

**REPORT NUMBER: 301R/305-CAL-12-003**

**SAFETY COMPLIANCE TESTING FOR FMVSS 301 & 305  
Fuel System Integrity – Rear Impact  
Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection**

**General Motors LLC  
2012 Buick Lacrosse  
Four Door Sedan**

**NHTSA No: CC0104**

**PREPARED BY:  
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**October 8, 2012**

**FINAL REPORT**

**PREPARED FOR:  
U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration Enforcement  
Office of Vehicle Safety Compliance  
Mail Code: NVS-220  
1200 New Jersey Avenue, SE  
Washington, DC 20590**



**TECHNICAL REPORT STANDARD TITLE PAGE**

<b>1. Report No.</b> 301R/305-CAL-12-003		<b>2. Government Accession No.</b>		<b>3. Recipient's Catalog No.</b>	
<b>4. Title and Subtitle</b> Final Report of FMVSS 301R/305 Compliance Testing of a 2012 Buick Lacrosse Four Door Sedan NHTSA No.: CC0104				<b>5. Report Date</b> October 8, 2012	
				<b>6. Performing Organization Code</b> CAL	
<b>7. Author(s)</b> Vanessa Walsh, Test Engineer David J. Travale, Technical Director				<b>8. Performing Organization Report No.</b> CAL-DOT-2012-003	
<b>9. Performing Organization Name and Address</b> Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225				<b>10. Work Unit No.</b>	
				<b>11. Contract or Grant No.</b> DTNH22-11-D-00243	
<b>12. Sponsoring Agency Name and Address</b> U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance- Enforcement Mail Code: NVS-220 1200 New Jersey Avenue, SE Washington, DC 20590				<b>13. Type of Report and Period Covered</b> Final Test Report August 7, 2012 - October 8, 2012	
				<b>14. Sponsoring Agency Code</b> NVS-220	
<b>15. Supplementary Notes</b>					
<b>16. Abstract</b> Compliance tests were conducted on the subject 2012 Buick Lacrosse Four Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301R-02 and TP-305-01 for the determination of FMVSS 301 & 305 compliance.  <b>No test failures were reported.</b>					
<b>17. Key Words</b> Compliance Testing Safety Engineering FMVSS 301R/305			<b>18. Distribution Statement</b> <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Avenue, SE Washington, D.C. 20590 Email: tis@nhtsa.dot.gov Fax: 202-493-2833		
<b>19. Security Classification of Report</b> UNCLASSIFIED		<b>20. Security Classification of Page</b> UNCLASSIFIED		<b>21. No. of Pages</b> 68	<b>22. Price</b>

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## **SECTION 1**

### **PURPOSE AND TEST PROCEDURE**

This rear impact test is part of the FMVSS 301R/305 Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-11-D-00243. The purpose of this test was to determine if the subject vehicle, a 2012 Buick Lacrosse Four Door Sedan, meets the performance requirements of FMVSS No. 301R "Fuel System Integrity – Rear Impact." and FMVSS No. 305 "Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection". The test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-301R-02, dated January 17, 2007) and (TP-305-01, dated September 11, 2008).

## SECTION 2

### COMPLIANCE TEST RESULTS SUMMARY

A 1915.5 kg 2012 Buick Lacrosse Four Door Sedan was impacted by a 1357.0 kg moving barrier at a velocity of 79.48 kph (49.39 mph). The test was performed by Calspan Corporation on 8/7/2012.

The test vehicle was equipped with a 15.8 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (68.2kg) was secured in the vehicle cargo area. Two ballast Part 572E 50th percentile male Anthropomorphic Test Devices (ATD) were placed in the front occupant seating positions. Electrical isolation measurements were taken immediately post-impact and observations were made related to electrolyte spillage and battery retention. A static rollover was subsequently performed on the subject vehicle and electrical isolation measurements were taken at every stage of the rollover.

There was no fuel system fluid spillage following the impact and including all portions of the static rollover test. The maximum vehicle longitudinal crush was 499 millimeters of which the average was 373 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

Based on the test results, the 2012 Buick Lacrosse Four Door Sedan appears to meet all requirements regarding electrolyte spillage, battery retention, and electrical isolation for FMVSS No.305 compliance testing.

The crash event was recorded by three high-speed cameras and one real-time camera. High-speed camera locations and other pertinent camera information are found on page 3-9 of this report. Data sheets can be found starting on page 3-2. Pre-test and post-test photographs of the vehicle can be found in Appendix A.

**SECTION 3**  
**DATA SHEETS**

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 – Test Vehicle Specifications

Data Sheet No. 2 – Pre-Test Data

Data Sheet No. 3 – Moving Deformable Barrier (MDB) Data

Data Sheet No. 4 – Pre-Impact Electrical Isolation Measurements & Calculations

Data Sheet No. 5 – High Speed Camera Locations and Data Summary

Data Sheet No. 6 – Post-Test Data

Data Sheet No. 7 – Post-Impact Electrical Isolation Measurements & Calculations

Data Sheet No. 8 – FMVSS No. 301 Static Rollover Test Data

Data Sheet No. 9 – FMVSS No. 305 Static Rollover Test Data

Data Sheet No. 10 – Photograph Data Sheet Checklist

**DATA SHEET NO. 1  
TEST VEHICLE SPECIFICATIONS**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**TEST VEHICLE INFORMATION AND OPTIONS**

NHTSA No.	CC0104
Model Year	2012
Make	Buick
Model	Lacrosse
Body Style	Four Door Sedan
Body Color	Gold/tan/copper
Odometer Reading (km/mi)	180 / 112
Engine Displacement (L)	2.4
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6-Speed
Final Drive	Front Wheel Drive

Overdrive	Yes
Air Conditioning (AC)	Yes
All-Wheel Drive (AWD)	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADL)	Yes
Power Brakes	Yes
Power Seats	Yes
Power Steering	Yes
Power Windows	Yes
Stability Control (Auto-Leveling)	No
Sunroof/T-Top	No
Tilt Steering Wheel	Yes
Traction Control System (TCS)	Yes

**DEALER AND DELIVERY INFORMATION FROM CERTIFICATION LABEL**

Manufactured By	General Motors LLC
Date of Manufacture	10/11
VIN	1G4GA5ER8CF204123

GVWR (kg)	2131
GAWR Front (kg)	1112
GAWR Rear (kg)	1019

**TIRE PLACARD & SIDEWALL INFORMATION**

Tire Placard Location: Driver's Door Sill

Spare Tire Type: T145/70D17

Measured Parameter	Front	Rear
Tire Manufacturer	Michelin	Michelin
Tire Name	Energy Saver A/S	Energy Saver A/S
Tire Type	All season	All season
Max. Tire Pressure (kPa)	300	300
Recommended Tire Size	P235/50R17	P235/50R17
Load Index/Speed Symbol	95T	95T
Recommended Cold Tire Pressure (kPa)	240	240
Tire Size on Vehicle	P235/50R17	P235/50R17
Treadwear/ Traction Grade/ Temperature Grade	480/A/B	480/A/B

**VEHICLE CAPACITY DATA**

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	0	5
Seat Type (Bench, Bucket, or Split Bench)	Bucket	Bench	--	
Capacity Weight (VCW) (kg)				410.00
DSC X 68.04 (kg)				340.20
Cargo Weight (RCLW) (kg)				69.80

**DATA SHEET NO. 1 (Continued)  
TEST VEHICLE SPECIFICATIONS**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**ELECTRIC VEHICLE PROPULSION SYSTEM**

Measured Parameter	Value
Type of Electric Vehicle (Electric/Gas-Electric Hybrid/Fuel Cell-Electric Hybrid)	Electric assist /Gas
Propulsion Battery Type	32 cell series connected(ip325) Li-Ion Battery Pck
Nominal Voltage (Volts)	115.2
Is this Vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of Automatic Propulsion Battery Disconnect, if applicable	Behind right rear pass seat
Auxiliary Battery Type	12V Lead acid

**PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED)**

Measured Parameter	Value
Electrolyte Fluid Type	Organic carbonates
Electrolyte Fluid Specific Gravity	1.1-1.2 gm/cc
Electrolyte Fluid Kinematic Viscosity (centistokes)	2.0-2.1
Electrolyte Fluid Color	colorless
Propulsion Battery Coolant Type, Color and Specific Gravity (if applicable)	Air cooled
Location of Battery Modules (Inside or Outside of Passenger Compartment?)	Inside

**PROPULSION BATTERY STATE OF CHARGE**

Measured Parameter	Units	Value
<i>For all battery types:</i> Voltage Range corresponding to <b>useable energy</b> of the battery:		
Minimum State of Charge	V	108.000
Maximum State of Charge	V	121.500
95% of Maximum	V	115.425
Test Voltage *	V	115.200
<i>For batteries that are rechargeable ONLY by an energy source on the vehicle:</i> Voltage range corresponding to <b>useable energy</b> of the battery :		
Minimum State of Charge	V	
Maximum State of Charge	V	
95% of Maximum	V	
Test Voltage *	V	

\* For all battery types-No less than 95% of Maximum Operating Voltage; for batteries that are rechargeable ONLY by an energy source on the vehicle-maximum practicable state of charge within normal operating range.

