REPORT NUMBER: NCAP305I-MGA-2018-005

NEW CAR ASSESSMENT PROGRAM (NCAP)
FMVSS No. 305 Indicant Test

MITSUBISHI MOTORS CORPORATION
2018 Mitsubishi Outlander PHEV SEL 5-Door SUV
NHTSA NUMBER: O20185602

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: December 17, 2018

Report Date: February 7, 2019

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590

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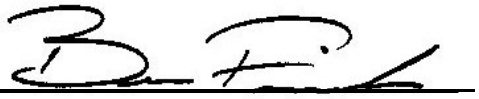
Prepared by: 
Ben Fischer, Project Engineer

Approved by: 
Joe Fleck, Project Engineer

Approval Date: February 7, 2019

FINAL REPORT ACCEPTANCE BY OVSC:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

1. Report No. NCAP305I-MGA-2018-005	*2. Government Accession No.*	*3. Recipient's Catalog No.*
4. Title and Subtitle Final Report of FMVSS 305 Compliance Testing of 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV, NHTSA No.: O20185602		*5. Report Date* February 7, 2019 *6. Performing Organization Code* MGA
7. Author(s) Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP305I-MGA-2018-005
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-13-D-00311L
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Test Report December 17, 2018 to February 7, 2019 *14. Sponsoring Agency Code* NRM-110
15. Supplementary Notes		

16. Abstract

An FMVSS No. 305 Indicant test, in conjunction with an NCAP side moving deformable barrier (MDB) impact test was conducted on the subject 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV in accordance with the specifications of the applicable Office of Crashworthiness Standards Test Procedures for the generation of consumer information for the New Car Assessment Program (NCAP). No test failures were reported.

17. Key Words New Car Assessment Program (NCAP) FMVSS 305 Indicant		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE Washington, DC 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* 42	22. Price

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SECTION 1
PURPOSE OF TEST

An FMVSS No. 305 Indicant test, in conjunction with an NCAP side moving deformable barrier (MDB) impact test was conducted on the subject 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV.

The Indicant test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Test Procedure, dated January 31, 2012 to determine compliance to the requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 305, “Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection” for the purpose of providing consumer information.

This FMVSS No. 305 Indicant test is part of the MY 2018 New Car Assessment Program Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract DTNH22-13-D-00311L.

SECTION 2
SUMMARY OF TEST RESULTS

A NCAP side moving deformable barrier (MDB) impact test was performed by MGA Research Corporation on a 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV on December 17, 2018. 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 each stage of the rollover.

Based on the test results, the 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV appears to meet the requirements for electrolyte spillage, electrical isolation, and battery retention during FMVSS No. 305 Indicant testing.

Data sheets, along with pre-test and post-test photographs of the test vehicle, are included in this report to document the test.

TEST NOTES

None

SECTION 3
DATA SHEETS

DATA SHEET 1
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

TEST VEHICLE INFORMATION

Year/Make/Model/Body Style	2018 Mitsubishi Outlander PHEV 5-Door SUV
NHTSA No.	O20185602
Color	Alloy Silver Metallic
Odometer Reading	195km / 121mi

DATA FROM CERTIFICATION LABEL

Manufactured By	MITSUBISHI MOTORS CORPORATION
Date of Manufacture	MAY 18
VIN:	JA4J24A56JZ063854

GVWR (kg)	2370
GAWR Front (kg)	1160
GAWR Rear (kg)	1270

ELECTRIC VEHICLE PROPULSION SYSTEM

Type of Electric Vehicle (Electric/Hybrid):	Hybrid
Electric Energy Storage/Device:	Lithium-Ion (Li-Ion) Battery
Nominal Voltage (V):	300 V
Is this vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of the Automatic Propulsion Battery Disconnect:	Physically contained within the Energy Storage System.
Auxiliary Battery Type:	Lead Acid Battery

DATA SHEET 1 (CONTINUED)
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

ELECTRIC ENERGY STORAGE CONVERSION/DEVICE SYSTEM DATA (COTR SUPPLIED)

