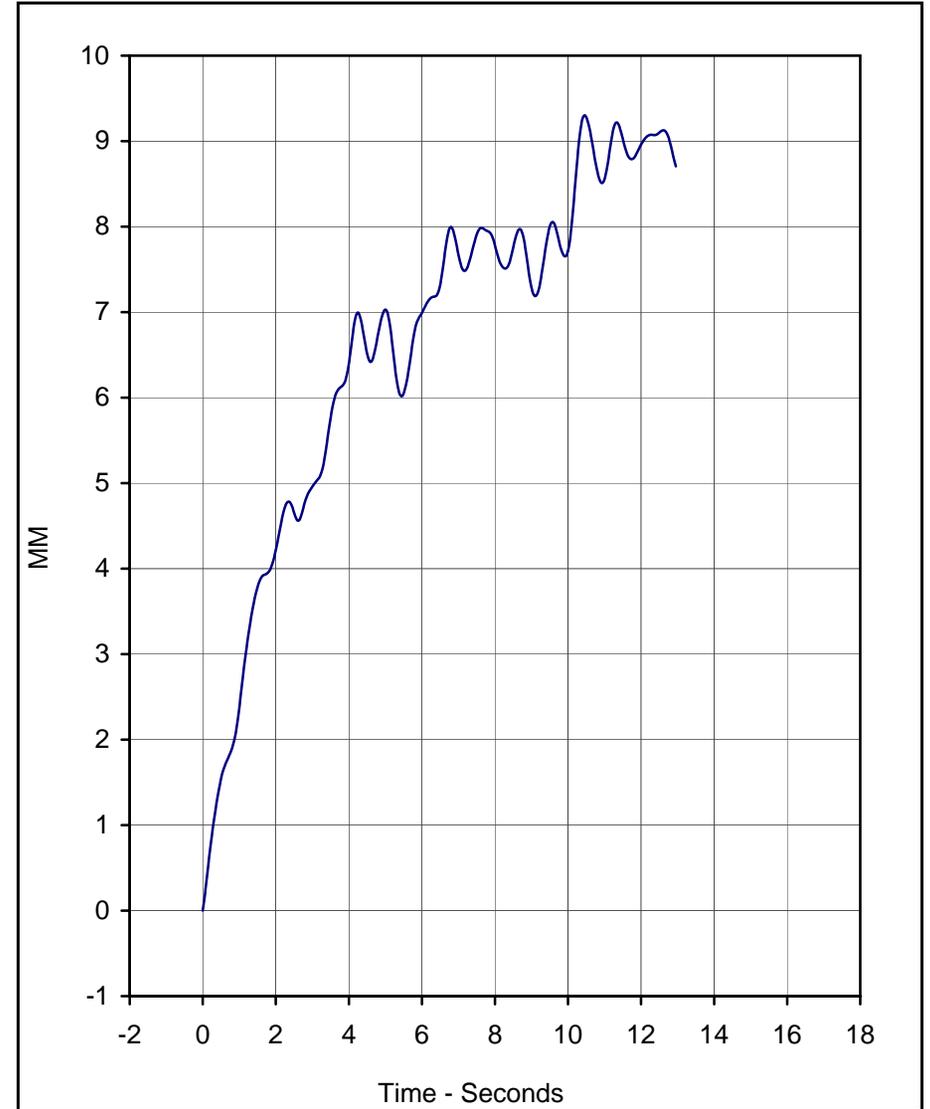
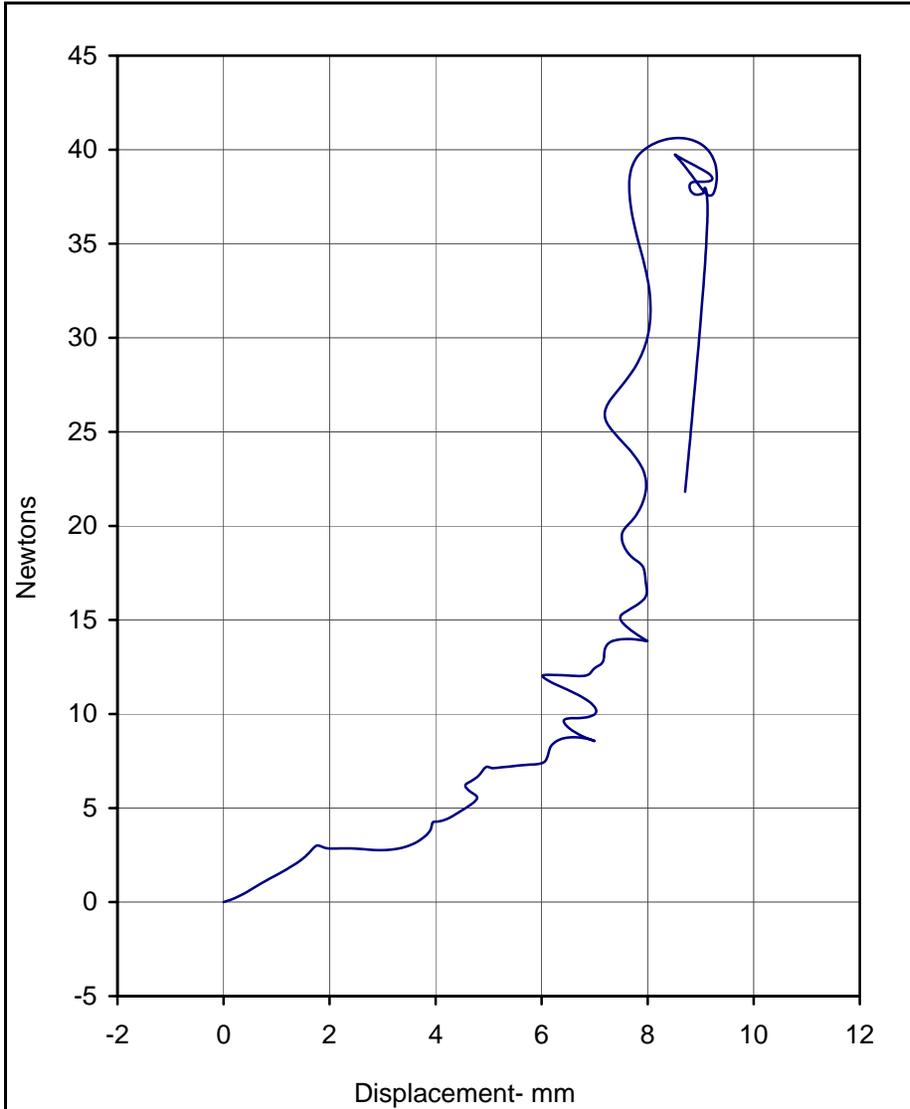
Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	8.1	7.6	61.5	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 1
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

