REPORT NUMBER: 301R/305-CAL-12-004

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 Chevrolet Volt
Four Door Sedan

NHTSA No: CC0108

PREPARED BY:
CALSPAN CORPORATION
TRANSPORTATION TEST OPERATIONS
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BUFFALO, NEW YORK 14225

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

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-11-D-00243.

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Acceptance Date:

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 301R/305-CAL-12-004	***2. Government Accession No.***	***3. Recipient's Catalog No.***
4. Title and Subtitle Final Report of FMVSS 301R/305 Compliance Testing of a 2012 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108		***5. Report Date*** October 8, 2012 **6. Performing Organization Code** CAL
7. Author(s) Vanessa Walsh, Test Engineer David J. Travale, Technical Director		***8. Performing Organization Report No.*** CAL-DOT-2012-004
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		***10. Work Unit No.*** ***11. Contract or Grant No.*** DTNH22-11-D-00243
12. Sponsoring Agency Name and Address 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		***13. Type of Report and Period Covered*** Final Test Report August 8, 2012 - October 8, 2012 ***14. Sponsoring Agency Code*** NVS-220

15. Supplementary Notes

16. Abstract

Compliance tests were conducted on the subject 2012 Chevrolet Volt 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.

No test failures were reported.

17. Key Words Compliance Testing Safety Engineering FMVSS 301R/305	***18. Distribution Statement*** Copies of this report are available from: 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

19. Security Classification of Report UNCLASSIFIED	***20. Security Classification of Page*** UNCLASSIFIED	***21. No. of Pages*** 68	***22. Price***

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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 Chevrolet Volt 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 1923.5 kg 2012 Chevrolet Volt Four Door Sedan was impacted by a 1357.0 kg moving barrier at a velocity of 78.97 kph (49.07 mph). The test was performed by Calspan Corporation on 8/8/2012.

The test vehicle was equipped with a 9.3 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (45.0kg) 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 473 millimeters of which the average was 71 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

Based on the test results, the 2012 Chevrolet Volt Four Door Sedan meets 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:

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

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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 Chevrolet Volt Four Door Sedan
Test Program: FMVSS 301R/305 Compliance Rear Impact Test
NHTSA No.: CC0108
Test Date: 8/8/2012

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	CC0108
Model Year	2012
Make	Chevrolet
Model	Volt
Body Style	Four Door Sedan
Body Color	Dark blue
Odometer Reading (km/mi)	37 / 59.5
Engine Displacement (L)	1.4
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	1-speed Direct Drive
Final Drive	Front Wheel Drive

Overdrive	No
Air Conditioning (AC)	Yes
All-Wheel Drive (AWD)	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADL)	Yes
Power Brakes	Yes
Power Seats	No
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	1G1RA6E45CU108266

GVWR (kg)	2053
GAWR Front (kg)	1136
GAWR Rear (kg)	917

TIRE PLACARD & SIDEWALL INFORMATION

Tire Placard Location: Driver's Door Sill
Spare Tire Type: None

Measured Parameter	Front	Rear
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Assurance	Assurance
Tire Type	All season	All season
Max. Tire Pressure (kPa)	350	350
Recommended Tire Size	P215/55R17	P215/55R17
Load Index/Speed Symbol	94V	94V
Recommended Cold Tire Pressure (kPa)	260	260
Tire Size on Vehicle	P215/55R17	P215/55R17
Treadwear/ Traction Grade/ Temperature Grade	580/A/A	580/A/A

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	2	0	4
Seat Type (Bench, Bucket, or Split Bench)	Bucket	Bucket	--	
Capacity Weight (VCW) (kg)				340.00
DSC X 68.04 (kg)				272.16
Cargo Weight (RCLW) (kg)				67.84

DATA SHEET NO. 1 (Continued)
TEST VEHICLE SPECIFICATIONS

Test Vehicle:	2012 Chevrolet Volt Four Door Sedan	NHTSA No.:	CC0108
Test Program:	FMVSS 301R/305 Compliance Rear Impact Test	Test Date:	8/8/2012

ELECTRIC VEHICLE PROPULSION SYSTEM

Measured Parameter	Value
Type of Electric Vehicle (Electric/Gas-Electric Hybrid/Fuel Cell-Electric Hybrid)	Gas -electric Hybrid
Propulsion Battery Type	Lithium Ion
Nominal Voltage (Volts)	370
Is this Vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of Automatic Propulsion Battery Disconnect, if applicable	Beneath center console
Auxiliary Battery Type	12V AGIM

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED)

Measured Parameter	Value
Electrolyte Fluid Type	1 molar concetration of lithium salt
Electrolyte Fluid Specific Gravity	1.15 g/ml
Electrolyte Fluid Kinematic Viscosity (centistokes)	Liquid
Electrolyte Fluid Color	Clear, pale yellow, semi-sweet smelling solution
Propulsion Battery Coolant Type, Color and Specific Gravity (if applicable)	Dex-Cool (Orange)
Location of Battery Modules (Inside or Outside of Passenger Compartment?)	Outside

PROPULSION BATTERY STATE OF CHARGE

Measured Parameter	Units	Value
For all battery types: Voltage Range corresponding to **useable energy** of the battery:		
Minimum State of Charge	V	0.000
Maximum State of Charge	V	390.000
95% of Maximum	V	370.500
Test Voltage *	V	388.500
For batteries that are rechargeable ONLY by an energy source on the vehicle: Voltage range corresponding to **useable energy** 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 Chevrolet Volt Four Door Sedan	NHTSA No.:	CC0108
Test Program:	FMVSS 301R/305 Compliance Rear Impact Test	Test Date:	8/8/2012

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	524.5	345.5		586.0	393.5	
Right	kg	521.0	316.0		579.0	365.0	
Ratio	%	61.2	38.8		60.6	39.4	
Totals	kg	1,045.5	661.5	1,707.0	1,165.0	758.5	1,923.5

TARGET TEST WEIGHT CALCULATION (TTW)

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1,707.0	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	67.8	(B)
Weight of two P572E ATDS @ 78kg each	kg	156.0	(C)
Target Vehicle Test Weight (TVTW)	kg	1,930.8	(A+B+C)

*As tested Weight = (TTW -10kg) <=ATW < (TTW -5kg); TTW = Weight of Test Vehicle with 2 dummies and 67.8kg of Cargo Weight

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Vehicle Wheelbase	mm	2690
Vehicle Length (at Centerline)	mm	4496
Vehicle Width	mm	1781
Weight of Ballast Secured in Cargo Area[1]	kg	45.0
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	1792
Vehicle Width at Widest Point Location		C-Pillar
Centerline offset for impact line	mm	358
Filler neck side (left/right)		Right

[1] 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	722	761	723	763	1042
As Tested (ATW)	mm	693	701	694	706	1061

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

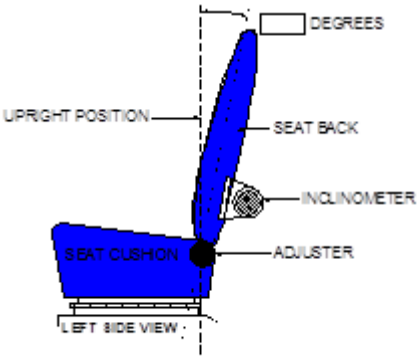
Test Vehicle: 2012 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test Test Date: 8/8/2012

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.



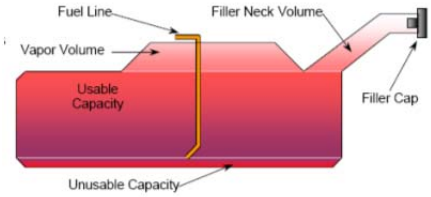
FRONT SEAT ASSEMBLY

Measured Parameter	Deg.
Driver Seat Back Angle	4.3
Passenger Seat Back Angle	4.0

SEAT FORE/AFT POSITIONING

Driver Seat: The driver's seat was positioned at the lowest position 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	318	159
Passenger Seat	310	155



VEHICLE FUEL TANK ASSEMBLY

FUEL TANK CAPACITY DATA

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	35.2
COTR Usable Capacity (Standard Tank)	Form No. 1	35.2
Test Volume Range	91-94% of Usable Capacity	32.0 – 33.1
Actual Test Volume (Solvent Used)	93% of Usable Capacity	32.6

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?	No

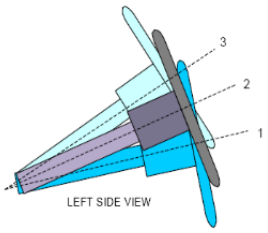
Fuel Pump Comments : Fuel pump will run when gasoline generater is commanded to start.

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

Test Vehicle: 2012 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test Test Date: 8/8/2012

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.



STEERING COLUMN ASSEMBLY

Operational Instructions: Steering wheel and column were adjusted and set to the center of the geometric locus at 27.5mm and 24 degrees

SEAT BELT UPPER ANCHORAGE

Nominal design riding position

Operational Instructions: Anchorages were set to most upright position.