Electrolyte Fluid Type:	Lithium hexafluorophosphate and carbonate ester	
Electrolyte Fluid Specific Gravity:	1.22 (g/mL) at 20°C	
Electrolyte Kinematic Viscosity (centistokes):	2.1 (cP) at 28.5°C	
Electrolyte Fluid Color:	Clear and colorless	
Electric Energy Storage/Conversion System Coolant Type, Color, Specific Gravity (if applicable):	None	
Location of Battery Modules:		Inside Passenger Compartment
	X	Outside Passenger Compartment
	The high-voltage battery is mounted below the occupant compartment.	

ELECTRIC ENERGY STORAGE CONVERSION/DEVICE STATE OF CHARGE

For all battery types:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge:	N/A
Maximum State of Charge:	328 V
95% of Maximum State of Charge:	311.6 V
Test Voltage - No less than 95% of maximum State of Charge:	327.1 V
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:	
Maximum State of Charge:	
Test Voltage – Maximum practicable State of Charge within Normal Operating Range:	

DATA SHEET 2
PRE-IMPACT DATA

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	Vehicle grounding point located on Front Power Drive Unit

ELECTRIC ENERGY STORAGE/CONVERSION TEST POINTS

Details of Electric Energy Storage/Conversion System Test Points:	Connected at Front Power Drive Unit located in engine compartment

DATA SHEET 3
PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS & CALCULATIONS

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

VOLTMETER INFORMATION

Make:	Fluke
Model:	177
Serial Number:	17210161
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Resolution (V):	0.001 Volts
Last Calibration Date:	5/29/2018

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM VOLTAGE

Measurement shall be made with Energy Storage/Conversion System connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion system energized) position.
If voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb (V):	327.1

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM TO VEHICLE CHASSIS

Vehicle chassis point(s) determined and supplied to contractor by COTR.

V1 (V):	300.2
V2 (V):	305.0

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the normal operating voltage of the vehicle (in volts) per SAE J1766.

Ro (Ω):	200,300

V1' (V) Pre-Impact:	7.3
V2' (V) Pre-Impact:	1.5

DATA SHEET 3 (CONTINUED)
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

ELECTRICAL ISOLATION MEASUREMENT

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

V1' (V):	7.3
Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']	
Ri1 (Ω):	16,201,890
V2' (V):	1.5
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']	
Ri2 (Ω):	80,416,926
Ri = The lesser of Ri1 and Ri2	
Ri Pre-Test (Ω):	16,201,890
Ri/Vb (Ω/V):	49,532
Minimum Electrical Isolation Value is 500 Ω/V	

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
≥500 Ω/V without electrical isolation monitoring		
≥100 Ω/V with electrical isolation monitoring	X	

DATA SHEET 4
POST-IMPACT DATA

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

VOLTMETER INFORMATION

Make:	Fluke
Model:	177
Serial Number:	17210161
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	300

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM VOLTAGE LOCATION OF MEASUREMENT

Measurement is made from the side of the automatic disconnect connected to the electric powertrain.

Vb (V):	14.4

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM VOLTAGE

V1 =	33.3	V	Impact Time:	0	Minutes	59	s
V2 =	5.0	V	Impact Time:	1	Minutes	11	s
V1' =	0.0	V	Impact Time:	1	Minutes	9	s
V2' =	0.0	V	Impact Time:	1	Minutes	15	s

ELECTRICAL ISOLATION MEASUREMENT

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1 =	76,484,525	Ω	Impact Time:	1	Minutes	9	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2 =	Zero Volts	Ω	Impact Time:	1	Minutes	15	s
Ri = The lesser of Ri1 and Ri2							
Ri =	Zero Volts	Ω	Impact Time:	1	Minutes	15	s
Ri/Vb = electrical Isolation Value/Nominal Battery Voltage							
Minimum Electrical Value is 500 Ω/V							
Ri/Vb =	Zero Volts	Ω/V	Impact Time:	0	Minutes	54	s