**DATA SHEET NO. 2  
PRE-TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	515.0	352.5		568.5	405.5	
Right	kg	485.0	345.5		538.0	403.5	
Ratio	%	58.9	41.1		57.8	42.2	
Totals	kg	1,000.0	698.0	1,698.0	1,106.5	809.0	1,915.5

**TARGET TEST WEIGHT CALCULATION (TTW)**

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1,698.0	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	69.8	(B)
Weight of two P572E ATDS @ 78kg each	kg	156.0	(C)
Target Vehicle Test Weight (TVTW)	kg	1,923.8	(A+B+C)

\*As tested Weight = (TTW -10kg) <=ATW < (TTW -5kg); TTW = Weight of Test Vehicle with 2 dummies and 69.8kg of Cargo Weight

**GENERAL TEST VEHICLE DATA**

Measured Parameter	Units	Value
Vehicle Wheelbase	mm	2837
Vehicle Length (at Centerline)	mm	5000
Vehicle Width	mm	1818
Weight of Ballast Secured in Cargo Area <sup>1</sup>	kg	68.2
Type of Ballast		Lead shot
Method of Securing Ballast		Placed in rear passenger foot well
Components Removed for Weight Reduction		None
Vehicle Width at Widest Point	mm	1864
Vehicle Width at Widest Point Location		C-Pillar
Centerline offset for impact line	mm	373
Filler neck side (left/right )		Right

<sup>1</sup> Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

**TEST VEHICLE ATTITUDE AND CG**

	Units	Left		Right		CG (aft of front axle)
		Front	Rear	Front	Rear	
As Delivered (UVW)	mm	725	741	736	745	1166
As Tested (ATW)	mm	707	724	715	727	1198

**DATA SHEET NO. 2 (Continued)  
PRE-TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

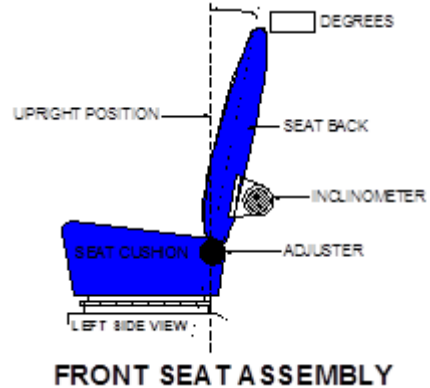
NHTSA No.: CC0104  
 Test Date: 8/7/2012

**SEATING**

**Nominal Design Riding Position** (for adjustable driver and passenger seat backs). *Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.*

**Driver Seat Instructions:** The driver seat back was positioned according to the Nominal Design Riding position listed in FORM 1.

**Passenger Seat Instructions:** The passenger seat back was positioned to allow for a zero head angle of the passenger dummy.

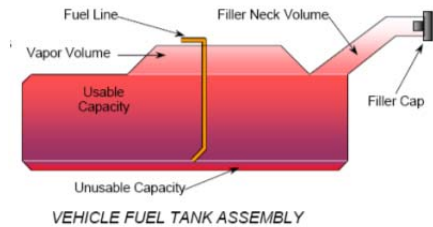


Measured Parameter	Deg.
Driver Seat Back Angle	13.9
Passenger Seat Back Angle	14.6

**SEAT FORE/AFT POSITIONING**

Driver Seat: The driver's seat was positioned at the mid-point of fore/aft travel.  
 Passenger Seat: The passenger's seat was positioned at the center position of fore/aft travel.

	Total # of Positions	Placed in Position #
Driver Seat	314	157
Passenger Seat	314	157



**FUEL TANK CAPACITY DATA**

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	59.8
COTR Usable Capacity (Standard Tank)	Form No. 1	59.8
Test Volume Range	91-94% of Usable Capacity	54.4 – 56.2
Actual Test Volume (Solvent Used)	93% of Usable Capacity	55.6

**FUEL SYSTEM DATA**

Measured Parameter	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.764
Test Fluid Kinematic Viscosity ( centistokes)	0.96
Test Fluid Color	Red
Electric Fuel Pump?	Yes
Can Activate Electric Fuel Pump with Ignition Switch On but Engine Off?	Yes

Fuel Pump Comments : None

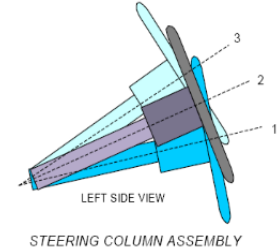
**DATA SHEET NO. 2 (Continued)  
PRE-TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**STEERING COLUMN ADJUSTMENT**

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.



Operational Instructions: Steering wheel and column were adjusted to the geometric locus at 27.5 mm and 23.2 degrees.

**SEAT BELT UPPER ANCHORAGE**

Nominal design riding position

Operational Instructions: Anchorage were set to most upright position

**MEASURED COLD TIRE PRESSURE @ TOTAL TEST WEIGHT**

Measured Parameter	Units	Value
Left Front (LF)	kPa	240
Right Front (RF)	kPa	240
Left Rear (LR)	kPa	240
Right Rear (RR)	kPa	240

**VEHICLE CHASSIS GROUND PT(S) LOCATION(S) & PROPULSION BATTERY SYSTEM**

Measured Parameter	Value
Details of Vehicle Chassis Ground Points & Locations	Everything is located within the battery and cannot be accessed without removing the battery cover located behind the rear passenger seat back.
Details of Propulsion Battery Components	

**COMMENTS:** None  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**DATA SHEET NO. 3  
MOVING DEFORMABLE BARRIER (MDB) DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

MDB Face Manufacturer: PLASCORE                      MDB Face Serial No. A1010010

**MDB SPECIFICATIONS**

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1250
Overall Length of MDB (incl. honeycomb impactor face)	4120
Wheelbase of Framework Carriage	2591
Tread of Framework Carriage (Front & Rear)	1875
CG Location of Front Axle	1139

**MDB WEIGHTS**

	Units	Front	Rear	Total
Left	kg	358.0	322.0	680.0
Right	kg	404.0	273.0	677.0
Ratio	%	56.2%	43.8%	100.0%
Totals	kg	762.0	595.0	1357.0

**MDB TIRE SIZE & PRESSURES**

	Units	Requirement	Left Front	Right Front	Left Rear	Right Rear
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15th, 2010

**DATA SHEET NO. 4**  
**PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**VOLTMETER INFORMATION**

Measured Parameter	Units	Value
Make & Model		Fluke 87
Serial No.		65280327
Internal Impedance Value	MΩ	10
Resolution	V	600.000
Last Calibration Date		10/20/2011

**NOTES:**

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**PROPULSION BATTERY VOLTAGE, RESISTANCE & ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

Measured Parameter	Symbol	Units	Value
Normal operating voltage range specified by the manufacturer	V <sub>b</sub>	V	115.2
Propulsion Battery Voltage : (ready to drive position)	V <sub>b</sub>	V	114.800
Propulsion Battery to Vehicle Chassis	V <sub>1</sub>	V	42.700
Propulsion Battery to Vehicle Chassis	V <sub>2</sub>	V	45.100
Propulsion Battery to Vehicle Chassis Across Known Resistor	R <sub>o</sub>	Ω	49900
Propulsion Battery to Vehicle Chassis with R <sub>o</sub> installed	V <sub>1</sub> '	V	0.884
Propulsion Battery to Vehicle Chassis with R <sub>o</sub> installed	V <sub>2</sub> '	V	0.934
$R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$	R <sub>i1</sub>	Ω	4,853,527
$R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$	R <sub>i2</sub>	Ω	4,593,669
Lesser value of R <sub>i1</sub> and R <sub>i2</sub>	R <sub>i</sub>	Ω	4,593,669
Electrical Isolation Value (Minimum E.I. Value is 500 Ω/V)	R <sub>i</sub> /V <sub>b</sub>	Ω/V	40,015

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)?  X Yes  No (Fail)

**NOTES:**

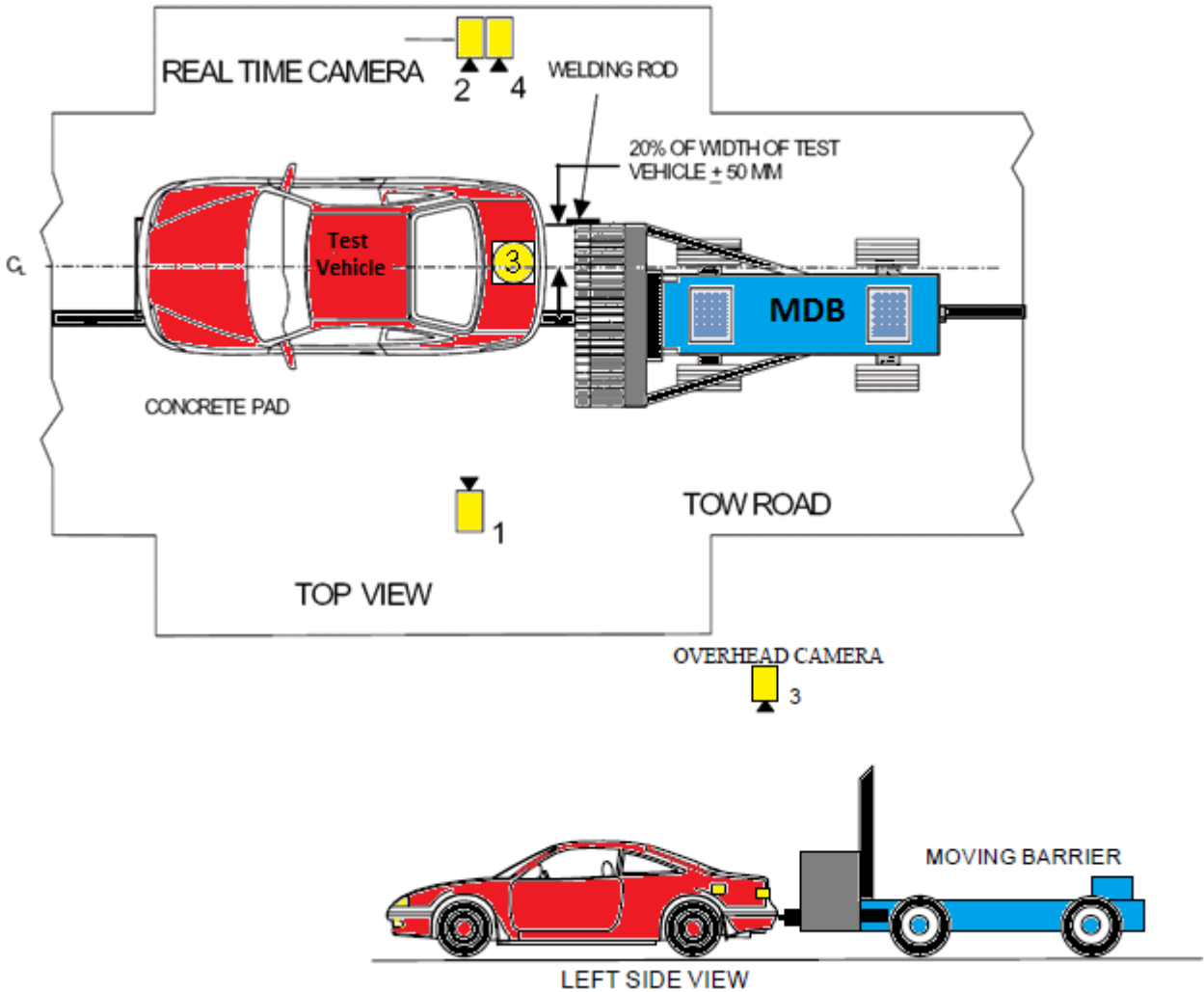
- The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion motor(s) activated) position.
- If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.
- The known resistance R<sub>o</sub> (in Ohms) should be approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant

**COMMENTS:** None

**DATA SHEET NO. 5**  
**HIGH SPEED CAMERA LOCATIONS AND DATA SUMMARY**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012



No.	Camera View	Coordinates (mm)			Angle (Deg)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	1600	8165	925	-0.8	24	1000
2	Real-Time Camera						30
3	Overhead View	517	0	5287	90.0	20	1000
4	Right Side View	1220	8565	954	-1.3	24	1000

\* Reference (from point of impact); all measurements accurate to within  $\pm 6$  mm.  
 X = (Impact Point) + Forward  
 Y = (Impact Point) + To Right  
 Z = (Ground Level) + Down

**DATA SHEET NO. 6  
POST-TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

VIN: 1G4GA5ER8CF204123

REQUIRED IMPACT VELOCITY RANGE: 78.5 to 80.1 km/h

**ACTUAL IMPACT VELOCITY (WITHIN 1.5 M OF IMPACT PLANE)**

Measurement Description	Units	Speed
Trap No. 1	km/h	79.48
Trap No. 2	km/h	79.46
Average Impact Speed	km/h	79.47

**WELDING ROD IMPACT POINT**

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	6
Horizontal distance from target center (+ is right)	±50 mm	mm	6

**STODDARD SOLVENT SPILLAGE MEASUREMENT:**

- A. From impact until vehicle motion ceases:  
 (Maximum allowable is 28 grams) 0 grams
- B. For the 5-minute period after motion ceases:  
 (Maximum allowable is 28 grams) 0 grams
- C. For the next 25 minutes:  
 (Maximum allowable is 28 grams/minute) 0 grams
- D. Spillage Details: No Spillage Occurred

**DATA SHEET NO. 6  
POST-TEST DATA (Continued)**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**DOOR OPENING AND SEAT TRACK INFORMATION**

Description	Driver	Passenger
Locked/Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Closed & Operational	Closed & Operational
Rear Door Opening	Closed & Operational	Closed & Operational
Seat Track Shift (mm)	0	0
Seat Back Failure	Reclined Backwards	Reclined Backwards
Glazing Damage	None	None

**POST TEST STRUCTURAL OBSERVATIONS**

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	Rear windshield shattered

**VEHICLE CRUSH MEASUREMENTS: LENGTH**

Measurement	Left Side	Centerline	Right Side
Pre-Test	4809	5000	4809
Post-Test	4614	4501	4384
Crush	195	499	425

**VEHICLE CRUSH MEASUREMENTS: WHEELBASE**

Measurement	Left Side	Centerline	Right Side
Pre-Test	2836		2838
Post-Test	2837		2841
Crush	1		3

**DATA SHEET NO. 7**  
**POST-IMPACT ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**VOLTMETER INFORMATION**

Measured Parameter	Units	Value
Make & Model		Fluke 87
Serial No.		65280327
Internal Impedance Value	MΩ	10
Nominal Propulsion Battery Voltage (V <sub>b</sub> )	V	114.700

**NOTES:**

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 M Ω
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**ELECTRICAL ISOLATION MEASUREMENTS & IMPACT CALCULATIONS**

Parameter	Value	Units		Value		Value	
V <sub>1</sub> =	30.980	V	Impact Time:	3	Minutes	55	Seconds
V <sub>2</sub> =	62.400	V	Impact Time:	4	Minutes	5	Seconds
R <sub>0</sub> =	49,900	Ω	Impact Time:		Minutes		Seconds
V <sub>1</sub> ' =	0.639	V	Impact Time:	4	Minutes	33	Seconds
V <sub>2</sub> ' =	1.719	V	Impact Time:	4	Minutes	42	Seconds
R <sub>i1</sub> =	7,141,707	Ω	Impact Time:	4	Minutes	33	Seconds
R <sub>i2</sub> =	2,636,008	Ω	Impact Time:	4	Minutes	42	Seconds
R <sub>i</sub> =	2,636,008	Ω	Impact Time:	4	Minutes	42	Seconds
R <sub>i</sub> /V <sub>b</sub> =	22,982	Ω/V	Impact Time:	4	Minutes	42	Seconds

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)?  X Yes  No (Fail)

**NOTES:**

- $R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$ ,  $R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$ ,  $R_i =$  Lesser value of  $R_{i1}$  and  $R_{i2}$
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant
- Minimum Electrical Isolation Value is 500 Ω/V

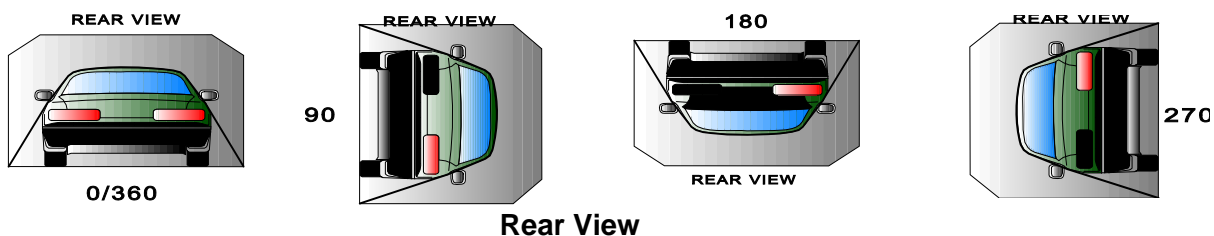
**PROPULSION BATTERY SYSTEM COMPONENTS**

Measured Parameter	Comments	Passed	Failed
Propulsion Battery Module movement within the passenger compartment	No Movement	X	
Intrusion of an outside Propulsion Battery Component into the passenger compartment	No Intrusion	X	
Is propulsion battery electrolyte spillage visible in the passenger compartment?		X	

**DATA SHEET NO. 8  
FMVSS NO. 301 STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012



**ROLLOVER SOLVENT COLLECTION TIME TABLE**

Test Phase	Rotation Time (spec. 1 -3 min)		Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds		Minutes	Seconds	
0° to 90°	1	12	5	6	12	7
90° to 180°	1	7	5	6	7	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	6	5	6	6	7

**FMVSS 301 REQUIREMENTS TABLE (Maximum allowable solvent spillage)**

First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
142	28	28	28

**ACTUAL TEST VEHICLE STODDARD SOLVENT SPILLAGE TABLE**

Test Phase	First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

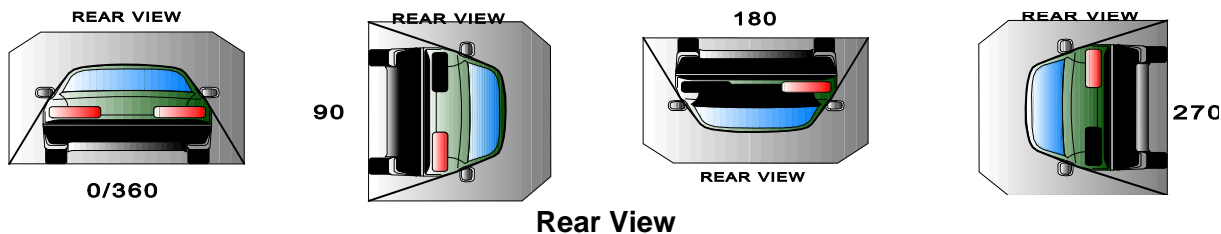
**ROLLOVER STODDARD SOLVENT SPILLAGE LOCATION TABLE**

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

**DATA SHEET NO. 9  
FMVSS NO. 305 STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012



**DETERMINATION OF PROPULSION BATTERY ELECTROLYTE COLLECTION  
TIME PERIOD**

Rollover Stage	Rotation Time (spec. 1 -3 min)		FMVSS 301 Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds		Minutes	Seconds	
0° to 90°	1	12	5	6	12	7
90° to 180°	1	7	5	6	7	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	6	5	6	6	7

**ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE**

Rollover Stage	Propulsion Battery Electrolyte Spillage	Units	Spillage Location
0° to 90°	0	Liters	
90° to 180°	0	Liters	
180° to 270°	0	Liters	
270° to 360°	0	Liters	
<b>Total Spillage</b>	<b>0</b>	<b>Liters</b>	

\* FMVSS 305 Requirements: Maximum allowable propulsion battery electrolyte spillage is 5.0 Liters

Is the total spillage of propulsion battery electrolyte greater than 5.0 Liters?  Yes (Fail)  No  
 Is propulsion battery electrolyte spillage visible in the passenger compartment?  Yes (Fail)  No

**VOLTMETER INFORMATION**

Measured Parameter	Units	Value
Make & Model		Fluke 87
Serial No.		65280327
Internal Impedance Value	MΩ	10
Nominal Propulsion Battery Voltage (V <sub>b</sub> )	V	114.600

**NOTES:**

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**DATA SHEET NO. 9 (Continued)**  
**FMVSS NO. 305 STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

**ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

Parameter	Rollover Stage	Value	Units		Minutes	Seconds
$V_1 =$	90°	30.960	V	Time:	2	12
	180°	30.960	V		8	19
	270°	30.960	V		14	22
	360°	30.960	V		20	26
$V_2 =$	90°	62.300	V	Time:	2	23
	180°	62.300	V		8	25
	270°	62.300	V		14	31
	360°	62.300	V		20	35
$V_1' =$	90°	0.639	V	Time:	2	28
	180°	0.639	V		8	33
	270°	0.638	V		14	36
	360°	0.638	V		20	42
$V_2' =$	90°	1.717	V	Time:	2	33
	180°	1.717	V		8	42
	270°	1.717	V		14	42
	360°	1.717	V		20	48
$R_{i1} =$	90°	7,132,432	$\Omega$	Time:	2	28
	180°	7,132,432	$\Omega$		8	33
	270°	7,143,847	$\Omega$		14	36
	360°	7,143,847	$\Omega$		20	42
$R_{i2} =$	90°	2,635,654	$\Omega$	Time:	2	33
	180°	2,635,654	$\Omega$		8	42
	270°	2,635,654	$\Omega$		14	42
	360°	2,635,654	$\Omega$		20	48
$R_i =$	90°	2,635,654	$\Omega$	Time:	2	33
	180°	2,635,654	$\Omega$		8	42
	270°	2,635,654	$\Omega$		14	42
	360°	2,635,654	$\Omega$		20	48
$R_i/V_b =$	90°	22,998.7	$\Omega/V$	Time:	2	33
	180°	22,998.7	$\Omega/V$		8	42
	270°	22,998.7	$\Omega/V$		14	42
	360°	22,998.7	$\Omega/V$		20	48

Is the Electrical Isolation Value  $\geq 500 \Omega/V$  (Yes/No)?  Yes  No (Fail)

**DATA SHEET NO. 9 (Continued)**  
**FMVSS NO. 305 STATIC ROLLOVER TEST DATA**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
Test Program: FMVSS 301R/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
Test Date: 8/7/2012

**NOTES:**

- $R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$ ,  $R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$ ,  $R_i =$  Lesser value of  $R_{i1}$  and  $R_{i2}$ ,  
 $R_i/V_b =$  Electrical Isolation Value/ Nominal Battery Voltage
  
- $V_1$ ,  $V_2$ ,  $V_1'$ , &  $V_2'$  voltage measurements were recorded at the start of each successive increment of **90°**, **180°**, **270°**, and **360°** of the static rollover test. The increment of rotation for each turn was completed within a maximum of 3 minutes.
  
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant
  
- Minimum Electrical Isolation Value is 500  $\Omega/V$

**COMMENTS:** None  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**DATA SHEET NO. 10**  
**PHOTOGRAPH DATA SHEET CHECKLIST**

Test Vehicle: 2012 Buick Lacrosse Four Door Sedan  
 Test Program: FMVSS 301/305 Compliance Rear Impact Test

NHTSA No.: CC0104  
 Test Date: 8/7/2012

Pre-Test	Post-Test	Photograph	
X	X	A.	View of the propulsion battery if any part of it is visible. Do NOT disassemble any parts other than carpet, seats and overlay to take these photographs.
X	X	B.	View of the electric propulsion drive. Take the best photograph possible without removing any parts.
X	X	C.	View of the vehicle passenger compartment adjacent to propulsion battery.
	X	D.	Post-test battery module movement, or retention loss, if applicable.
	X	E.	Post-test battery component intrusion.
	X	F.	Post-test view of test vehicle while vehicle is on static rollover machine.
X	X	G.	Photographs of propulsion battery system mounting and/or intrusion failures.
	X	H.	Post-test propulsion battery electrolyte spillage location view.
X	X	I.	Labels and markings related to propulsion battery system.
X	X	J.	Other photographs requested by COTR.

**COMMENTS:** None  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**APPENDIX A**  
**PHOTOGRAPHS**

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Figure A-1: Vehicle Certification Placard