MEASURED COLD TIRE PRESSURE @ TOTAL TEST WEIGHT

Measured Parameter	Units	Value
Left Front (LF)	kPa	260
Right Front (RF)	kPa	260
Left Rear (LR)	kPa	260
Right Rear (RR)	kPa	260

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

Measured Parameter	Value
Details of Vehicle Chassis Ground Points & Locations	Ground point is located under the battery shield and attaches onto the frame of the vehicle. All other leads were attached to the manufacturers supplied instrumentation wire harness at the APM on the underside of the vehicle at the front of the RESS.
Details of Propulsion Battery Components	

COMMENTS: None

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

Test Vehicle: 2012 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test Test Date: 8/8/2012

MDB Face Manufacturer: PLASCORE MDB Face Serial No. A1110018

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 Chevrolet Volt Four Door Sedan	NHTSA No.:	CC0108
Test Program:	FMVSS 301R/305 Compliance Rear Impact Test	Test Date:	8/8/2012

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 M Ω*
- *An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.*

PROPULSION BATTERY VOLTAGE, RESISTANCE &
ELECTRICAL ISOLATION MEASURMENTS & CALCULATIONS

Measured Parameter	Symbol	Units	Value
Normal operating voltage range specified by the manufacturer	V_b	V	370
Propulsion Battery Voltage : (ready to drive position)	V_b	V	388.500
Propulsion Battery to Vehicle Chassis	V_1	V	177.100
Propulsion Battery to Vehicle Chassis	V_2	V	178.800
Propulsion Battery to Vehicle Chassis Across Known Resistor	R_o	Ω	191900
Propulsion Battery to Vehicle Chassis with R_o installed	V_1'	V	35.290
Propulsion Battery to Vehicle Chassis with R_o installed	V_2'	V	33.750
$R_{i1}= R_o*(1+V_2/V_1)*[(V_1-V_1')/V_1']$	R_{i1}	Ω	1,549,671
$R_{i2}= R_o*(1+V_1/V_2)*[(V_2-V_2')/V_2']$	R_{i2}	Ω	1,641,646
Lesser value of R_{i1} and R_{i2}	R_i	Ω	1,549,671
Electrical Isolation Value (Minimum E.I. Value is 500 Ω/V)	R_i/V_b	Ω/V	3,989

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

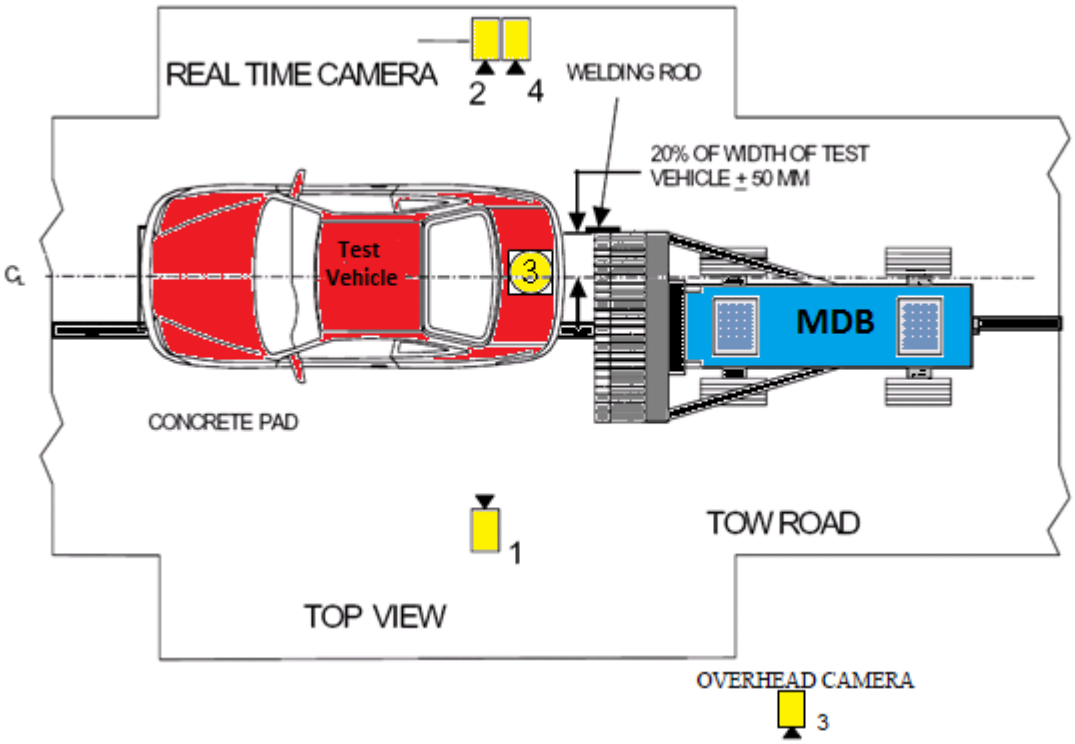
NOTES:

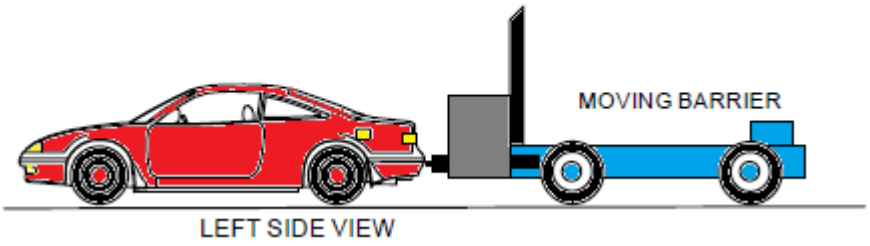
- *The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion motor(s) activated) position.*
- *If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.*
- *The known resistance Ro (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 Chevrolet Volt Four Door Sedan	NHTSA No.:	CC0108
Test Program:	FMVSS 301R/305 Compliance Rear Impact Test	Test Date:	8/8/2012





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 ±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 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test Test Date: 8/8/2012

VIN: 1G1RA6E45CU108266

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	78.97
Trap No. 2	km/h	78.95
Average Impact Speed	km/h	78.96

WELDING ROD IMPACT POINT

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	-16
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 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test Test Date: 8/8/2012

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	Slightly Reclined	Slightly Reclined
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 on impact

VEHICLE CRUSH MEASUREMENTS: LENGTH

Measurement	Left Side	Centerline	Right Side
Pre-Test	4355	4496	4357
Post-Test	4828	4135	4031
Crush	-473	361	326

VEHICLE CRUSH MEASUREMENTS: WHEELBASE

Measurement	Left Side	Centerline	Right Side
Pre-Test	2691		2689
Post-Test	2682		2695
Crush	9		-6

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

Test Vehicle:	2012 Chevrolet Volt Four Door Sedan	NHTSA No.:	CC0108
Test Program:	FMVSS 301R/305 Compliance Rear Impact Test	Test Date:	8/8/2012

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 87
Serial No.		65280327
Internal Impedance Value	MΩ	10
Nominal Propulsion Battery Voltage (V_b)	V	1.825

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 MEASURMENTS & IMPACT CALCULATIONS

Parameter	Value	Units		Value		Value	
V_1 =	0.819	V	Impact Time:	4	Minutes	15	Seconds
V_2 =	0.837	V	Impact Time:	4	Minutes	21	Seconds
$R_{o\,=}$	191,900	Ω	Impact Time:		Minutes		Seconds
V_1' =	0.125	V	Impact Time:	4	Minutes	37	Seconds
V_2' =	0.128	V	Impact Time:	4	Minutes	48	Seconds
R_{i1} =	2,154,274	Ω	Impact Time:	4	Minutes	37	Seconds
R_{i2} =	2,103,033	Ω	Impact Time:	4	Minutes	48	Seconds
R_i =	2,103,033	Ω	Impact Time:	4	Minutes	48	Seconds
R_i/V_b =	1,152,347	Ω/V	Impact Time:	4	Minutes	48	Seconds

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

NOTES:

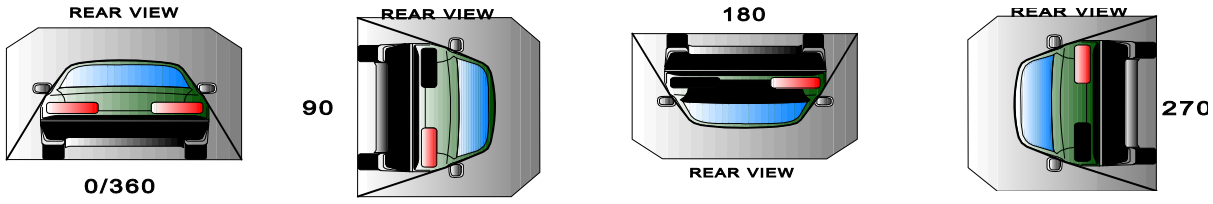
- *R_{i1}= R_o*(1+V_2/V_1)*[(V_1-V_1')/V_1'], R_{i2}= R_o*(1+V_1/V_2)*[(V_2-V_2')/V_2'], R_i = Lesser value of R_{i1} and R_{i2}*
- *If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant*
- *Minimum Electrical 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 Chevrolet Volt Four Door Sedan
Test Program: FMVSS 301R/305 Compliance Rear Impact Test
NHTSA No.: CC0108
Test Date: 8/8/2012



Rear View

ROLLOVER SOLVENT COLLECTION TIME TABLE

Test Phase	Rotation Time (spec. 1 -3 min)		Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds	Minutes	Minutes	Seconds	Minutes
0° to 90°	1	13	5	6	13	7
90° to 180°	1	6	5	6	6	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	7	5	6	7	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

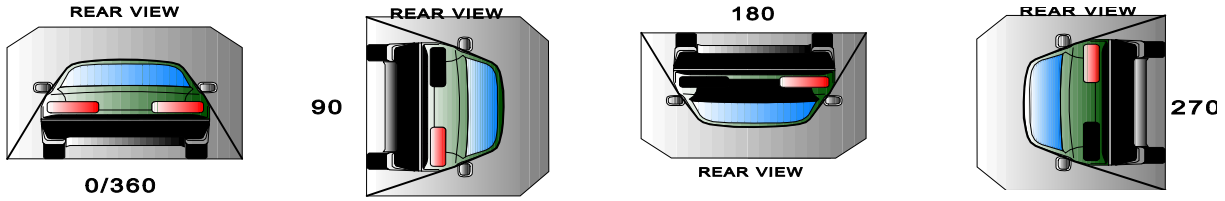
Test Phase	First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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 Chevrolet Volt Four Door Sedan
NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test
Test Date: 8/8/2012