Load Direction: 0 / 90
 Test Date: 8/28/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

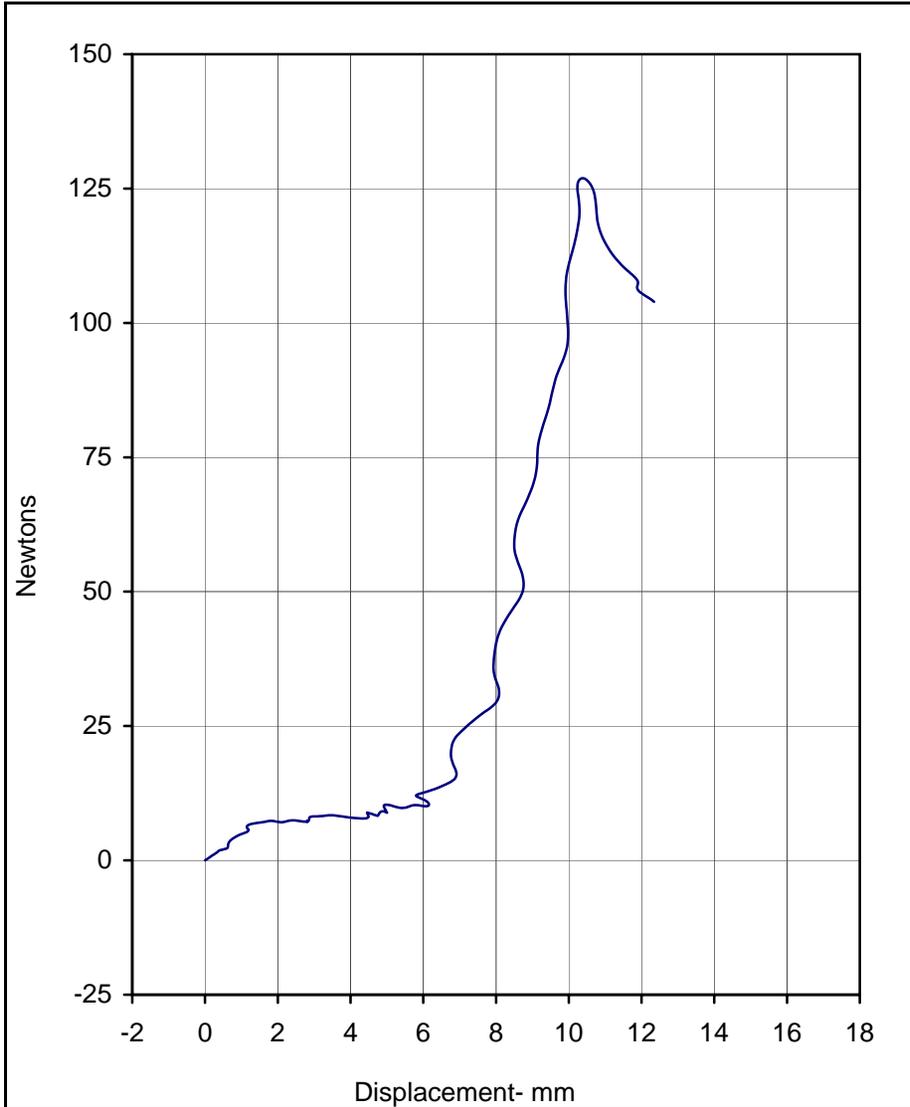
Units	Peak Force	Displacement	Filter (Hz)
Newtons	40.6	8.5	1

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	9.3	10.5	47.8	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 2
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