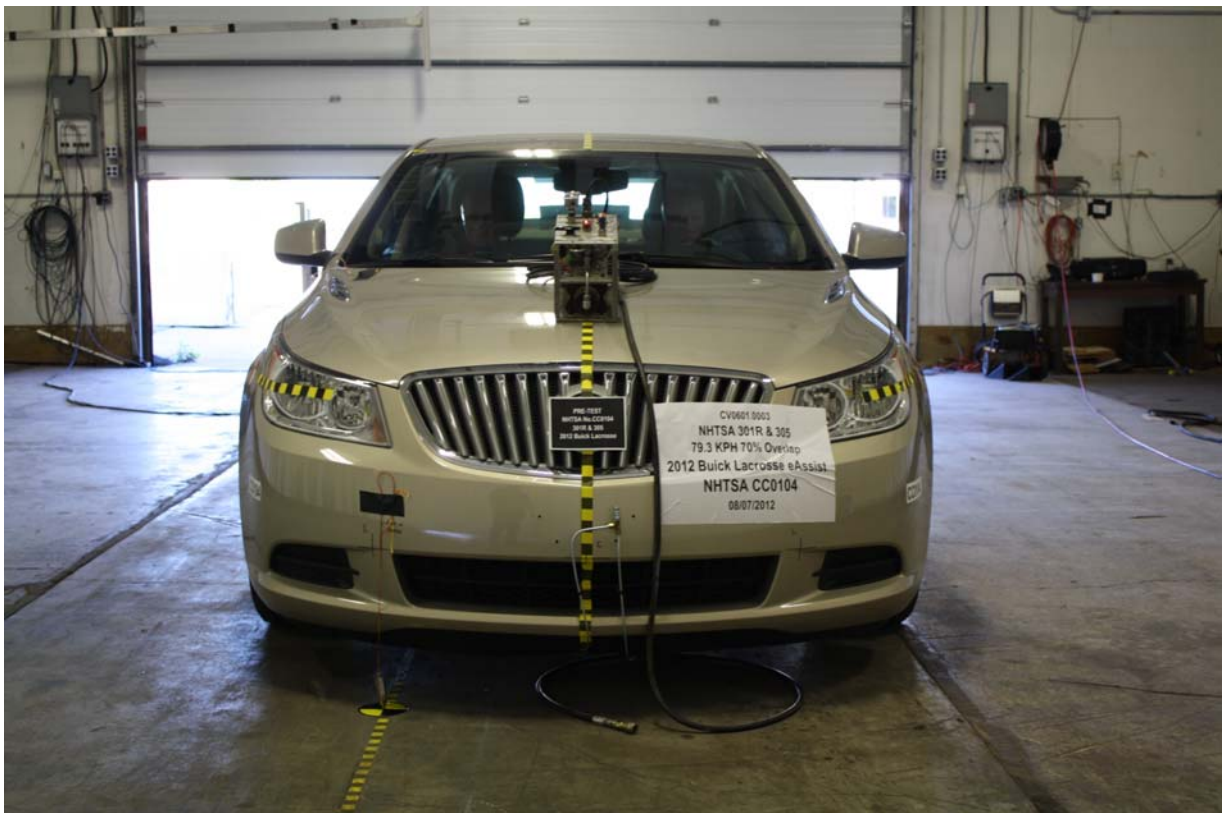
Figure A-2: Vehicle Tire Placard



**Figure A-3: As Delivered Left Front  $\frac{3}{4}$  View**



**Figure A-4: As Delivered Right Rear  $\frac{3}{4}$  View**



**Figure A-5: Pre-Test Front View**



**Figure A-6: Post-Test Front View**



**Figure A-7: Pre-Test Left Side View**



**Figure A-8: Post-Test Left Side View**



**Figure A-9: Pre-Test Right Side View**



**Figure A-10: Post-Test Right Side View**



**Figure A-11: Pre-Test Left Front 3/4 View**



**Figure A-12: Post-Test Left Front 3/4 View**



**Figure A-13: Pre-Test Right Front 3/4 View**



**Figure A-14: Post-Test Right Front 3/4 View**



**Figure A-15: Pre-Test Left Rear 3/4 View**



**Figure A-16: Post-Test Left Rear 3/4 View**



**Figure A-17: Pre-Test Right Rear 3/4 View**



**Figure A-18: Post-Test Right Rear 3/4 View**



**Figure A-19: Pre-Test Rear View**



**Figure A-20: Post-Test Rear View**



**Figure A-21: Pre-Test MDB Front View**



**Figure A-22: Post-Test MDB Front View**



Figure A-23: Pre-Test MDB Left Side View



Figure A-24: Post-Test MDB Left Side View



**Figure A-25: Pre-Test MDB Right Side View**



**Figure A-26: Post-Test MDB Right Side View**



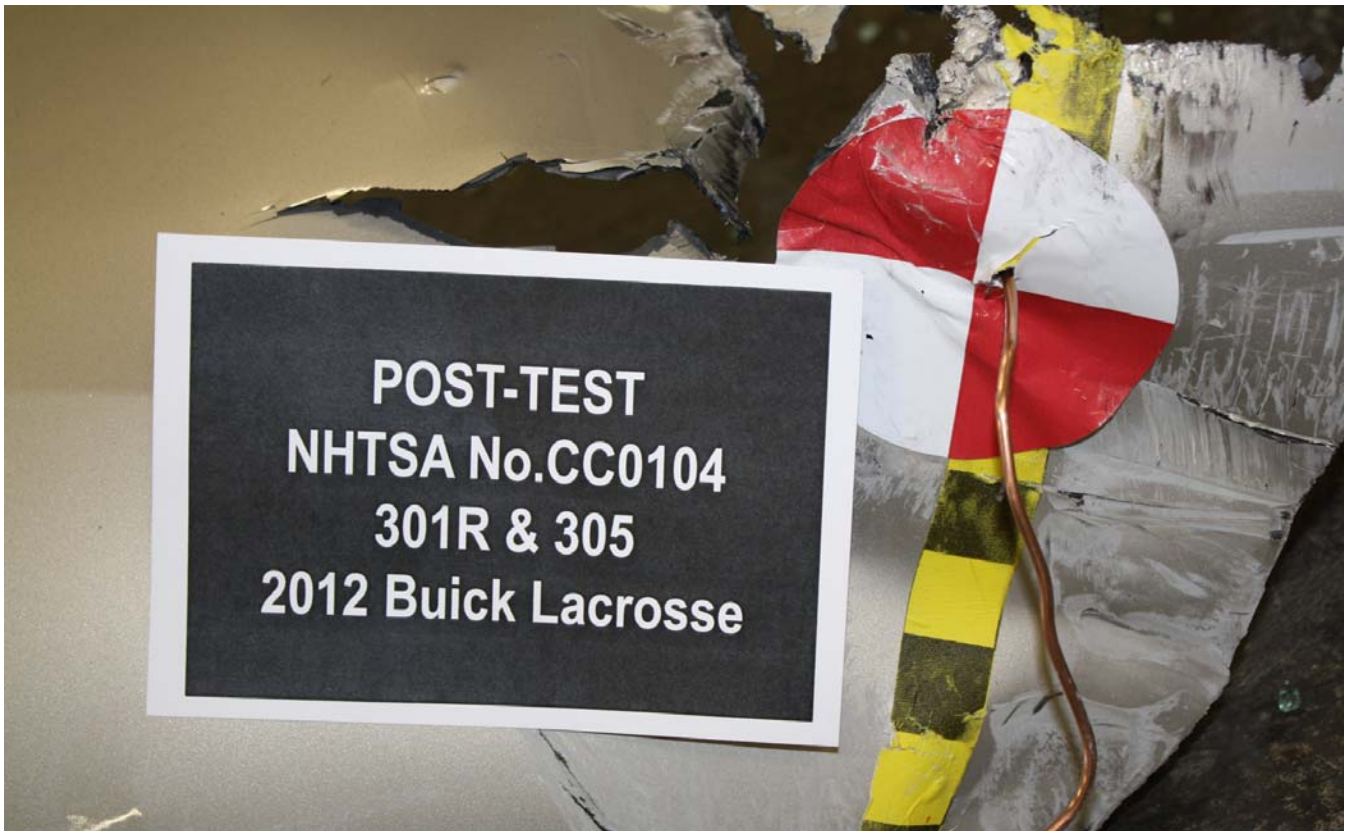
Figure A-27: Pre-Test MDB Top View



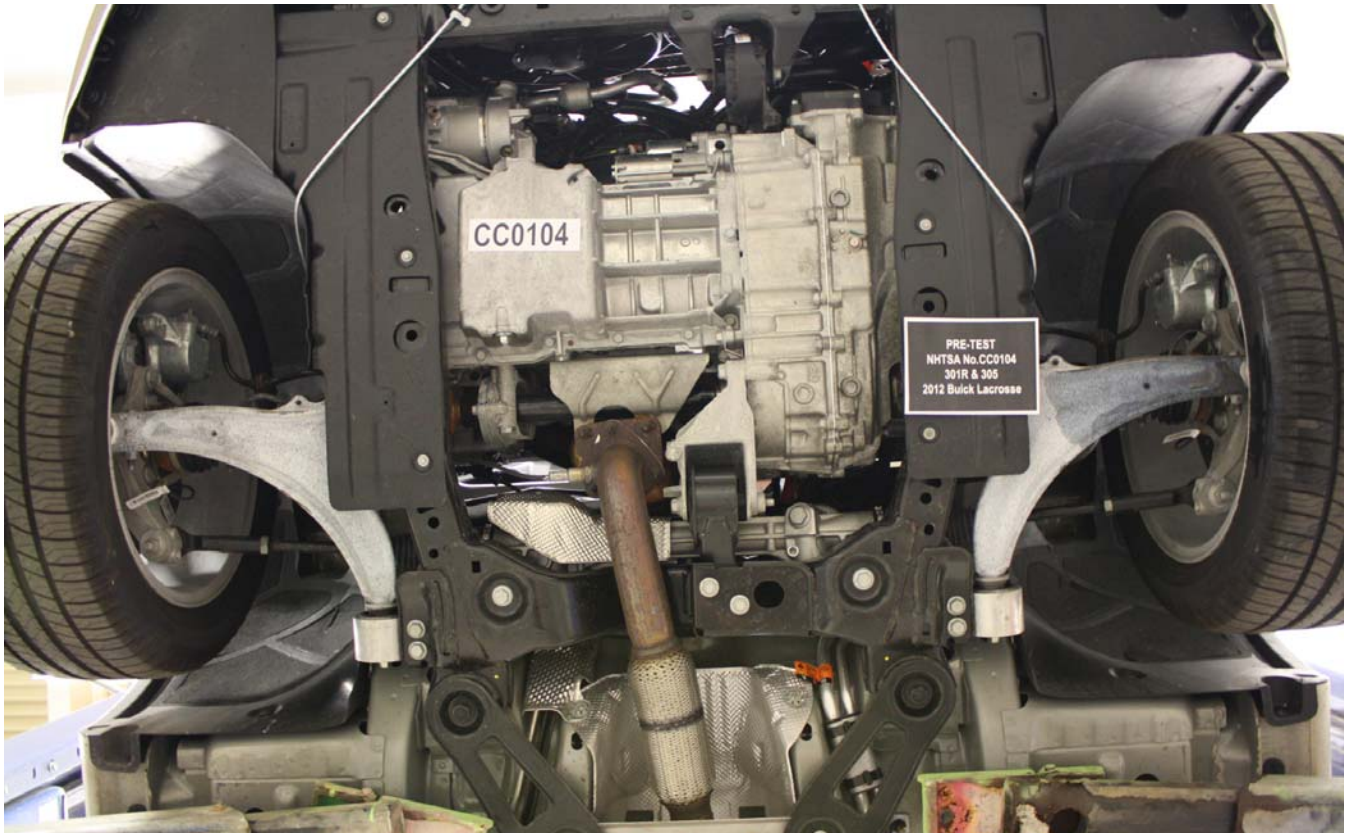
Figure A-28: Post-Test MDB Top View



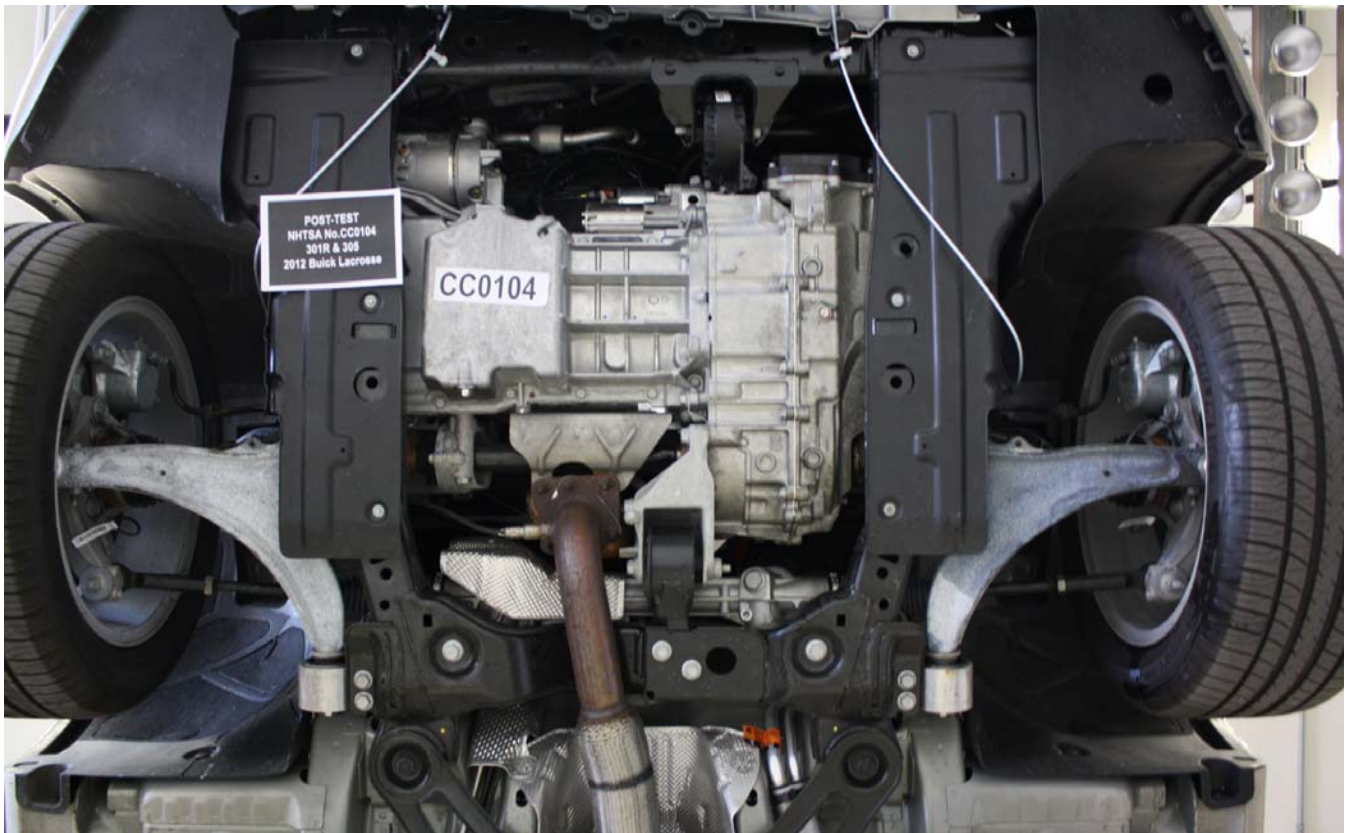
**Figure A-29: Pre-Test Overhead Vehicle and MDB View**