Rear View

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	Minutes	Seconds	Minutes
0° to 90°	1	13	5	6	13	7
90° to 180°	1	6	5	6	6	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	7	5	6	7	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	
Total Spillage	No Spillage	Liters	

** 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) [X] No

Is propulsion battery electrolyte spillage visible in the passenger compartment? [ ] Yes (Fail) [X] No

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 87
Serial No.		65280327
Internal Impedance Value	MΩ	10
Nominal Propulsion Battery Voltage (V_b)	V	1.812

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.*

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

Test Vehicle: 2012 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301R/305 Compliance Rear Impact Test Test Date: 8/8/2012

ELECTRICAL ISOLATION MEASURMENTS & CALCULATIONS

Parameter	Rollover Stage	Value	Units		Minutes	Seconds
V_1 =	90°	0.810	V	Time:	2	23
	180°	0.983	V		8	35
	270°	0.807	V		14	35
	360°	0.807	V		20	32
V_2 =	90°	0.834	V	Time:	2	28
	180°	0.703	V		8	43
	270°	0.836	V		14	44
	360°	0.832	V		20	38
V_1' =	90°	0.123	V	Time:	2	34
	180°	0.185	V		8	55
	270°	0.123	V		14	53
	360°	0.123	V		20	45
V_2' =	90°	0.128	V	Time:	2	45
	180°	0.138	V		9	7
	270°	0.127	V		15	4
	360°	0.127	V		20	51
R_{i1} =	90°	2,175,421	Ω	Time:	2	34
	180°	1,419,744	Ω		8	55
	270°	2,172,651	Ω		14	53
	360°	2,167,362	Ω		20	45
R_{i2} =	90°	2,086,438	Ω	Time:	2	45
	180°	1,884,285	Ω		9	7
	270°	2,105,469	Ω		15	4
	360°	2,098,534	Ω		20	51
R_i =	90°	2,086,438	Ω	Time:	2	45
	180°	1,419,744	Ω		8	55
	270°	2,105,469	Ω		15	4
	360°	2,098,534	Ω		20	45
R_i/V_b =	90°	1,151,455.8	Ω/V	Time:	2	45
	180°	783,523.2	Ω/V		8	55
	270°	1,161,958.6	Ω/V		15	4
	360°	1,158,131	Ω/V		20	45

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

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

Test Vehicle:	2012 Chevrolet Volt Four Door Sedan	NHTSA No.:	CC0108
Test Program:	FMVSS 301R/305 Compliance Rear Impact Test	Test Date:	8/8/2012

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}, Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage*

- *V1, V2, V1', & V2' voltage measurements were recorded at the start of each successive increment of **90º**, **180º**, **270º**, and **360º** 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 Ω/ V*

COMMENTS: None

DATA SHEET NO. 10
PHOTOGRAPH DATA SHEET CHECKLIST

Test Vehicle: 2012 Chevrolet Volt Four Door Sedan NHTSA No.: CC0108
Test Program: FMVSS 301/305 Compliance Rear Impact Test Test Date: 8/8/2012

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

*Please note that pre-test photo placard reads C0108 but should read CC0108

*Please note that pre-test photo placard reads C0108 but should read CC0108

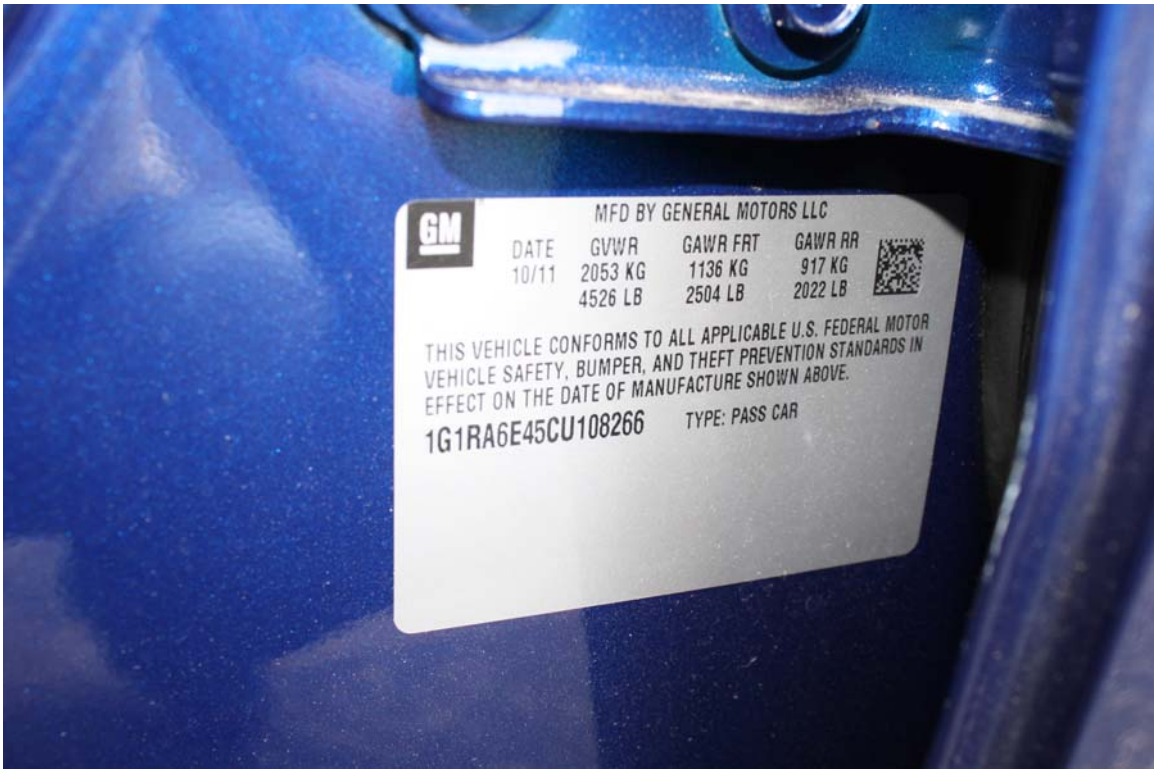


Figure A-1: Vehicle Certification Placard

Figure A-2: Vehicle Tire Placard

Figure A-3: As Delivered Left Front ¾ View

Figure A-4: As Delivered Right Rear ¾ 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