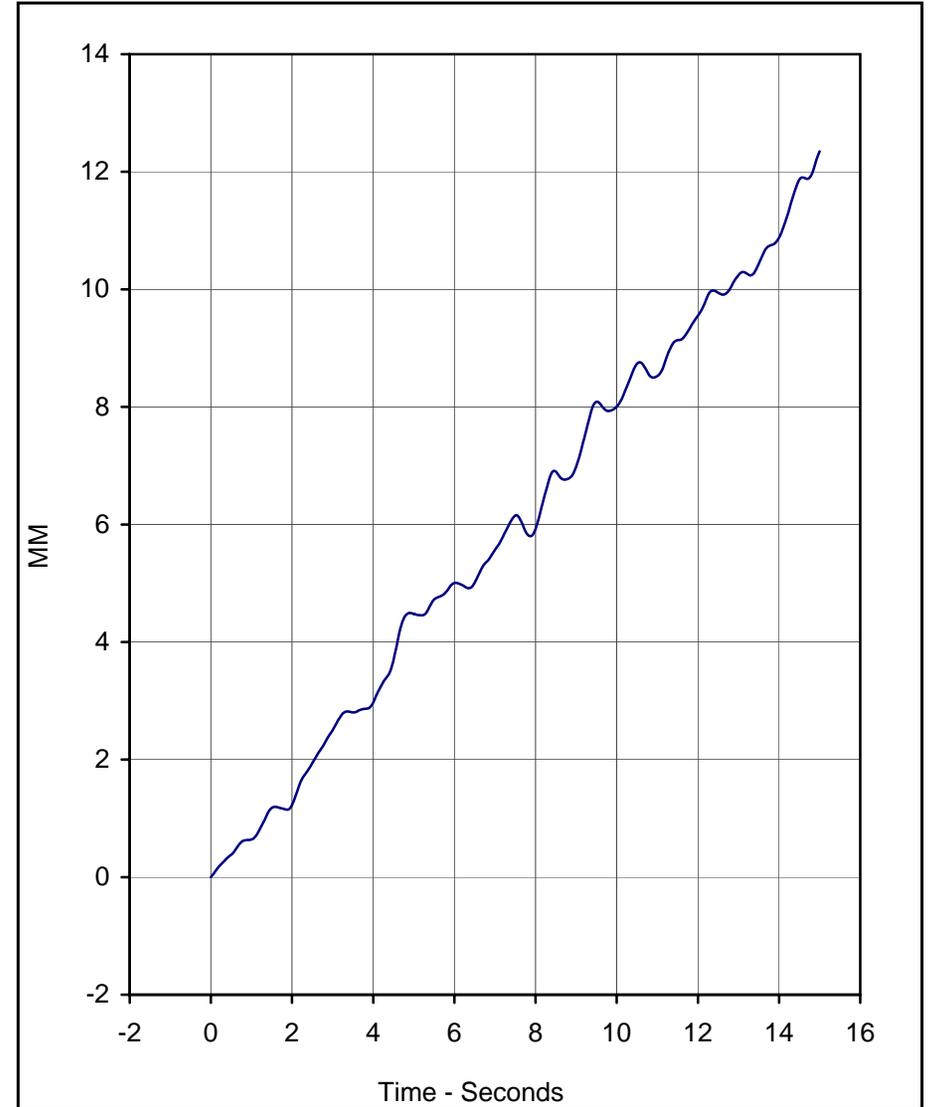
Load Direction: +45 / 90
 Test Date: 8/28/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	126.9	10.4	1



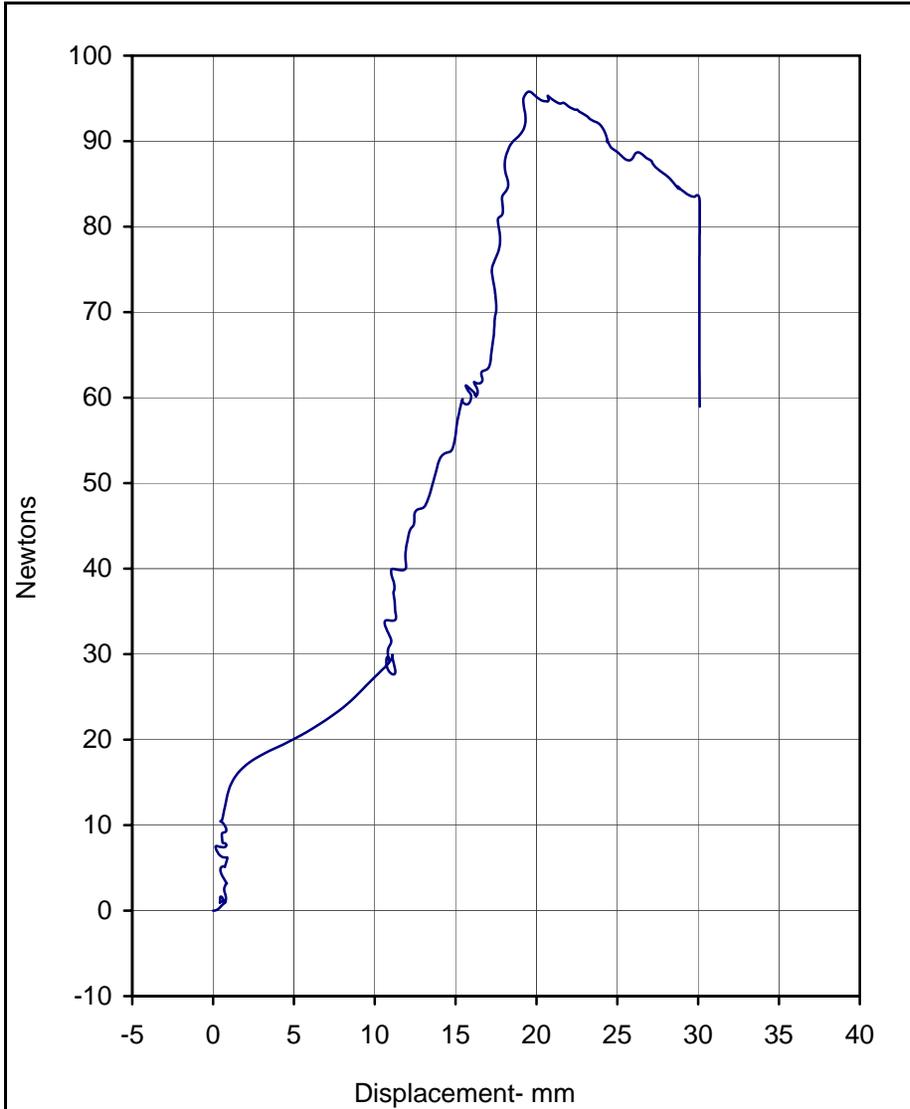
Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	12.3	15.0	48.6	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 3
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