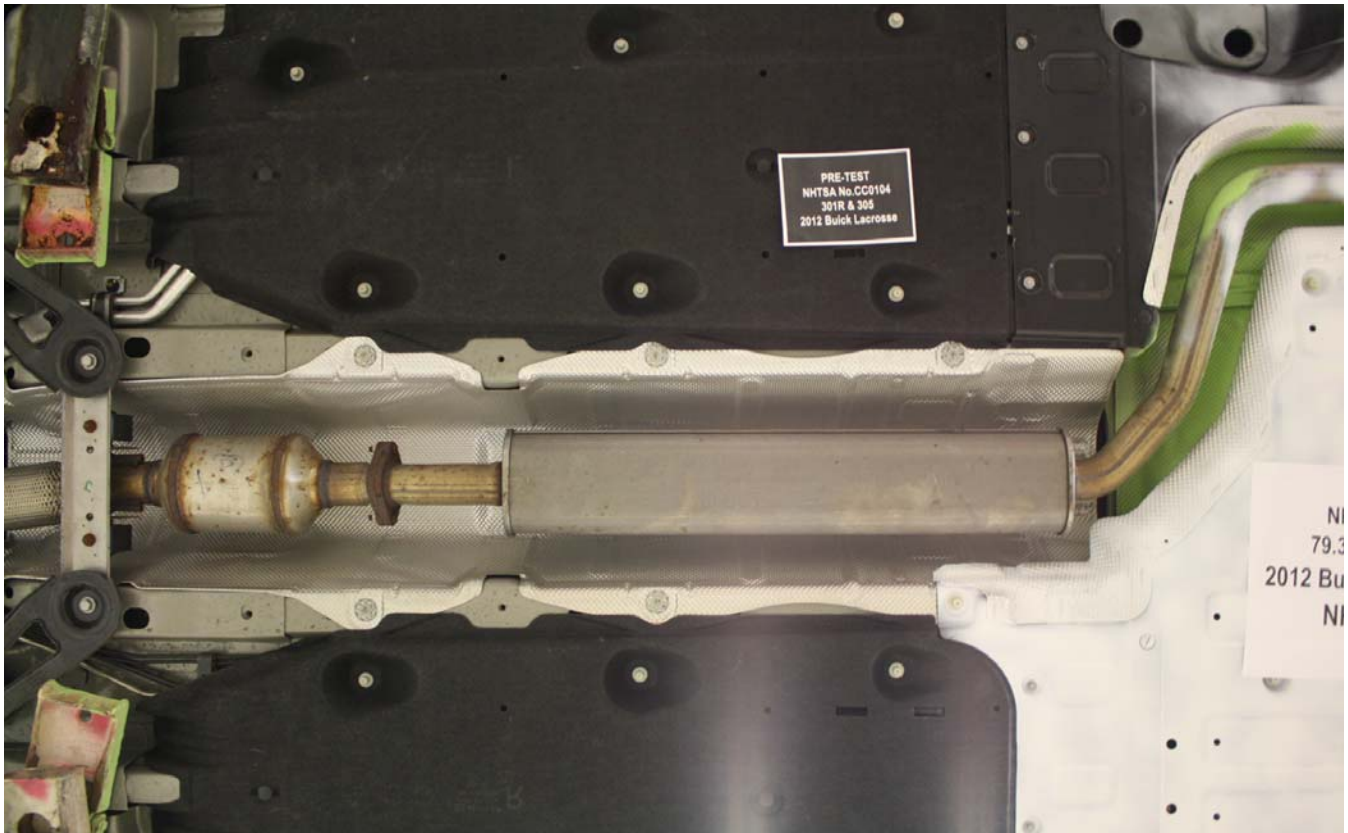
**Figure A-30: Post-Test Impact Target View**