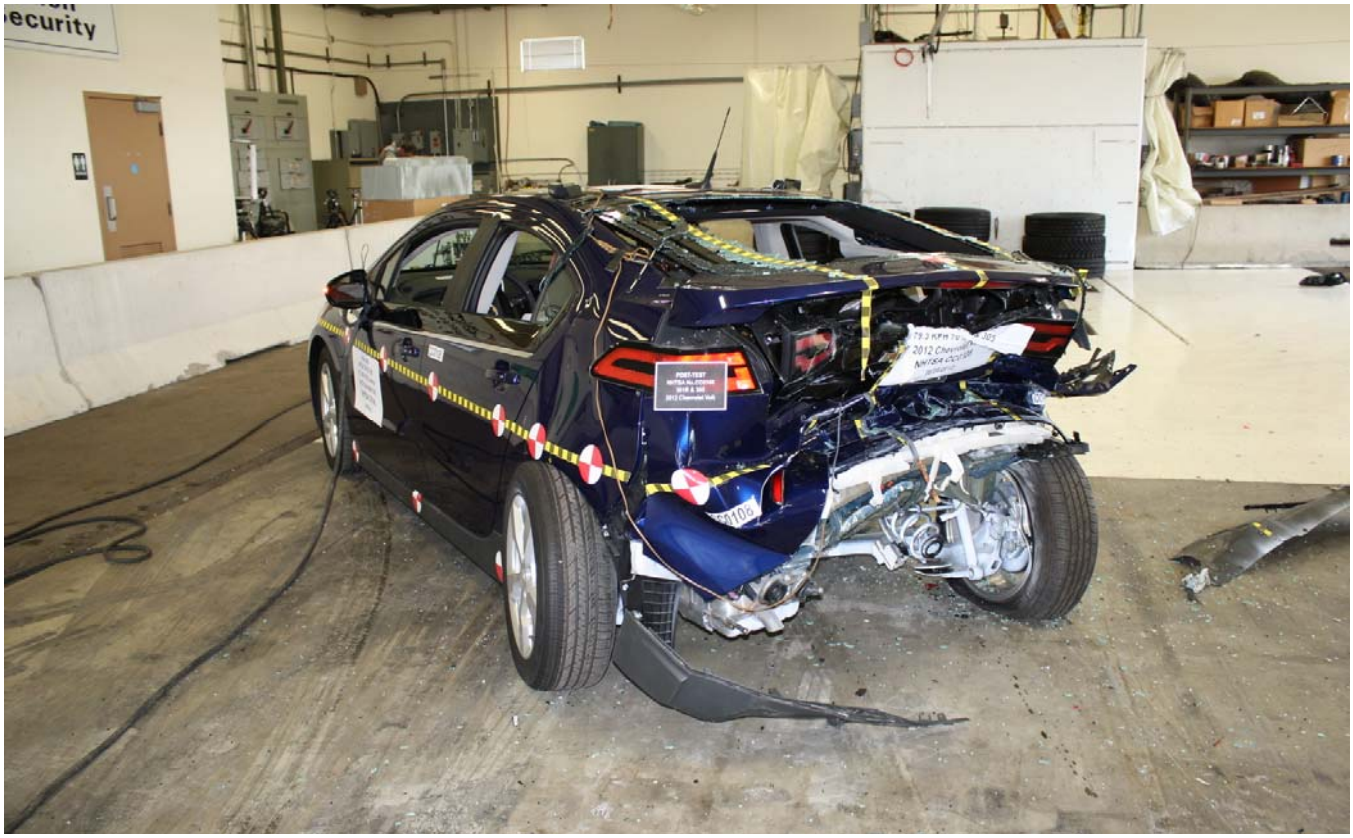


Figure A-20: Post-Test Rear View

Figure A-21: Pre-Test MDB Front View

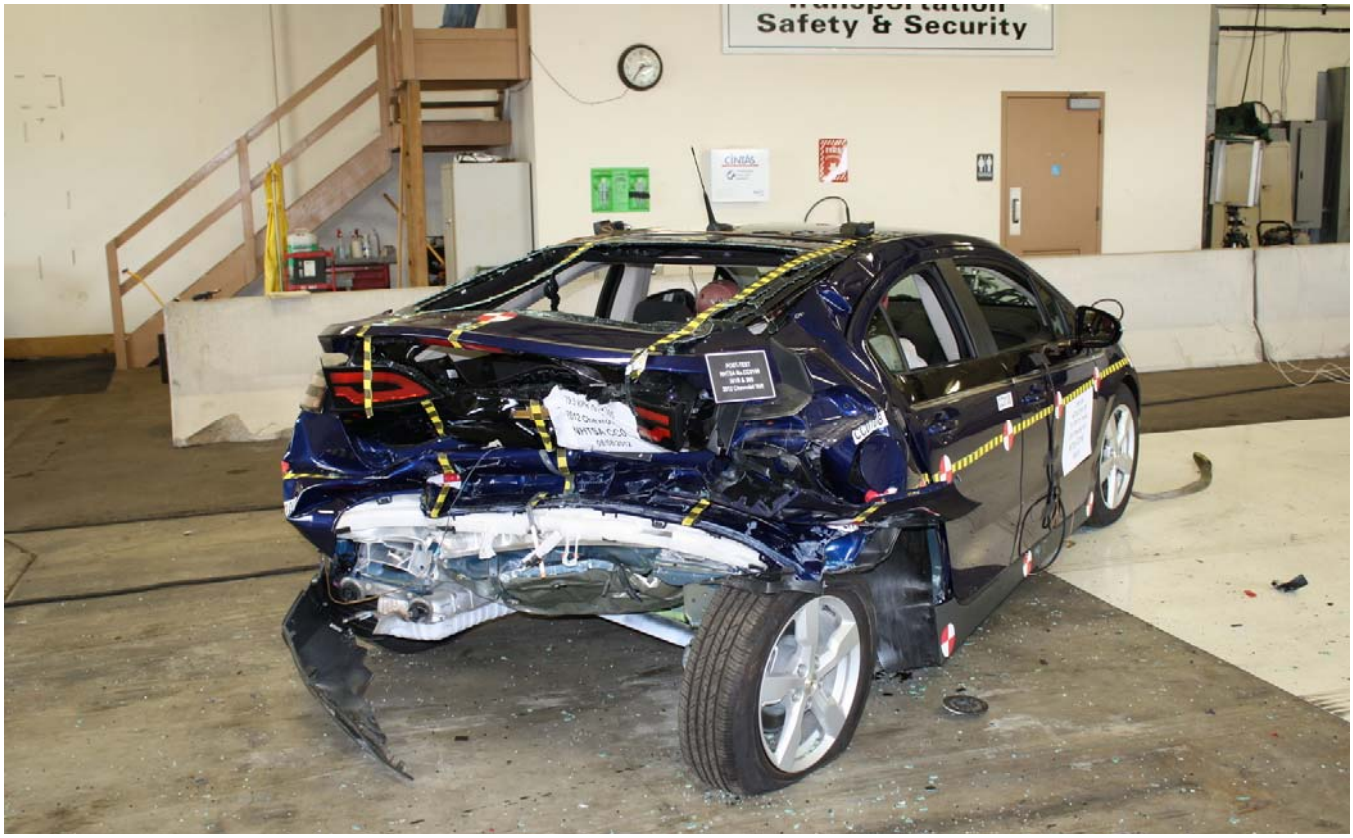


Figure A-22: Post-Test MDB Front View

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

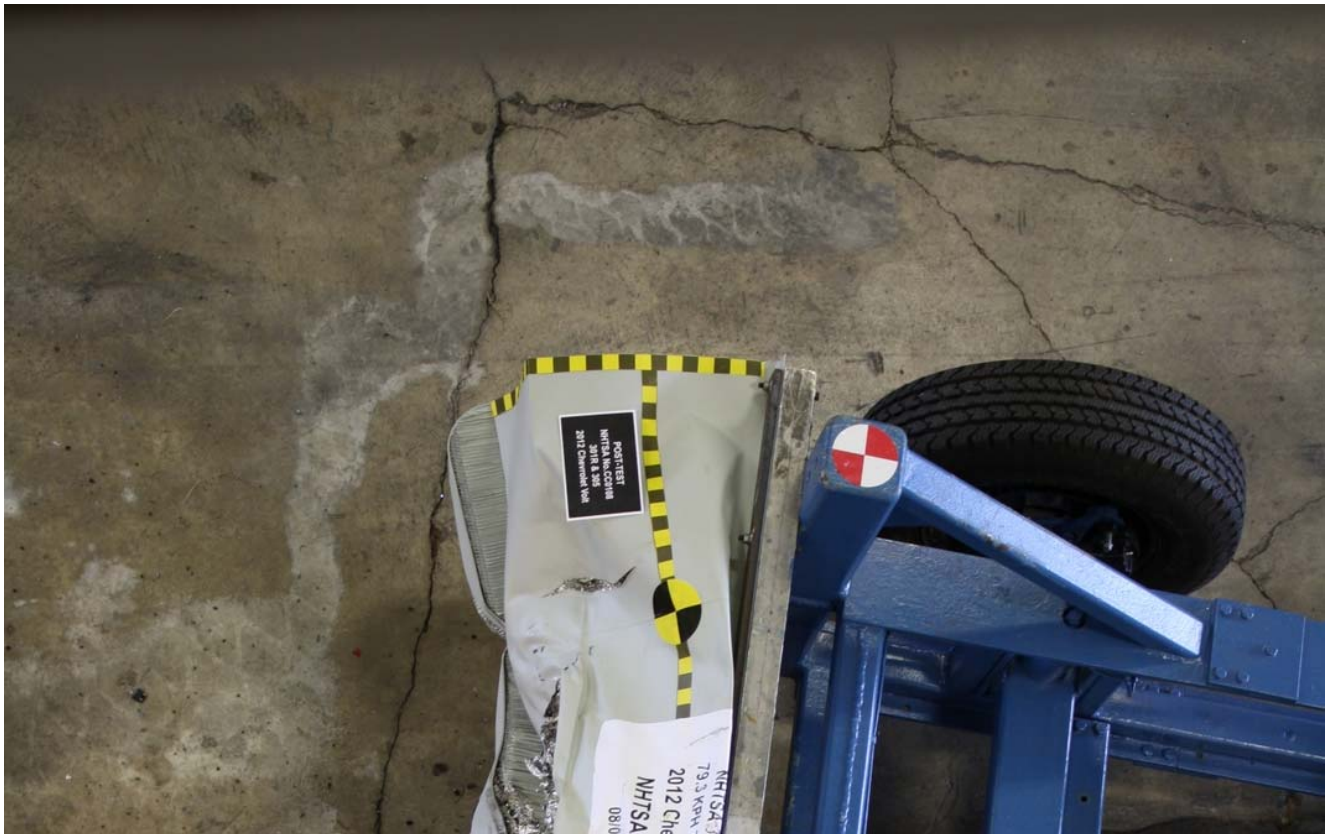


Figure A-28: Post-Test MDB Top View

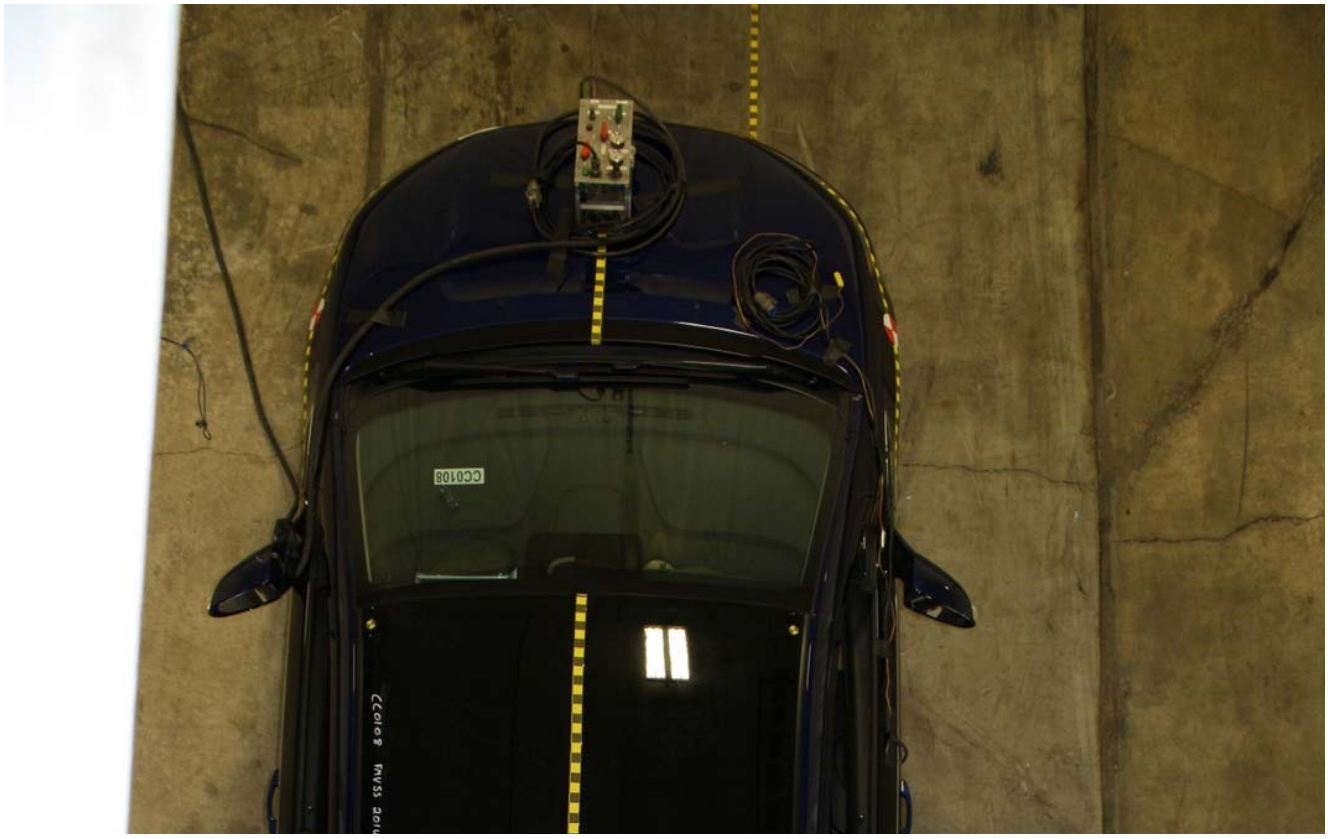


Figure A-29: Pre-Test Overhead Vehicle and MDB View

Figure A-30: Post-Test Impact Target View

Figure A-31: Pre-Test Front Underbody View