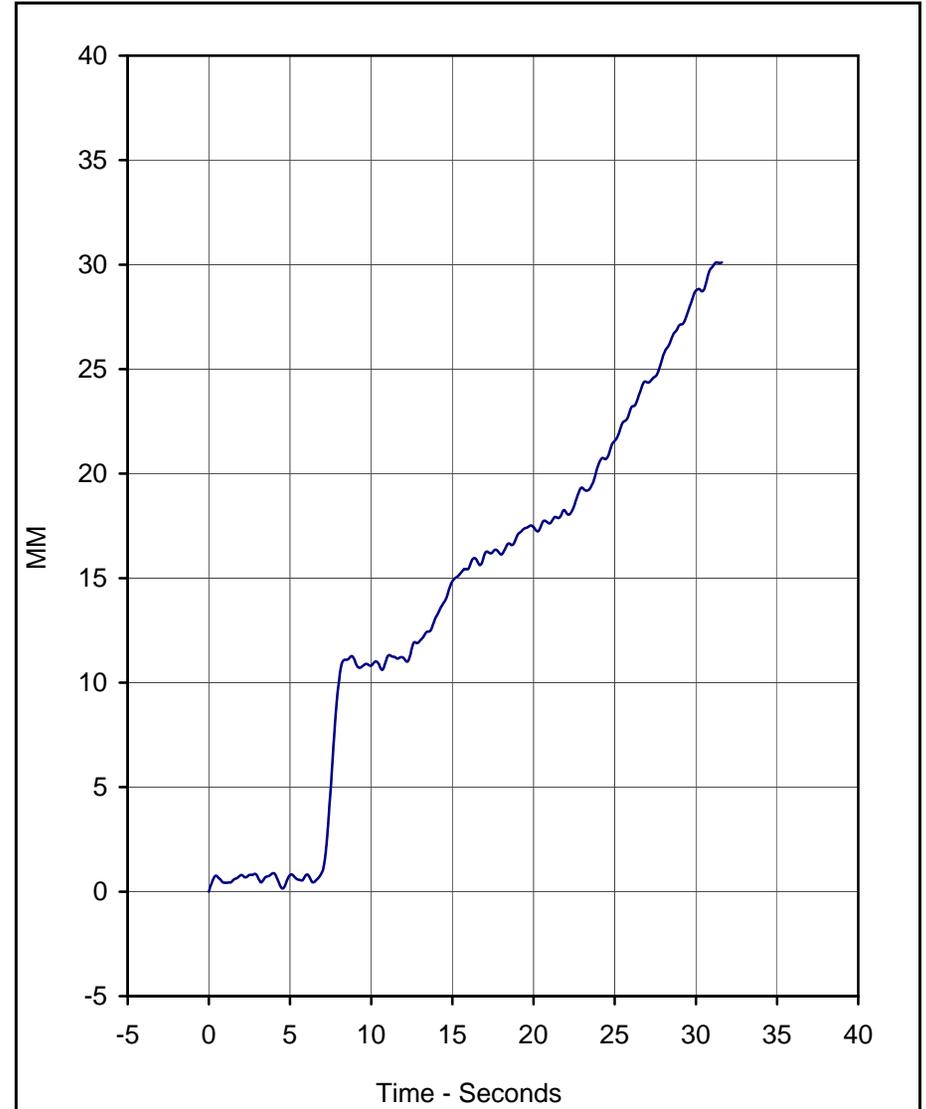
Load Direction: -45 / 90
 Test Date: 8/28/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	95.8	19.6	1