**Figure A-31: Pre-Test Front Underbody View**



**Figure A-32: Post-Test Front Underbody View**



**Figure A-33: Pre-Test Mid Underbody View**



**Figure A-34: Post-Test Mid Underbody View**

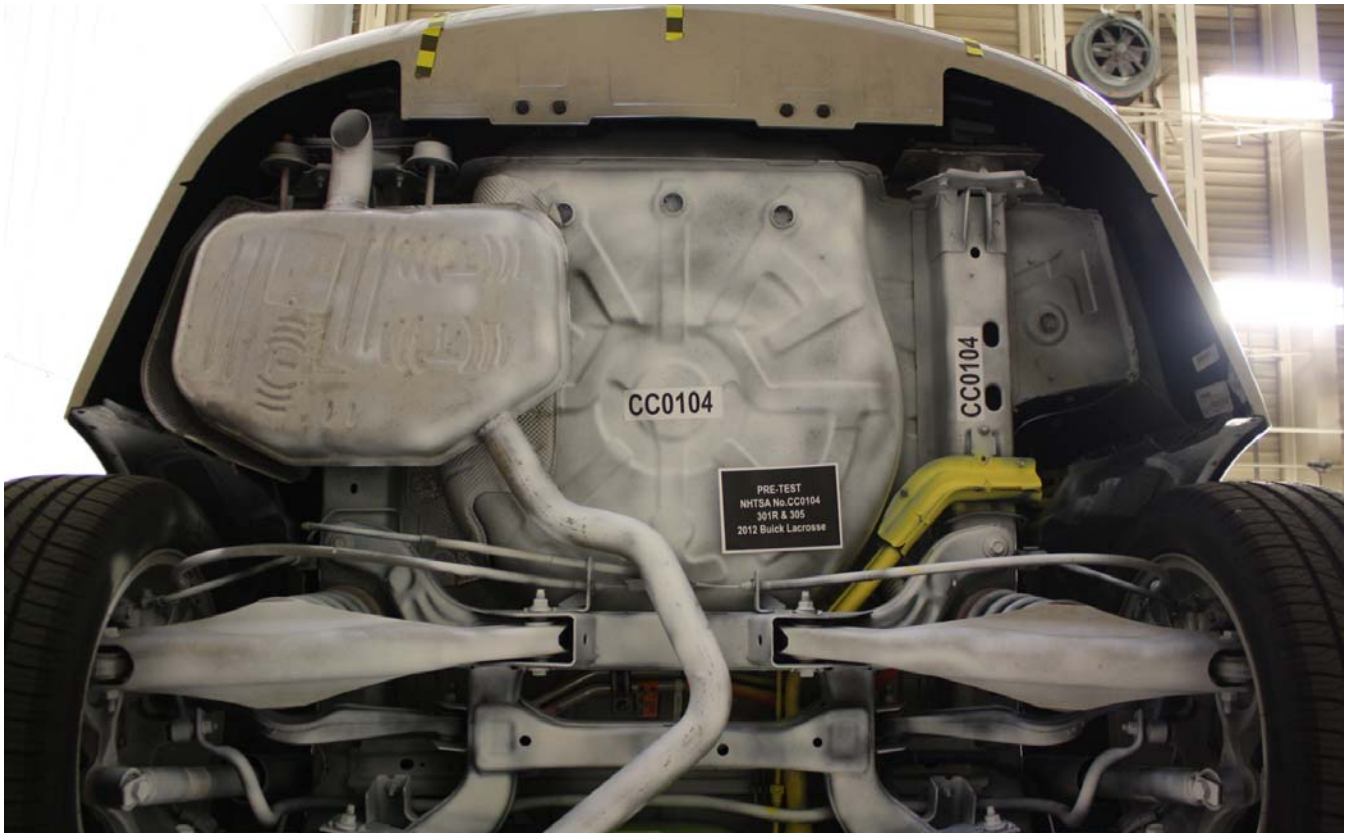


Figure A-35: Pre-Test Rear Underbody View

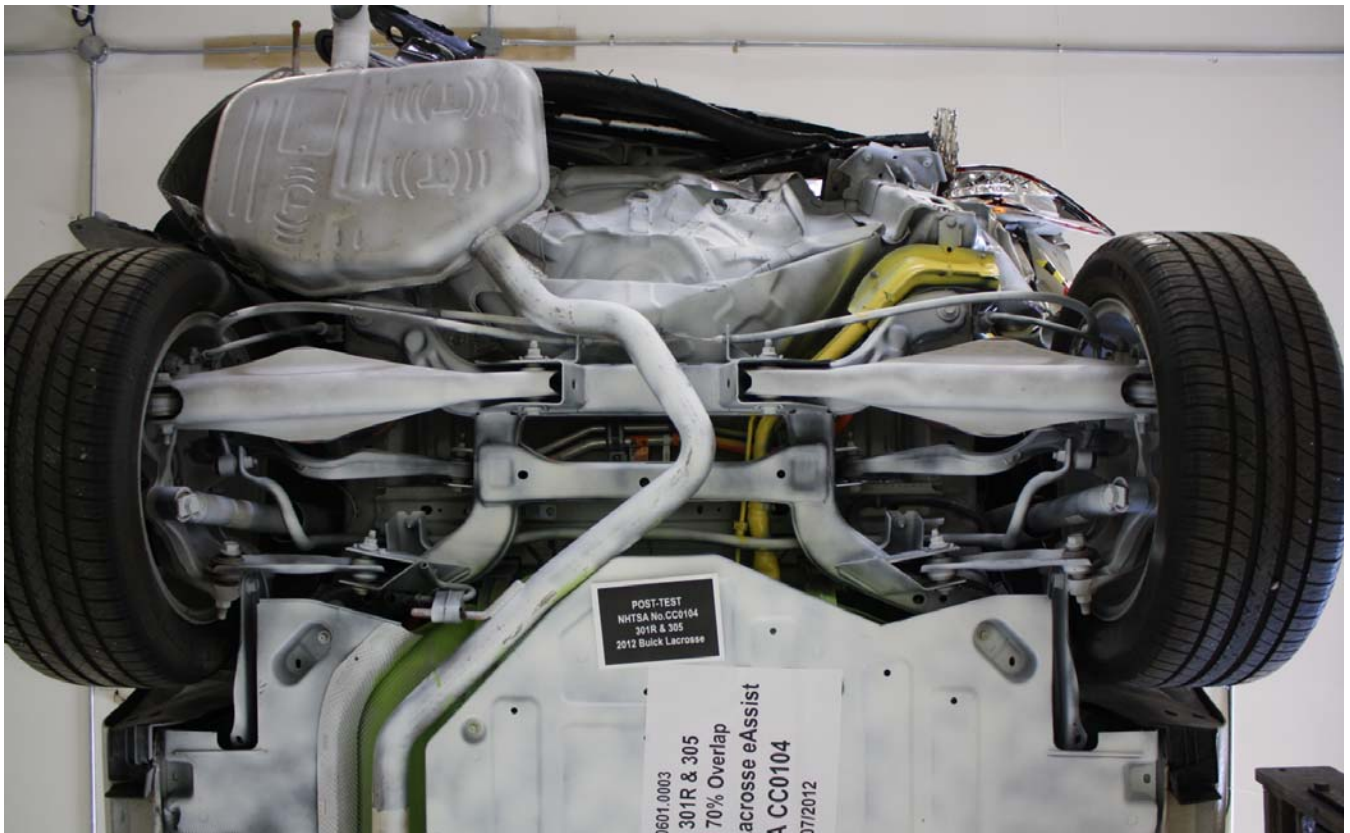


Figure A-36: Post-Test Rear Underbody View



Figure A-37: Pre-Test Fuel Filler Cap View



Figure A-38: Post-Test Fuel Filler Cap View



Figure A-39: Impact View



Figure A-40: Speed Trap View



Figure A-41: Auxiliary Power Module Warning Label



Figure A-42: Power Inverter Warning Label



Figure A-43: First Responder Warning Label

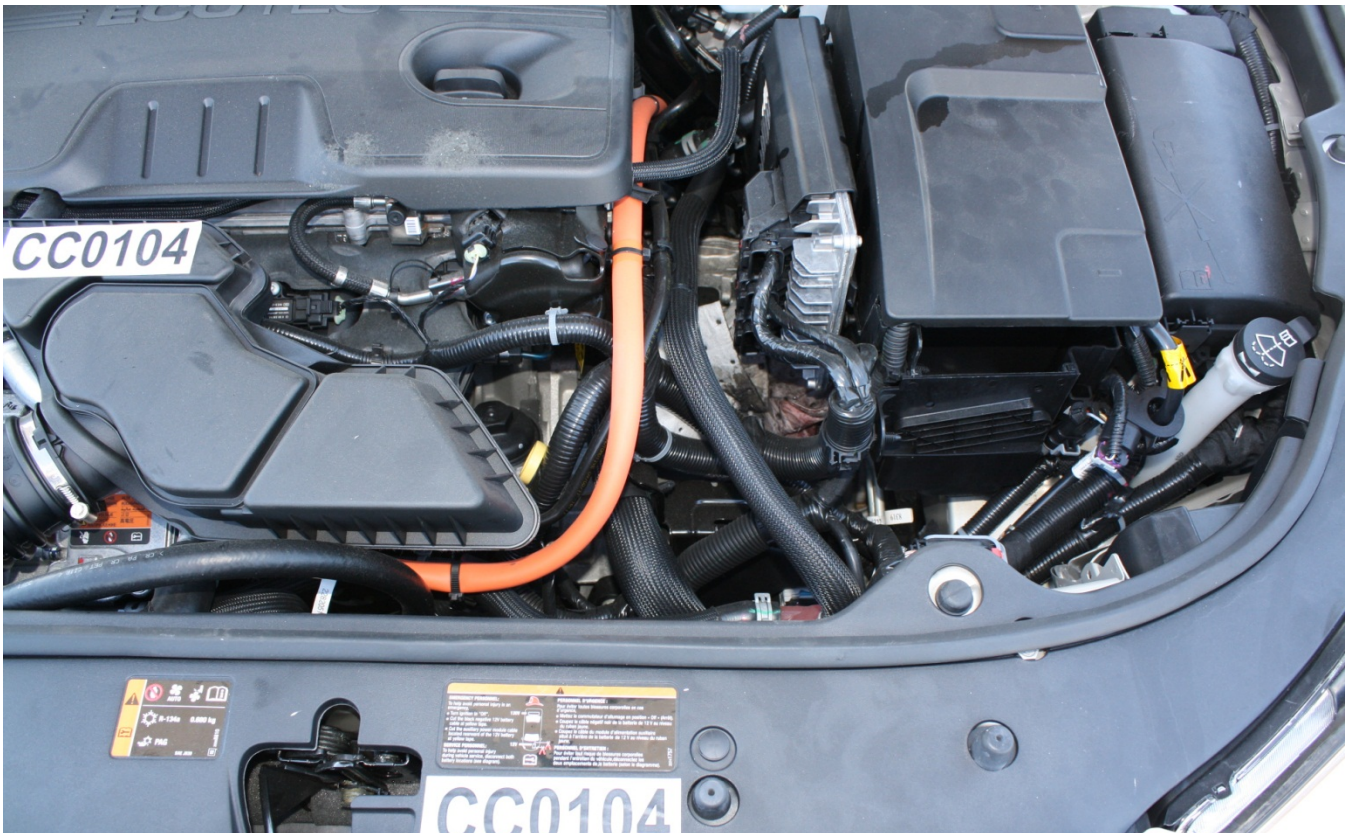


Figure A-44: First Responder Warning Label Location



Figure A-45: Other Vehicle Label(s) Related to Electrical Propulsion System



Figure A-46: Manual High Voltage Service Disconnect in Place



**Figure A-47: Manual High Voltage Service Disconnect Removed (Plug)**



**Figure A-48: Manual High Voltage Service Disconnect Removed (Location where removed)**



**Figure A-49: Pre-Impact View of Propulsion Battery**



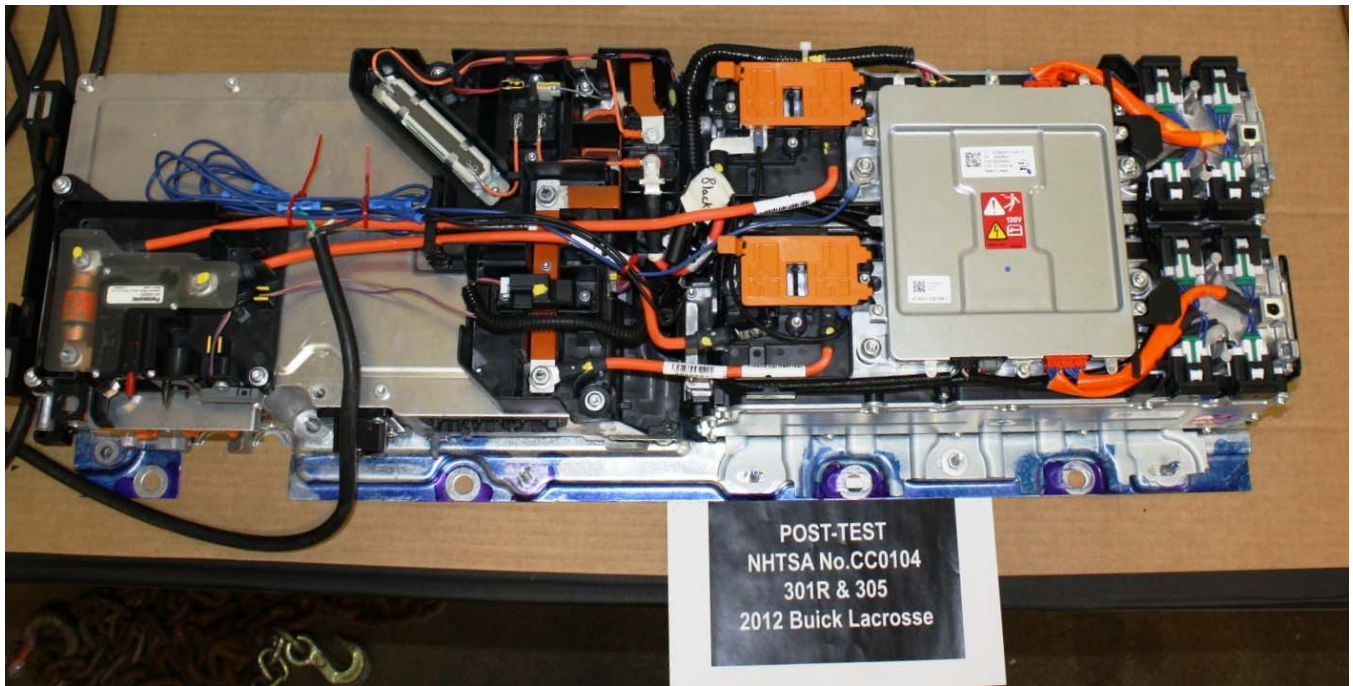
**Figure A-50: Post-Impact Front View of Propulsion Battery**



Figure A-51: Post-Impact Rear View of Propulsion Battery (if any part of it is visible)



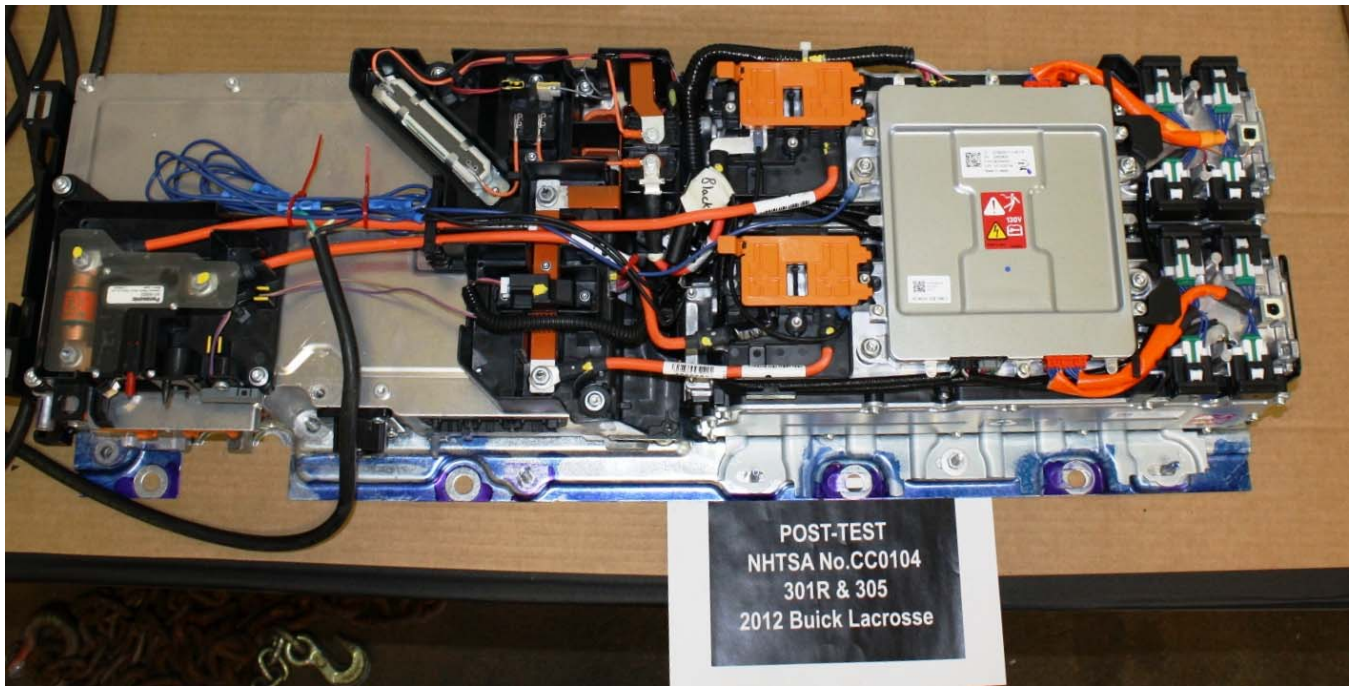
Figure A-52: Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules