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
≥500 Ω/V without electrical isolation monitoring		
≥100 Ω/V with electrical isolation monitoring	X	

DATA SHEET 4 (CONTINUED)
POST-IMPACT DATA

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

ELECTRIC ENERGY STORAGE/CONVERSION DEVICE

	Inside Passenger Compartment	Outside Passenger Compartment
Location of Electric Energy Storage/Conversion Device:		X

	Yes, Pass	No, Fail
All Components of Electrical Energy Storage/Conversion Device remained attached to the vehicle with at least one mounting location.	X	

Describe Electric Energy Storage/Conversion Device movement within the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes, Fail	No, Pass
Has the Electric Energy Storage/Conversion Device moved within the passenger compartment?		X

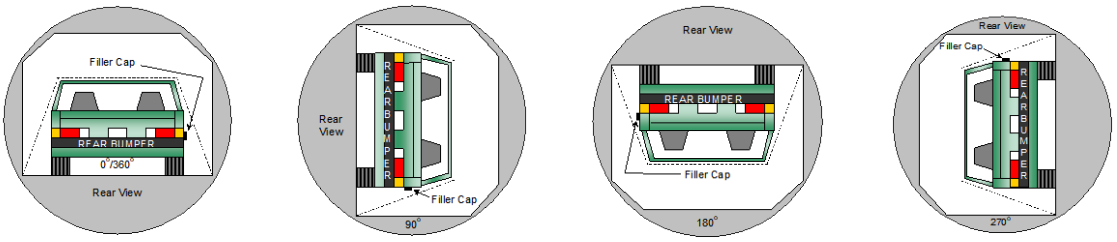
Describe intrusion of an outside Electric Energy Storage/Conversion Device into the passenger compartment [Supply photographs as appropriate]:
No Intrusion

	Yes, Fail	No, Pass
Has an outside Electric Energy Storage/Conversion Device intruded into the passenger compartment?		X

	Yes, Fail	No, Pass
Is Electric Energy Storage/Conversion Device electrolyte spillage visible in the passenger compartment?		X

DATA SHEET 5
STATIC ROLLOVER TEST DATA

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602



0°/360° **90°** **180°** **270°**

REAR VIEW

DETERMINATION OF ELECTRIC ENERGY STORAGE/CONVERSION DEVICE ELECTROLYTE COLLECTION TIME PERIOD

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	minutes	54	seconds	5	minutes	6	minutes	54	seconds	7	minutes
90° - 180°	1	minutes	51	seconds	5	minutes	6	minutes	51	seconds	7	minutes
180° - 270°	1	minutes	48	seconds	5	minutes	6	minutes	48	seconds	7	minutes
270° - 360°	1	minutes	50	seconds	5	minutes	6	minutes	50	seconds	7	minutes

ACTUAL TEST VEHICLE ELECTRIC ENERGY STORAGE/CONVERSION DEVICE ELECTROLYTE SPILLAGE

Rollover Stage	Electric Energy Storage/Conversion Device Electrolyte Spillage (L)	Spillage Location
0° to 90°	0	Not Applicable
90° to 180°	0	Not Applicable
180° to 270°	0	Not Applicable
270° to 360°	0	Not Applicable

Total Spillage: ____0____L

	Yes, Fail	No, Pass
Is the total spillage of Electric Energy Storage/Conversion Device electrolyte greater than 5.0 Liters?		X
Is Electric Energy Storage/Conversion Device electrolyte spillage visible in the passenger compartment?		X

DATA SHEET 5 (CONTINUED)
STATIC ROLLOVER TEST DATA

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

VOLTMETER INFORMATION

Make:	Fluke
Model:	177
Serial Number:	17210161
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Nominal Electric Energy Storage/Conversion Device Voltage (Vb) (V):	300
Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90°, 180°, 270°, and 360° of the static rollover test.	