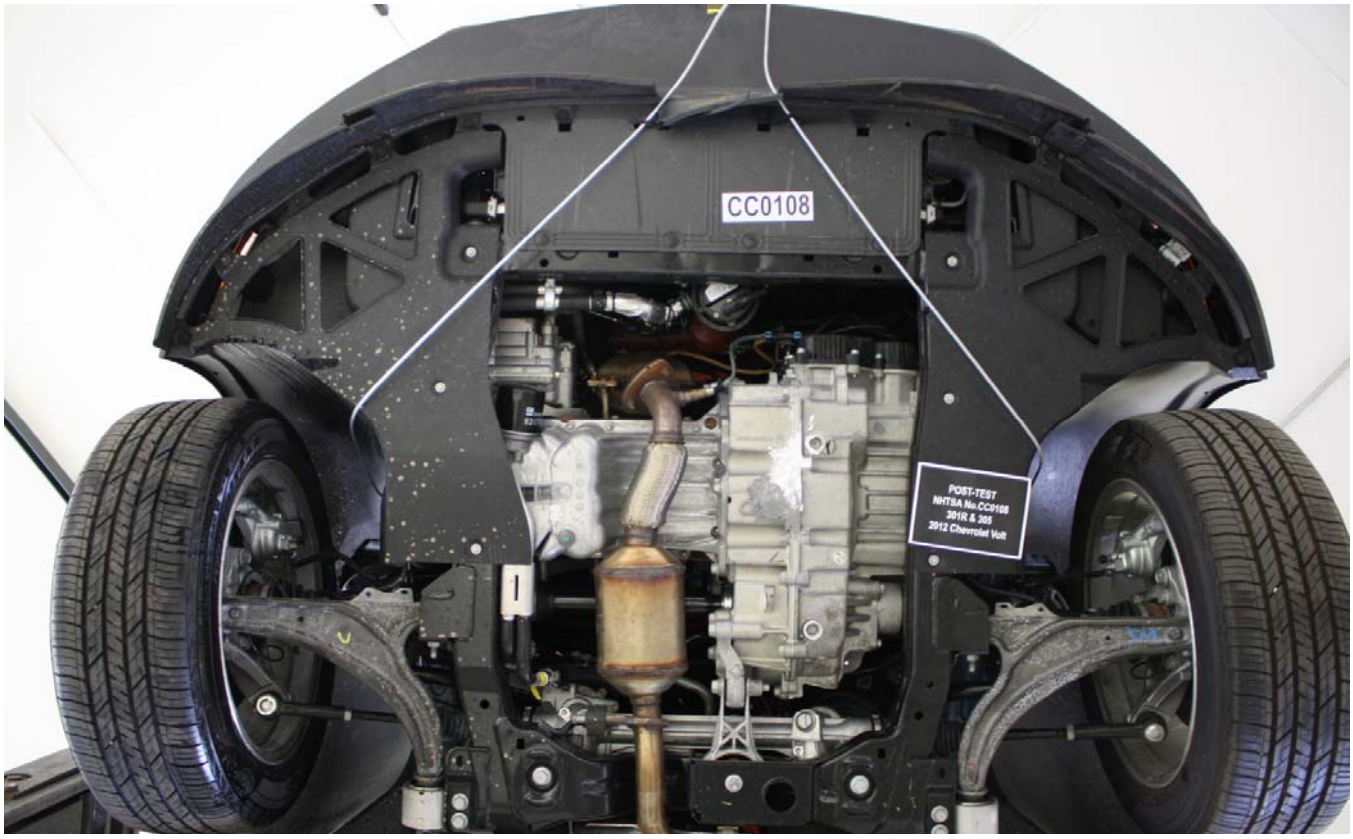


Figure A-32: Post-Test Front Underbody View

Figure A-33: Pre-Test Mid Underbody View

Figure A-34: Post-Test Mid Underbody View

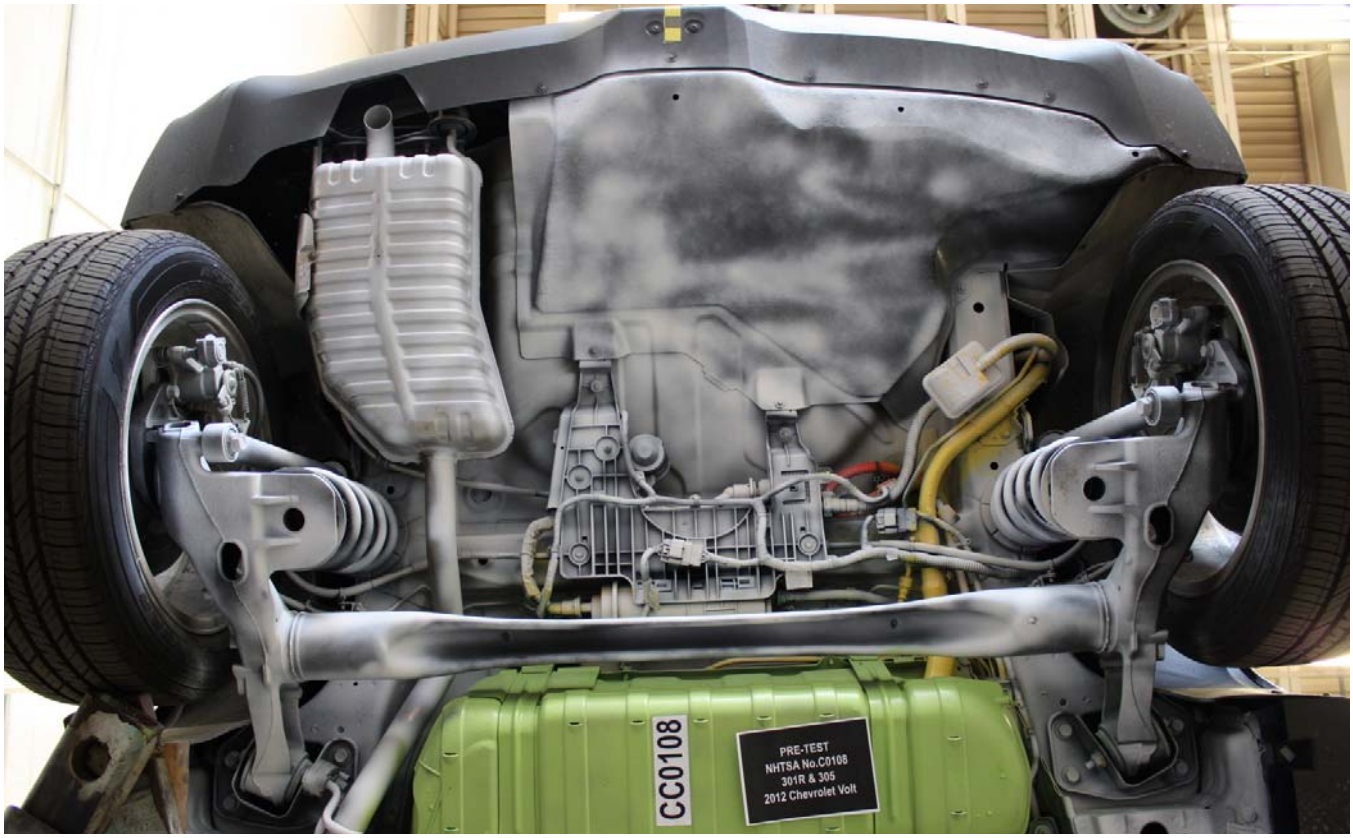


Figure A-35:Pre-Test Rear Underbody View

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

Photo Not Applicable

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

Photo Not Applicable

enclosed in battery

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)