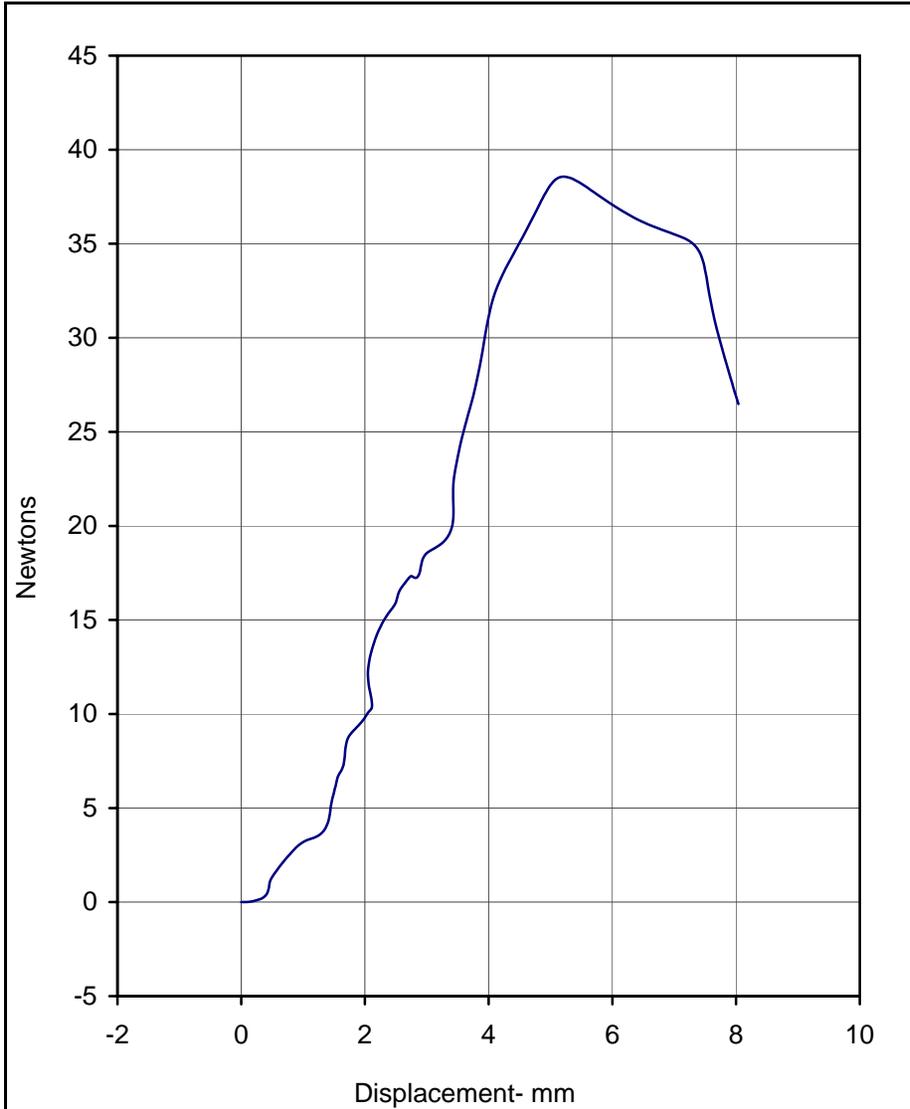
Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	30.1	31.6	57.9	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 4
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

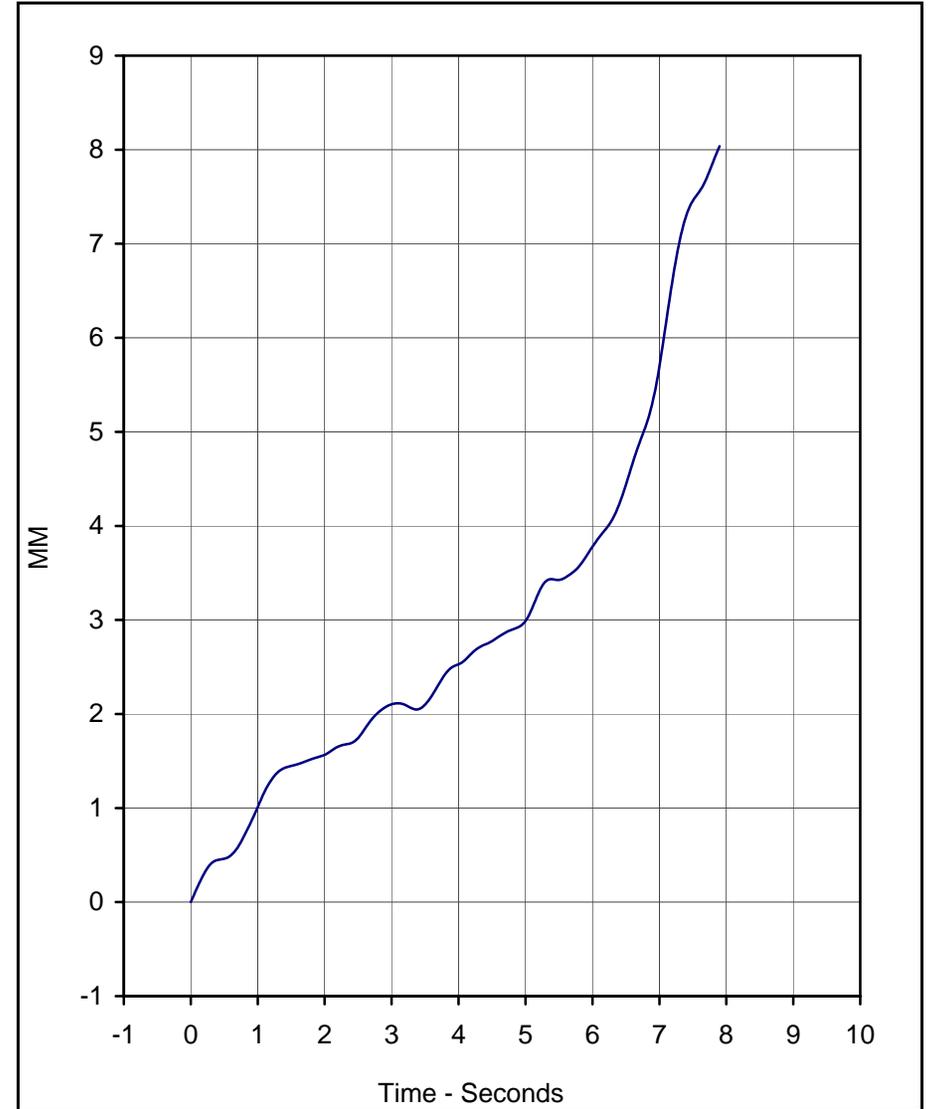
Load Direction: -45 / +45
 Test Date: 8/28/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	38.6	5.2	1