**Figure A-53: Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules**



**Figure A-54: Pre-Impact View of Propulsion Battery Module(s)**



**Figure A-55: Post-Impact View of Propulsion Battery Module(s)**



**Figure A-56: Pre-Impact View of Electric Propulsion Drive**



**Figure A-57: Post-Impact View of Electric Propulsion Drive**



**Figure A-58: Pre-Impact View of High Voltage Interconnect(s)**



Figure A-59: Pre-Impact View Propulsion Battery Venting System(s)

# Photo Not Applicable

Figure A-60: Pre-Impact View of Other Visible Electric Propulsion Components



Figure A-61: Pre-Impact View of Ground Lead Attached

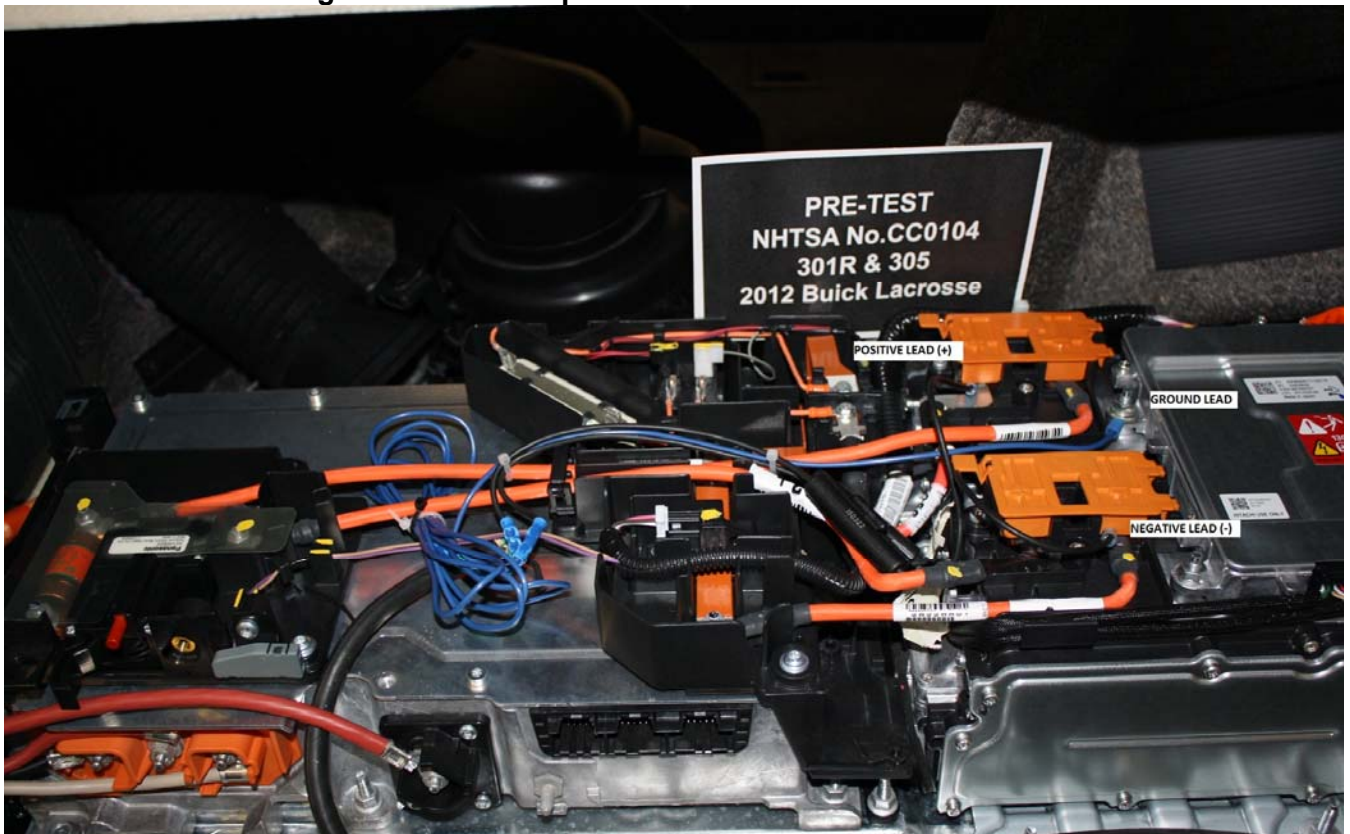


Figure A-62: Pre-Impact View of High Voltage Leads Attached



Figure A-63: Pre-Impact Close-Up View of High Voltage Leads Attached



Figure A-64: Pre-Impact View of Installed Test Interface Port



Figure A-65: Post-Impact View of Installed Test Interface Port

# Photo Not Applicable

Figure A-66: Pre-Impact View of Other Test Devices

# Photo Not Applicable

Figure A-67: Post-Impact View of Other Test Devices



Figure A-68: FMVSS No. 301 Static Rollover 90° View



**Figure A-69: FMVSS No. 301 Static Rollover 180° View**



**Figure A-70: FMVSS No. 301 Static Rollover 270° View**



**Figure A-71: FMVSS No. 301 Static Rollover 360° View**



**Figure A-72: FMVSS No. 305 Static Rollover at 90° Highlighting Propulsion Battery Location**



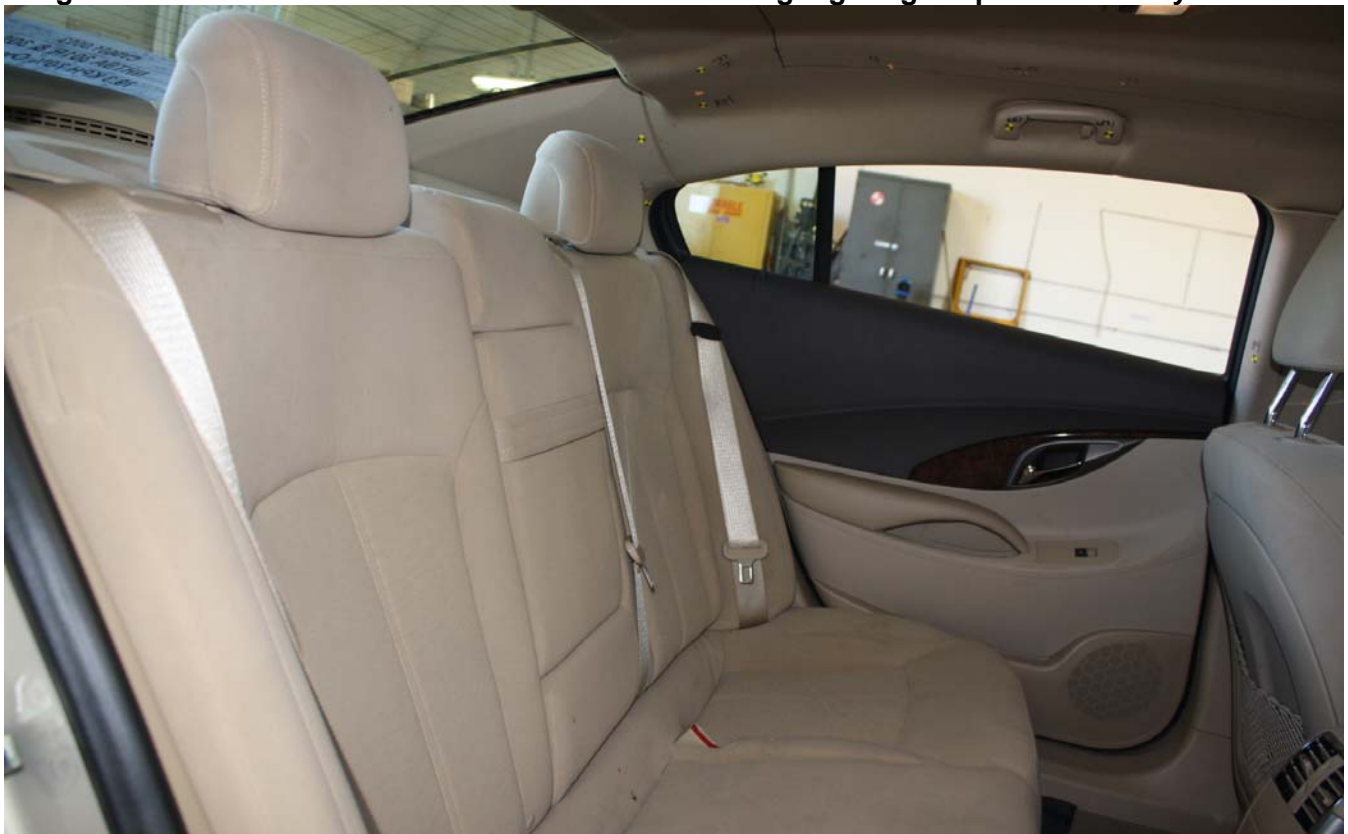
**Figure A-73: FMVSS No. 305 Static Rollover at 180° Highlighting Propulsion Battery Location**



**Figure A-74: FMVSS No. 305 Static Rollover at 270° Highlighting Propulsion Battery Location**



**Figure A-75: FMVSS No. 305 Static Rollover at 360° Highlighting Propulsion Battery Location**



**Figure A-76: Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery**



**Figure A-77: Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery**

**Photo Not Applicable**

**Figure A-78: Post-Impact Propulsion Battery System Mounting and/or Intrusion Failure(s)**

# Photo Not Applicable

Figure A-79: Post-Impact View of Battery Component Intrusion (if applicable)

# Photo Not Applicable

Figure A-80: Post-Impact View of Battery Module Movement or Retention Loss (if applicable)

# Photo Not Applicable

Figure A-81: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (if applicable)

# Photo Not Applicable

Figure A-82: Post-Test View of Propulsion Battery Electrolyte Spillage Location (if applicable)