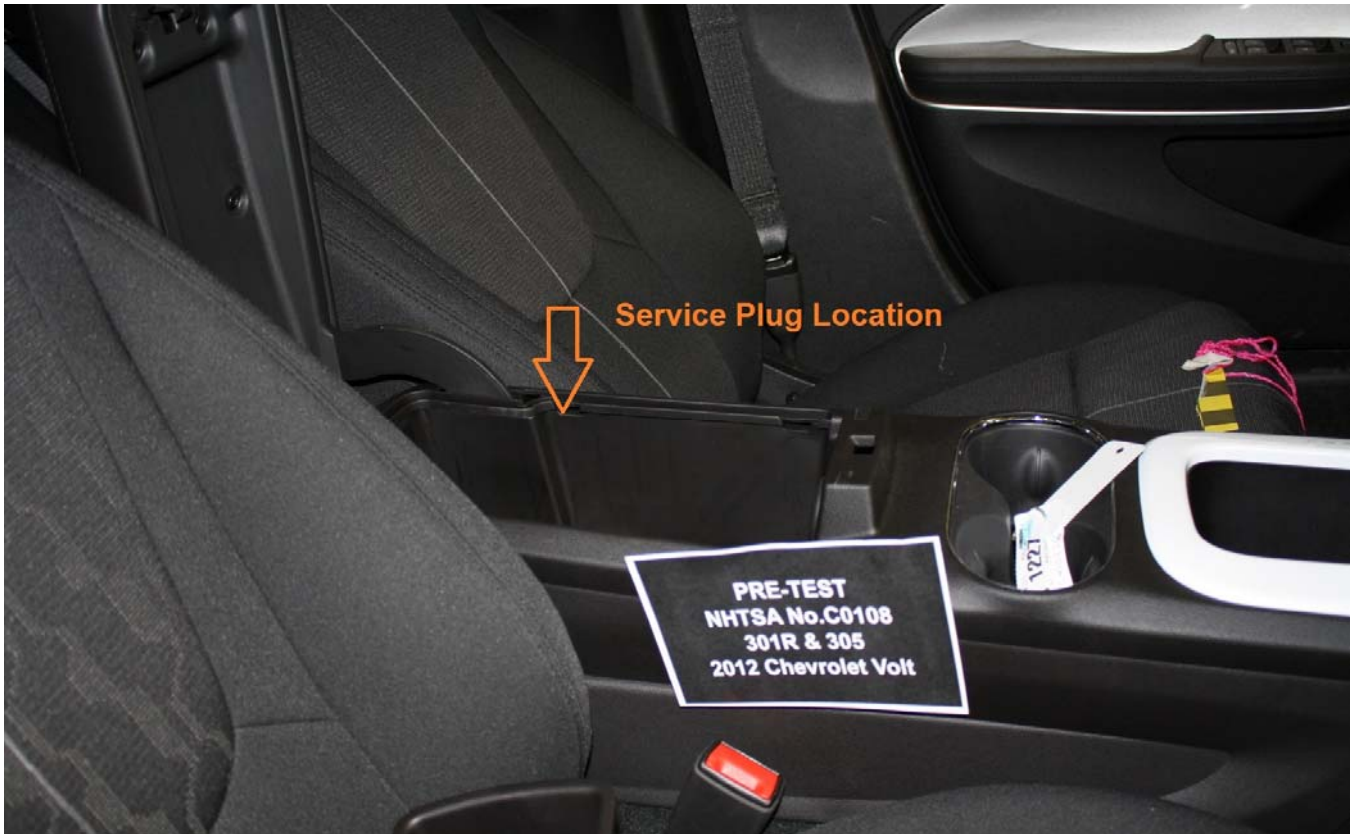


Figure A-48: Manual High Voltage Service Disconnect Removed (Location where removed)

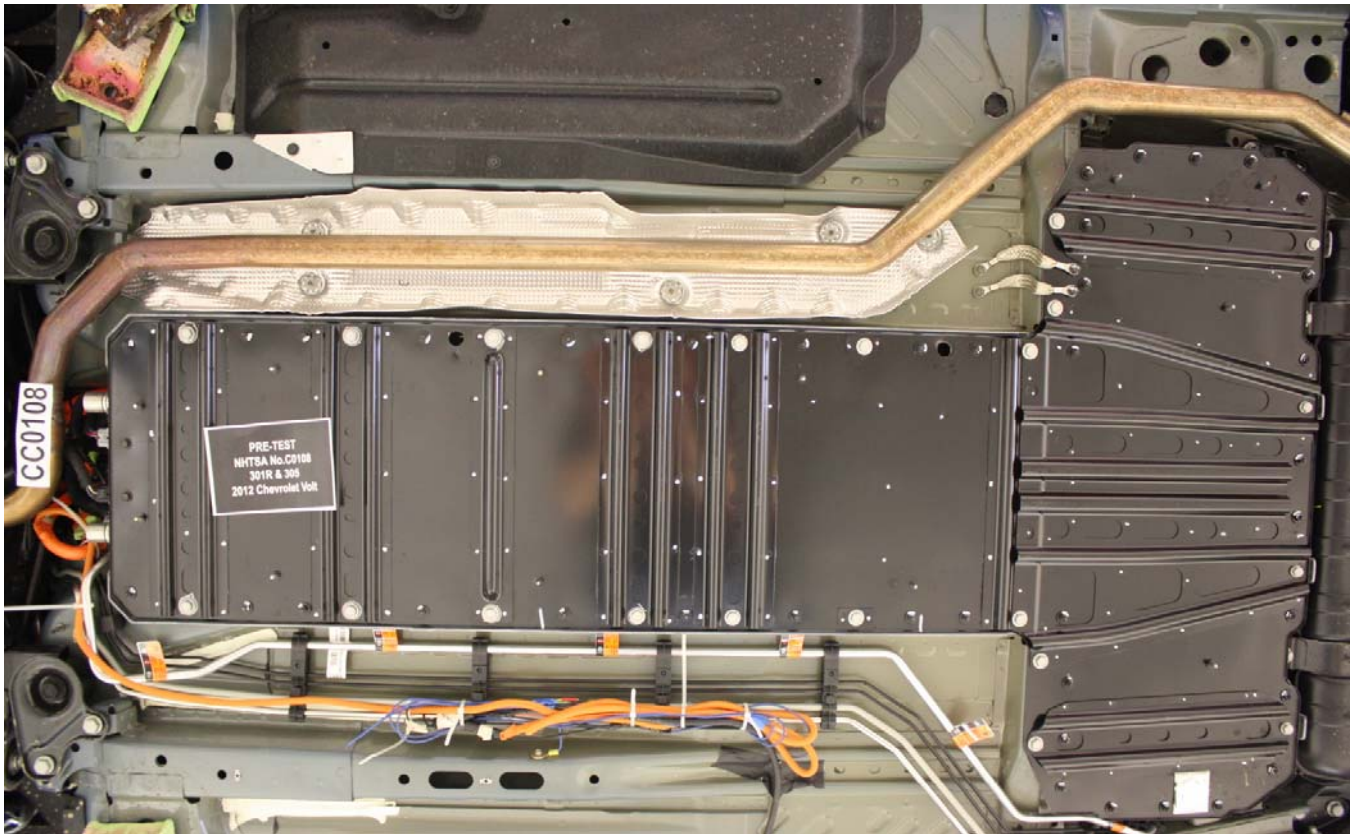


Figure A-49: Pre-Impact View of Propulsion Battery

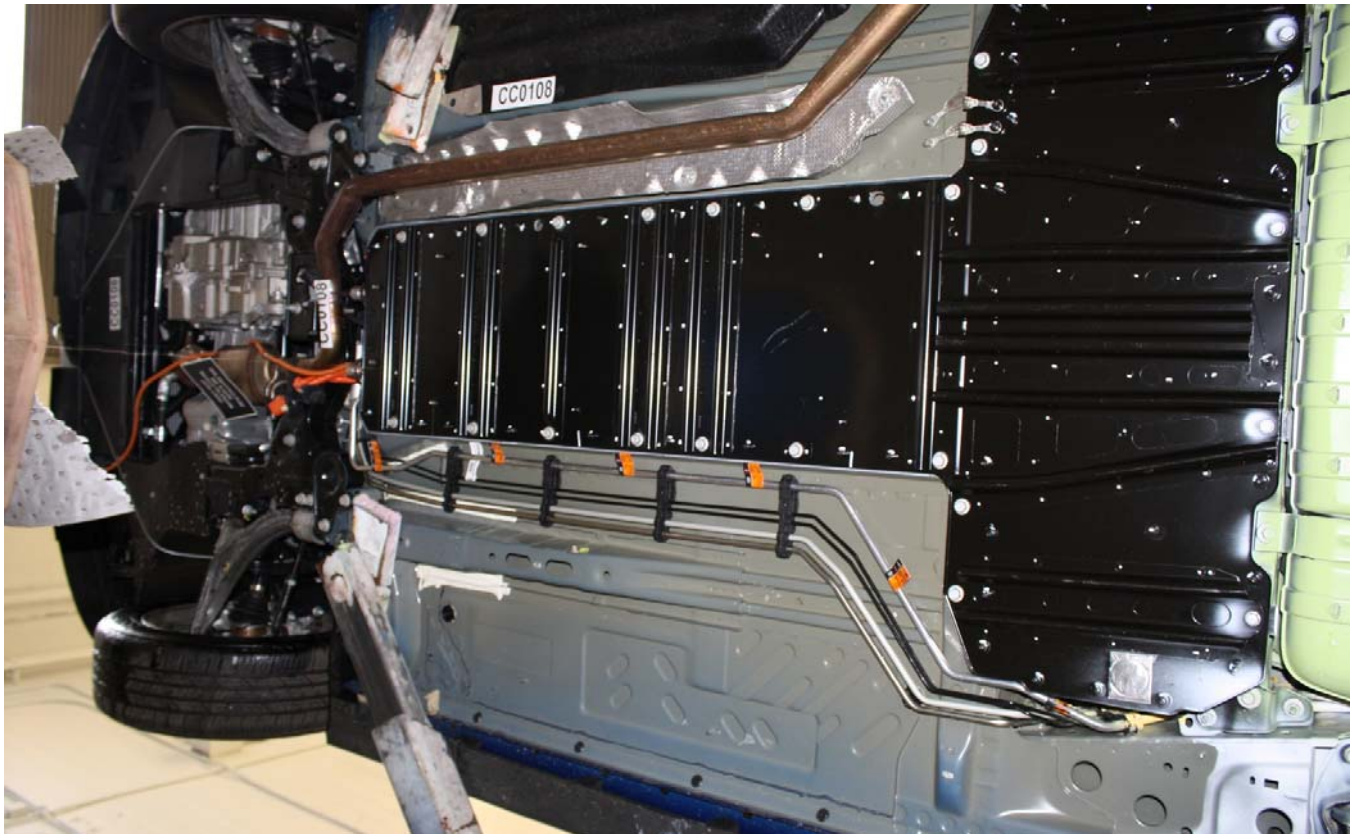


Figure A-50: Post-Impact Front View of Propulsion Battery

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)