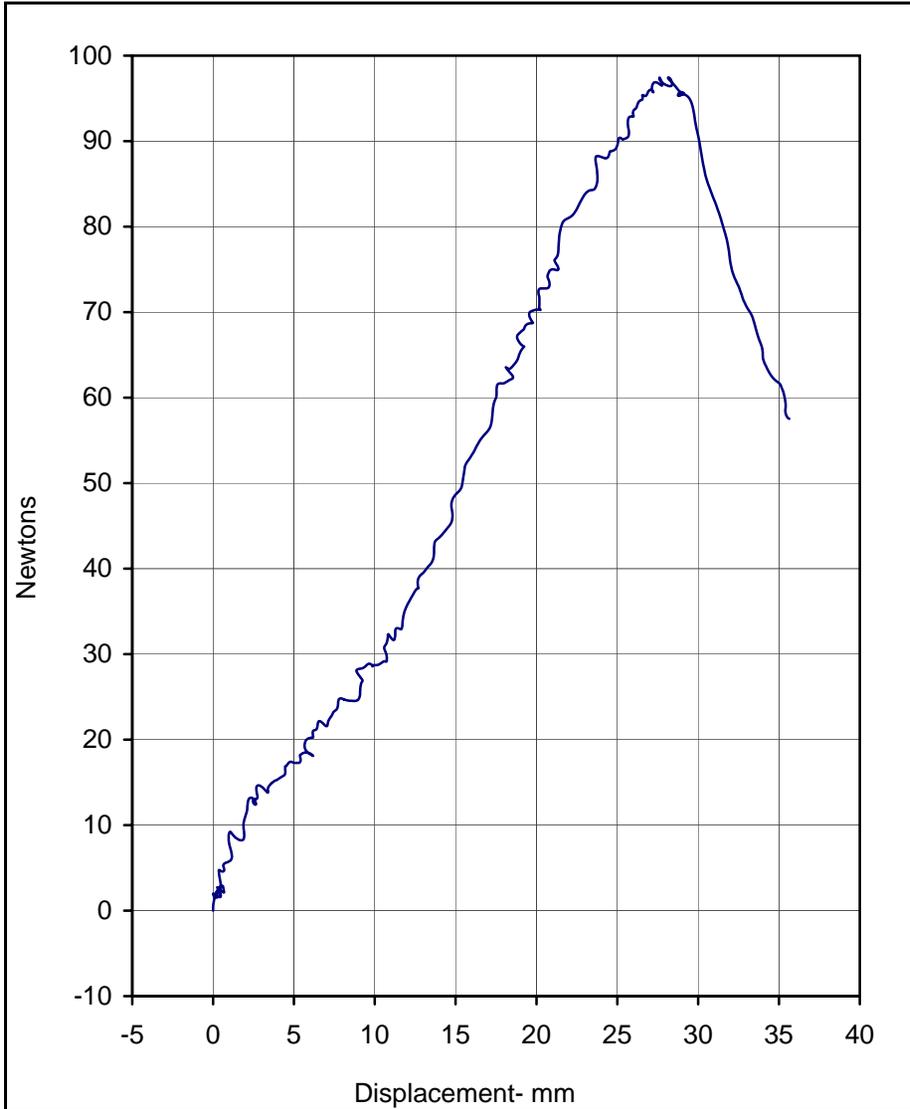
Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	8.0	7.9	61.1	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 5
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

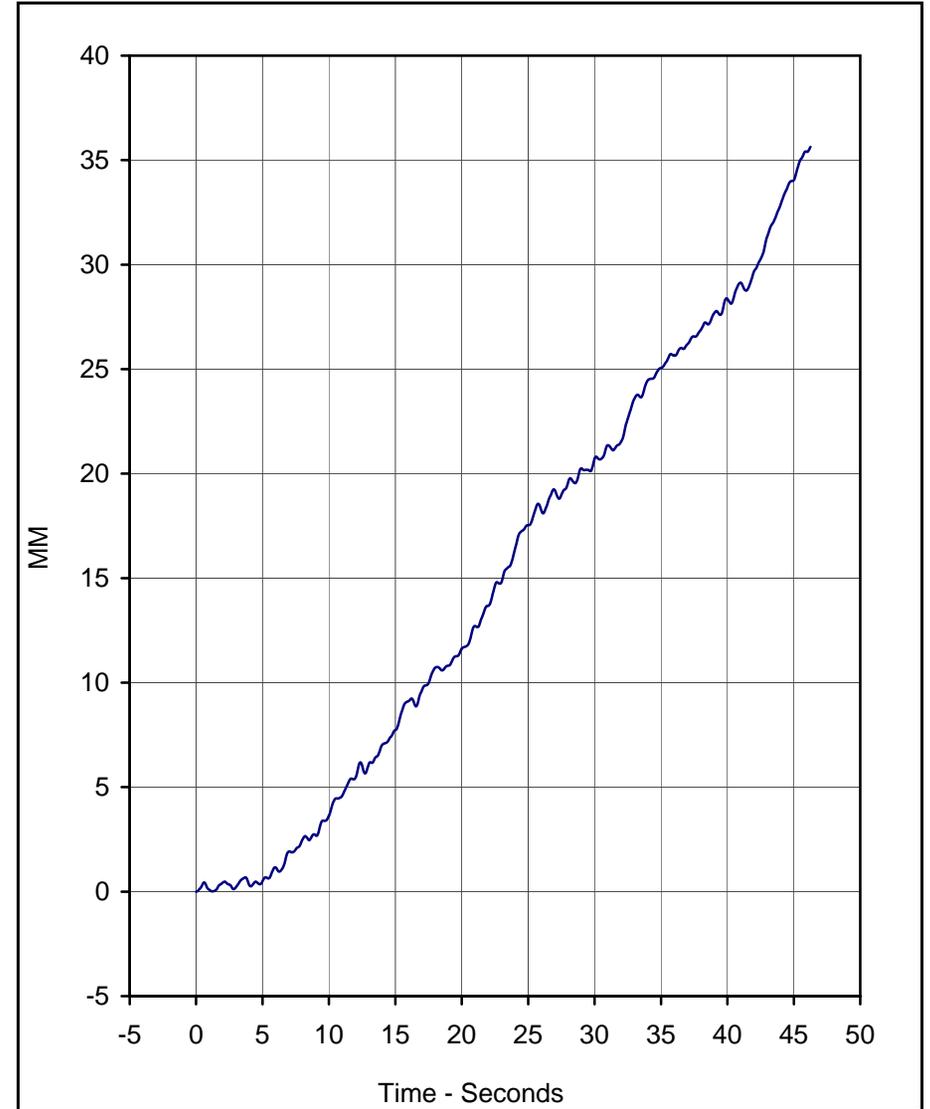
Load Direction: +45 / +45
 Test Date: 8/28/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	97.4	28.2	1



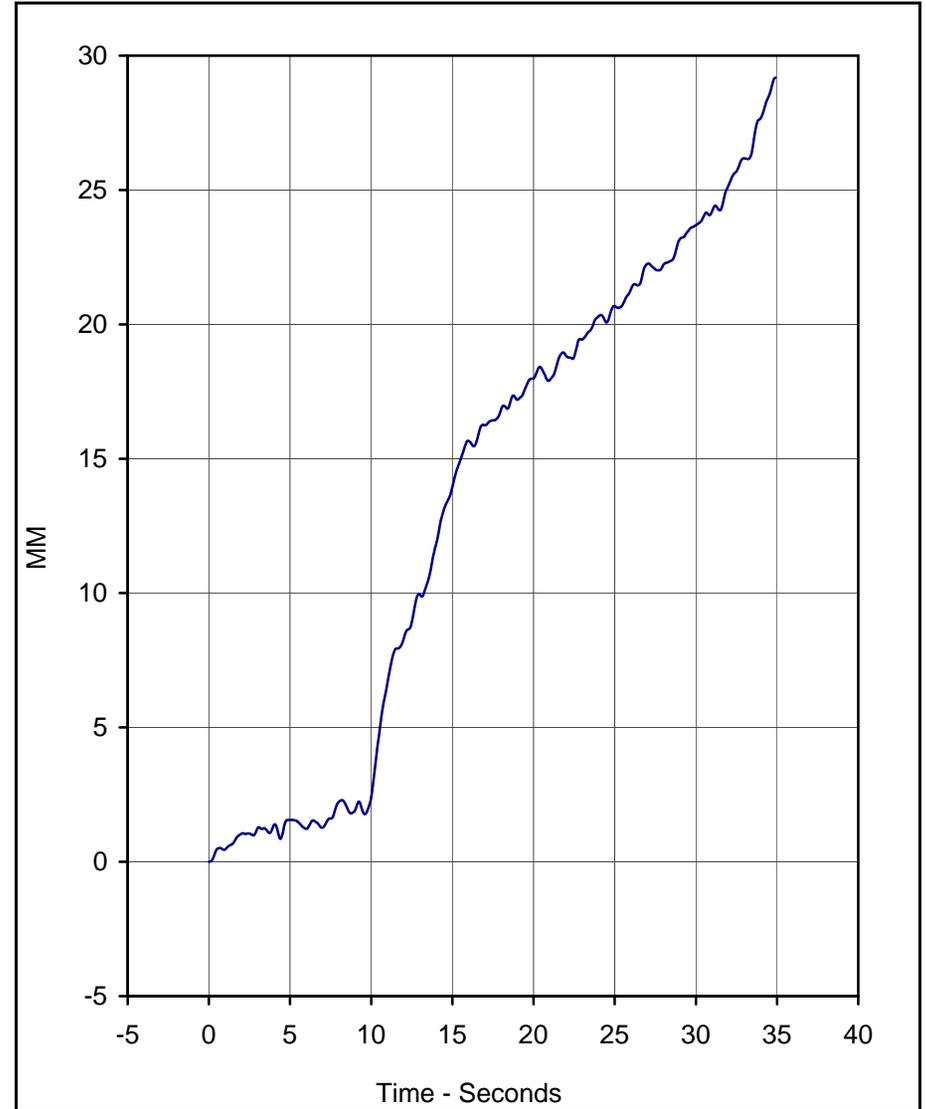
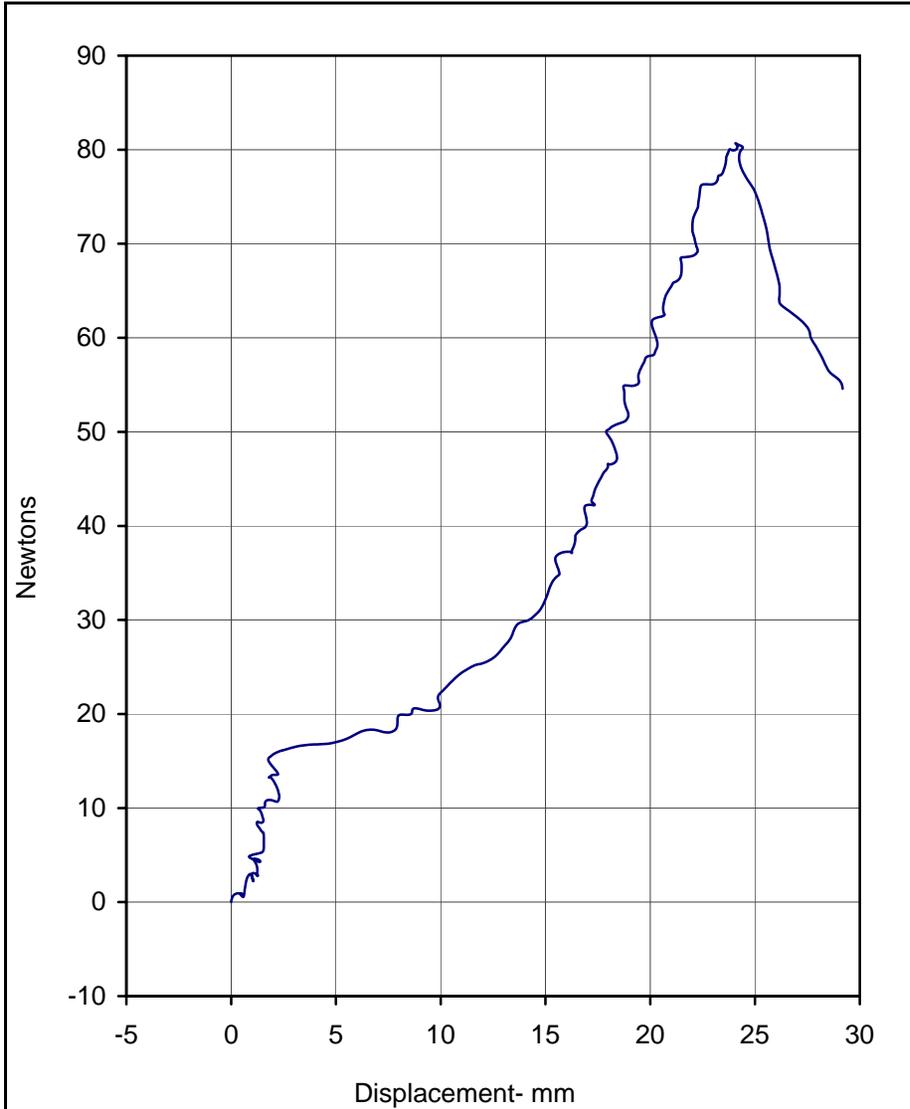
Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	35.6	46.3	45.5	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 6
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