Photo Not Applicable

enclosed in battery

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

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

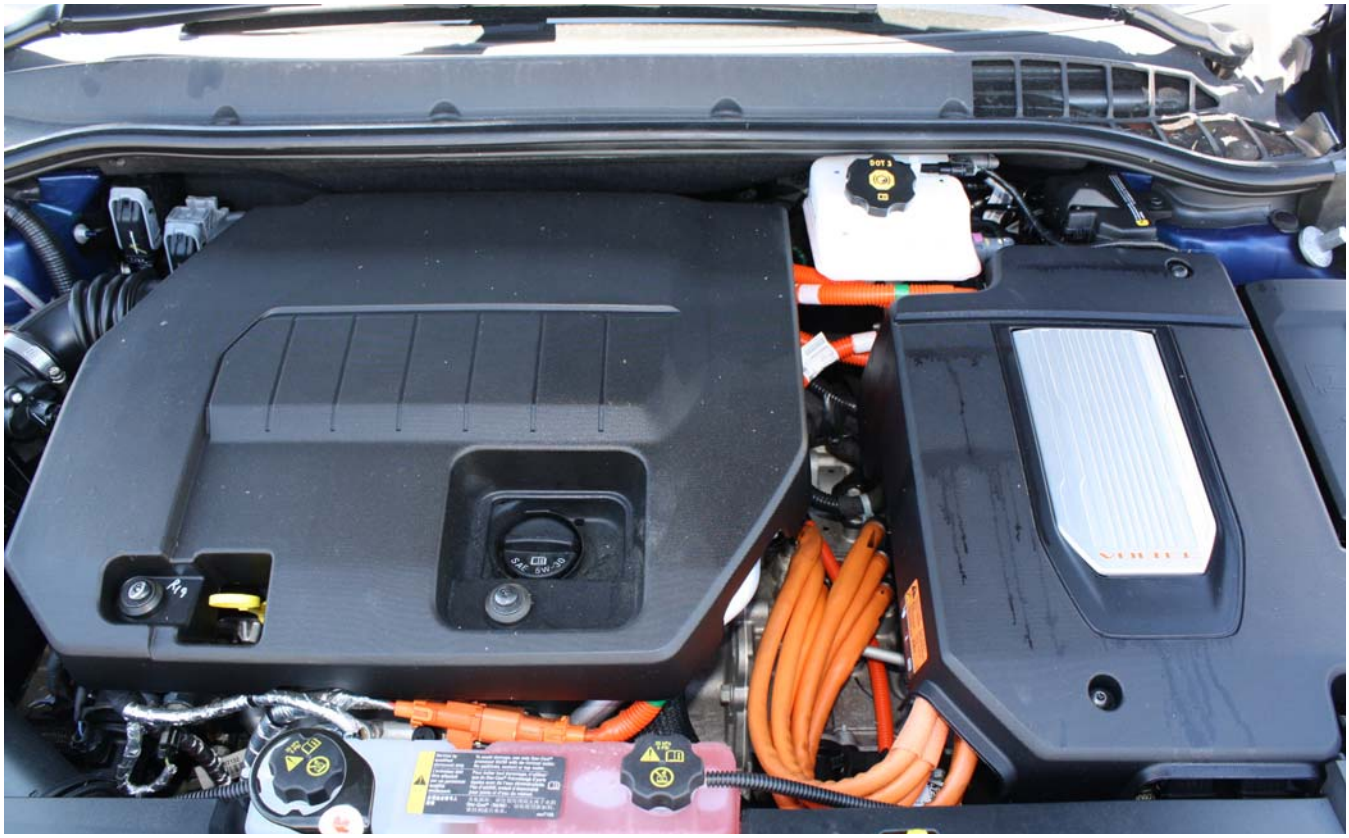


Figure A-57: Post-Impact View of Electric Propulsion Drive

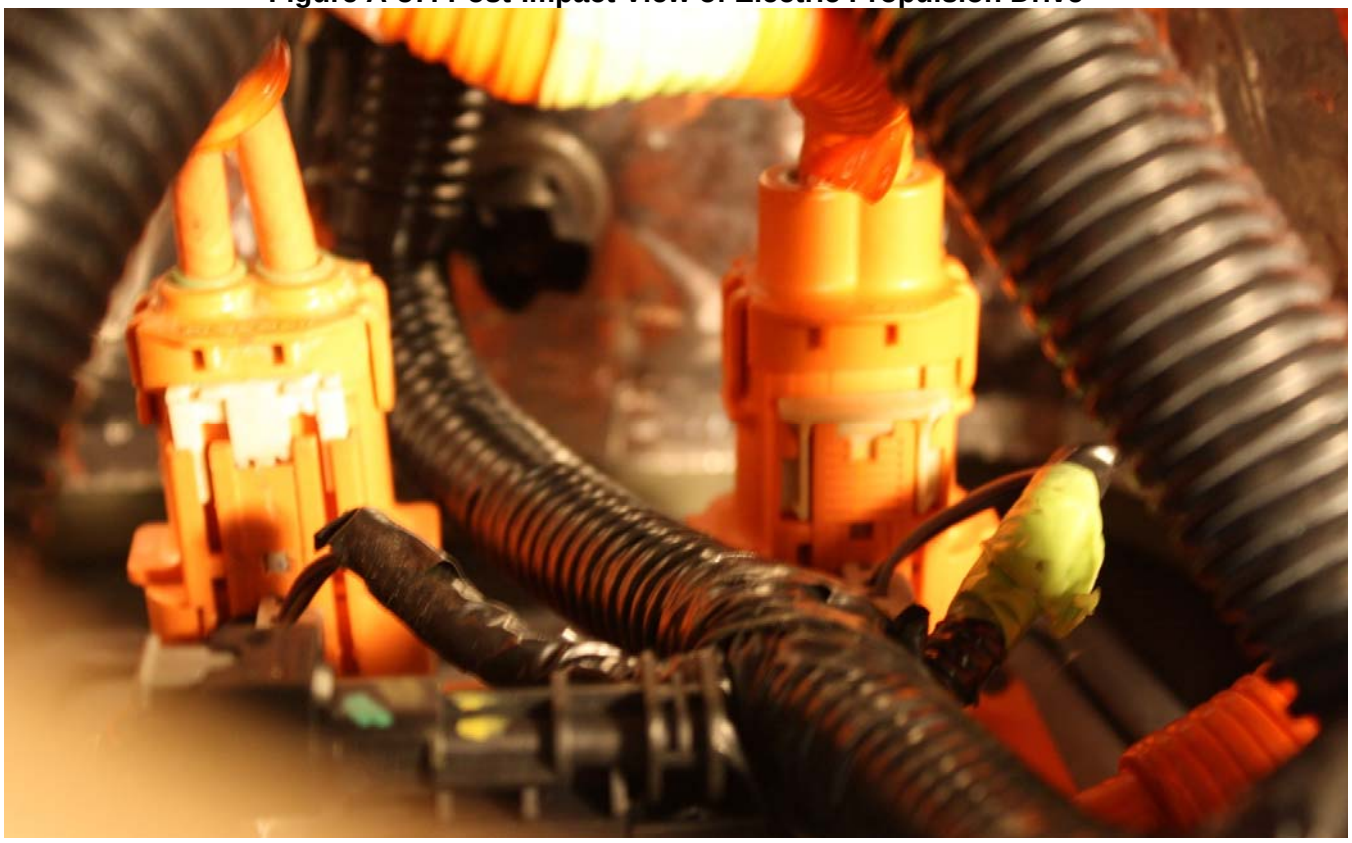


Figure A-58: Pre-Impact View of High Voltage Interconnect(s)

Photo Not Applicable

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

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

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

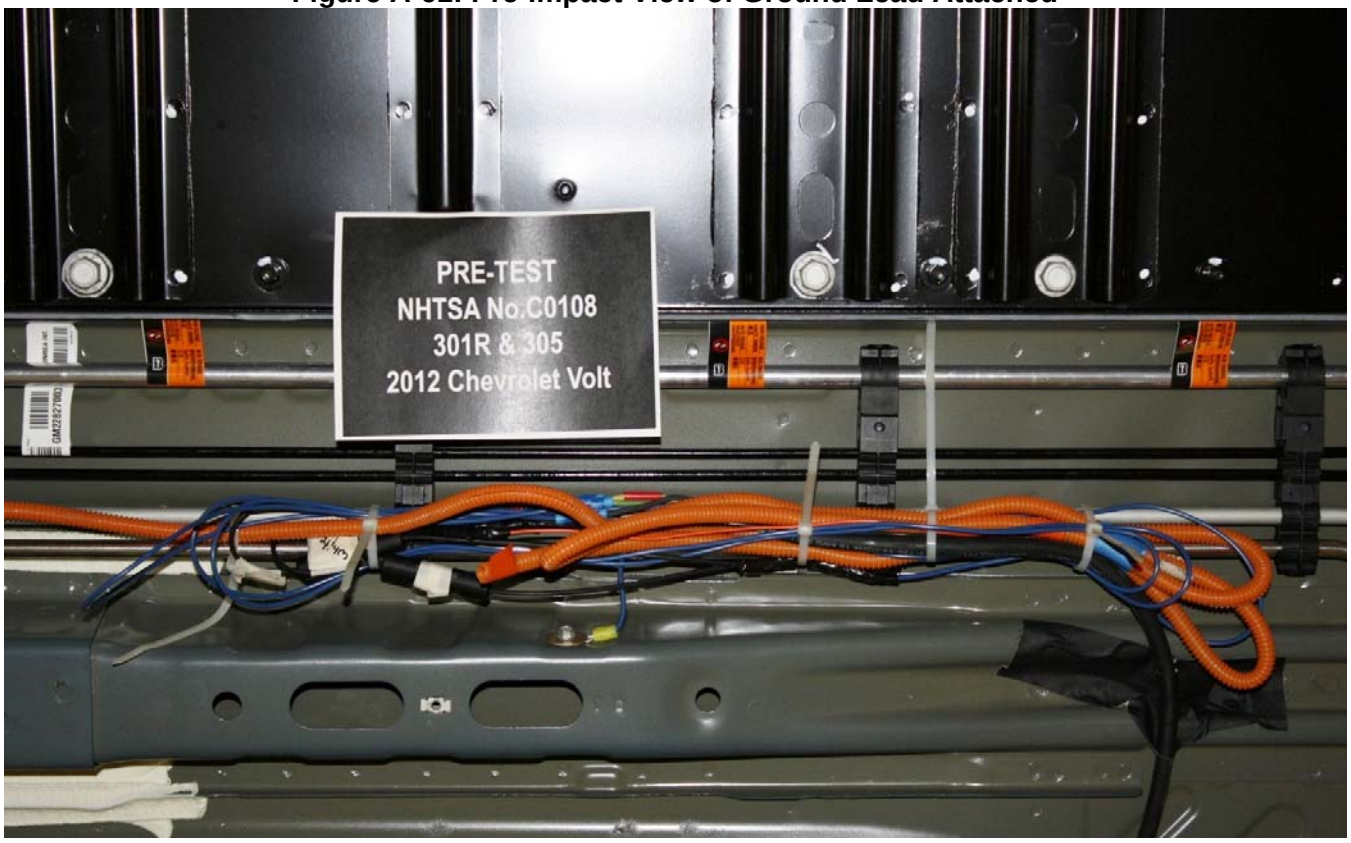


Figure A-62: Pre-Impact View of High Voltage Leads Attached

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

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

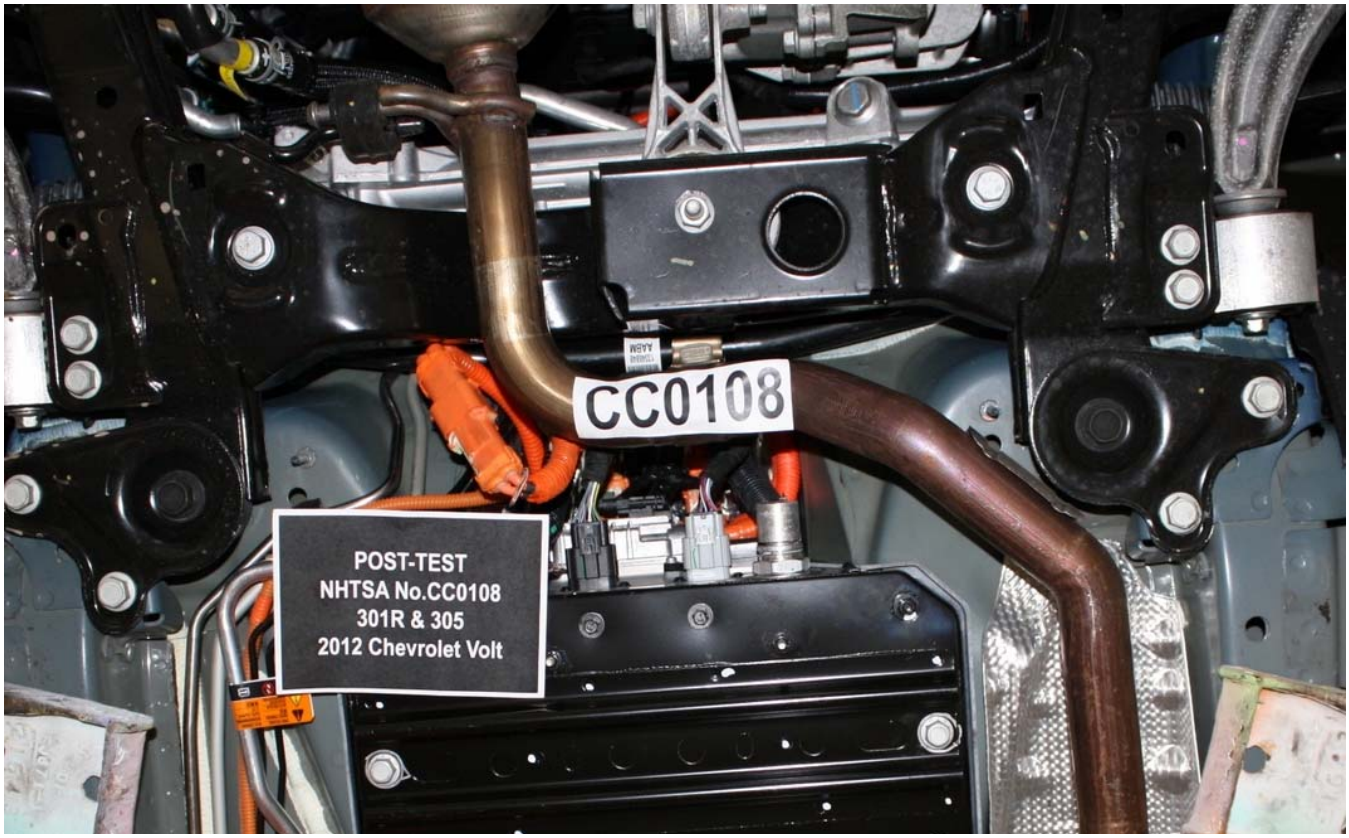


Figure A-65: Post-Impact View of Installed Test Interface Port

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)

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

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

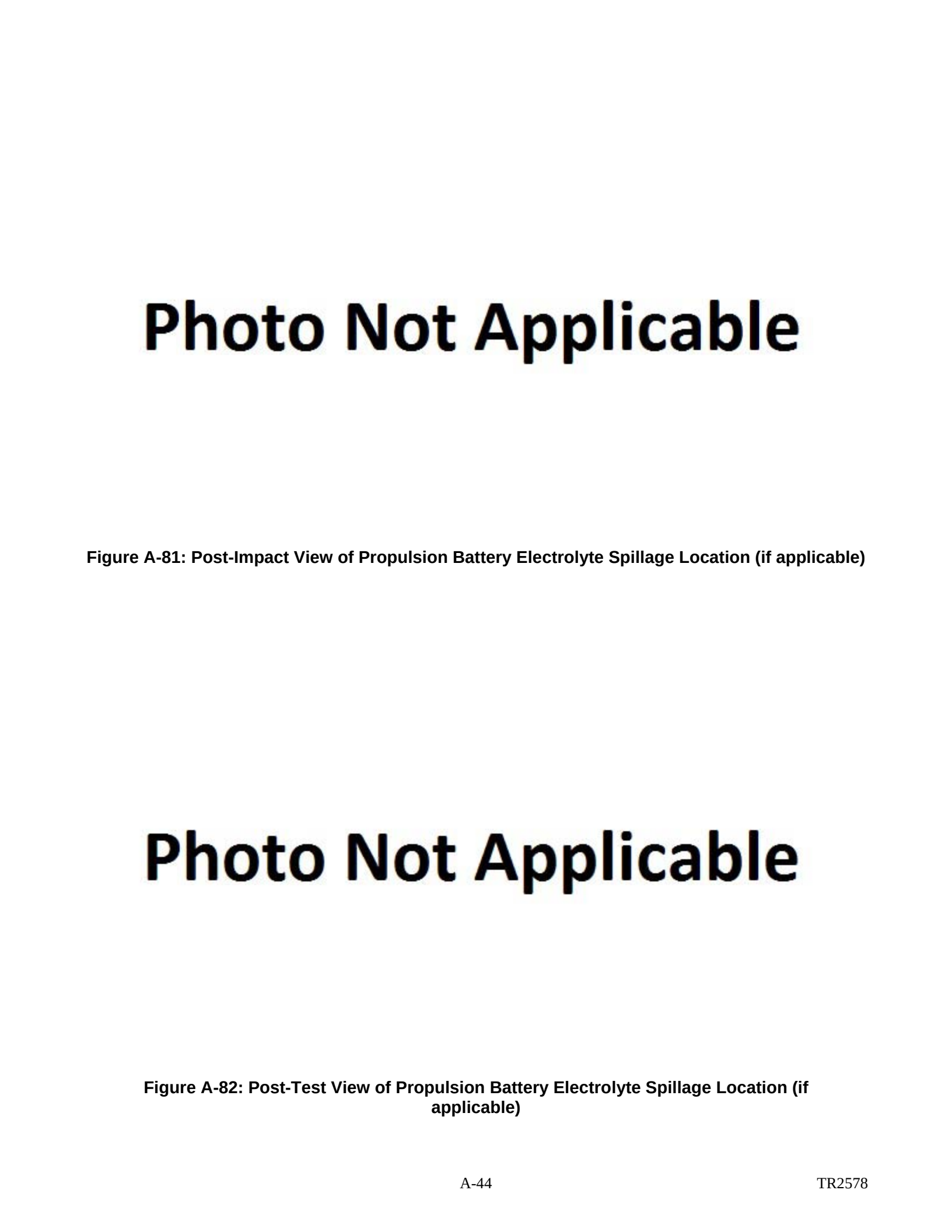


Figure A-81: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (if applicable)

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