Load Direction: +45 / -45
 Test Date: 8/28/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	80.7	24.1	1

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	29.2	34.9	49.1	1

Test Program: 2008 FMVSS 111 Rearview Mirrors Test No.: 7
 Test Vehicle: 2008 Chevrolet Impala LS No.: C80102

Load Direction: -45 / -45
 Test Date: 8/28/08



APPENDIX C
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

**2008 FMVSS 111 Rearview Mirrors
 Test Equipment List
 8/28/08
 2008 Chevrolet Impala LS**

Description	Manufacturer	Model No.	Serial No.	Limit	Accuracy	Cal. Date	Due Cal.
Hydraulic Pump	Lincoln	T-3825-C	2460952	8 gpm @ 2700 psi	N/A	N/A	N/A
Computer	Panasonic	CF-71	8IMAA01852	N/A	N/A	N/A	N/A
TDAS	DTS	TDAS	DM0103	N/A	SAE J211	11/28/07	11/27/08
Load Cell	Lebow	3167	1573	667 N	± 1.0%	6/20/08	6/20/09
Displacement Xdcr.	Celesco	PTX101-0030	J0654652	76 CM	± 1.0%	7/1/08	7/1/09



APPENDIX D
EYELIPSE LOCATIONS SUPPLIED BY MANUFACTURER

VEHICLE INFORMATION / TEST SPECIFICATIONS

FMVSS No. 111

Vehicle Make/Model/Year: 2008 Chevrolet Impala (4-Dr Sedan) – GMX211

Driver's Eye Reference Points:

Coordinate System:

X = Longitudinal Dimension

Y = Lateral Dimension

Z = Vertical Dimension

Positive Values are as follows:

X = Forward of Reference Point

Y = Outboard of Reference Point (to driver's side)

Z = Above Reference Point

Provide Reference/Body Fiducial Point that dimensions below are measured from. **Point must be easily accessible and usable by test laboratory personnel, i.e. seat track mounting bolt, seat belt anchorage bolt, door latch at B pillar striker.** (Provide sketch of reference point if necessary.)

Front Outboard Seat Track Bolt Head (see attached sketch)

COORDINATES	LEFT SIDE MIRROR		INSIDE MIRROR		RIGHT SIDE MIRROR	
	LE1 (left eye)	RE1 (right eye)	LE2	RE2	LE3	RE3
X	- 438 mm	- 416 mm	- 419 mm	- 441 mm	- 403 mm	- 445 mm
Y	- 189 mm	- 250 mm	- 209 mm	- 270 mm	- 229 mm	- 279 mm
Z	832 mm	832 mm	833 mm	833 mm	830 mm	830 mm
Mirror Mfr., Model Part No.	Visiocorp DG7, DK2 15866207, 15866245		Gentex, Magna Donnelly -UE1, UE1, DD6 25812208, 15282731, 10345906		Visiocorp DG7, DK2 15866206, 15866244	