ELECTRICAL ISOLATION MEASUREMENT

V1 =	0	V	0°	Time:		Minutes		s
V1 =	0	V	90°	Time:	2	Minutes	20	s
V1 =	0	V	180°	Time:	2	Minutes	13	s
V1 =	0	V	270°	Time:	2	Minutes	20	s
V1 =	0	V	360°	Time:	2	Minutes	17	s
V2 =	0	V	0°	Time:		Minutes		s
V2 =	0	V	90°	Time:	2	Minutes	24	s
V2 =	0	V	180°	Time:	2	Minutes	18	s
V2 =	0	V	270°	Time:	2	Minutes	23	s
V2 =	0	V	360°	Time:	2	Minutes	20	s
V1' =	0	V	0°	Time:		Minutes		s
V1' =	0	V	90°	Time:	2	Minutes	30	s
V1' =	0	V	180°	Time:	2	Minutes	28	s
V1' =	0	V	270°	Time:	2	Minutes	23	s
V1' =	0	V	360°	Time:	2	Minutes	20	s
V2' =	0	V	0°	Time:		Minutes		s
V2' =	0	V	90°	Time:	2	Minutes	34	s
V2' =	0	V	180°	Time:	2	Minutes	22	s
V2' =	0	V	270°	Time:	2	Minutes	26	s
V2' =	0	V	360°	Time:	2	Minutes	23	s
Vb =	0	V	0°	Time:		Minutes		s
Vb =	0	V	90°	Time:	2	Minutes	14	s
Vb =	0	V	180°	Time:	2	Minutes	10	s
Vb =	0	V	270°	Time:	2	Minutes	18	s
Vb =	0	V	360°	Time:	2	Minutes	15	s

DATA SHEET 5 (CONTINUED)
STATIC ROLLOVER TEST DATA

Test Vehicle: 2018 Mitsubishi Outlander PHEV SEL 5-Door SUV NHTSA No. O20185602

ELECTRICAL ISOLATION CALCULATION

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']								
Ri1 =	Zero Volts	Ω	0°	Time:		Minutes		s
Ri1 =	Zero Volts	Ω	90°	Time:	2	Minutes	20	s
Ri1 =	Zero Volts	Ω	180°	Time:	2	Minutes	13	s
Ri1 =	Zero Volts	Ω	270°	Time:	2	Minutes	20	s
Ri1 =	Zero Volts	Ω	360°	Time:	2	Minutes	17	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']								
Ri2 =	Zero Volts	Ω	0°	Time:		Minutes		s
Ri2 =	Zero Volts	Ω	90°	Time:	2	Minutes	24	s
Ri2 =	Zero Volts	Ω	180°	Time:	2	Minutes	18	s
Ri2 =	Zero Volts	Ω	270°	Time:	2	Minutes	23	s
Ri2 =	Zero Volts	Ω	360°	Time:	2	Minutes	20	s
Ri = The lesser of Ri1 and Ri2								
Ri =	Zero Volts	Ω	0°	Time:		Minutes		s
Ri =	Zero Volts	Ω	90°	Time:	2	Minutes	20	s
Ri =	Zero Volts	Ω	180°	Time:	2	Minutes	13	s
Ri =	Zero Volts	Ω	270°	Time:	2	Minutes	20	s
Ri =	Zero Volts	Ω	360°	Time:	2	Minutes	17	s
Ri/Vb = Electrical Isolation Value/Nominal Battery Voltage Minimum Electrical Isolation Value is 500 Ω /V								
Ri/Vb =	Zero Volts	Ω/V	0°	Time:		Minutes		s
Ri/Vb =	Zero Volts	Ω/V	90°	Time:	2	Minutes	14	s
Ri/Vb =	Zero Volts	Ω/V	180°	Time:	2	Minutes	10	s
Ri/Vb =	Zero Volts	Ω/V	270°	Time:	2	Minutes	18	s
Ri/Vb =	Zero Volts	Ω/V	360°	Time:	2	Minutes	15	s

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
≥500 Ω/V without electrical isolation monitoring		
≥100 Ω/V with electrical isolation monitoring	X	

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Photo No. 001 - Auxiliary Power Module Warning Label

Photo No. 002 - Power Inverter Warning Label

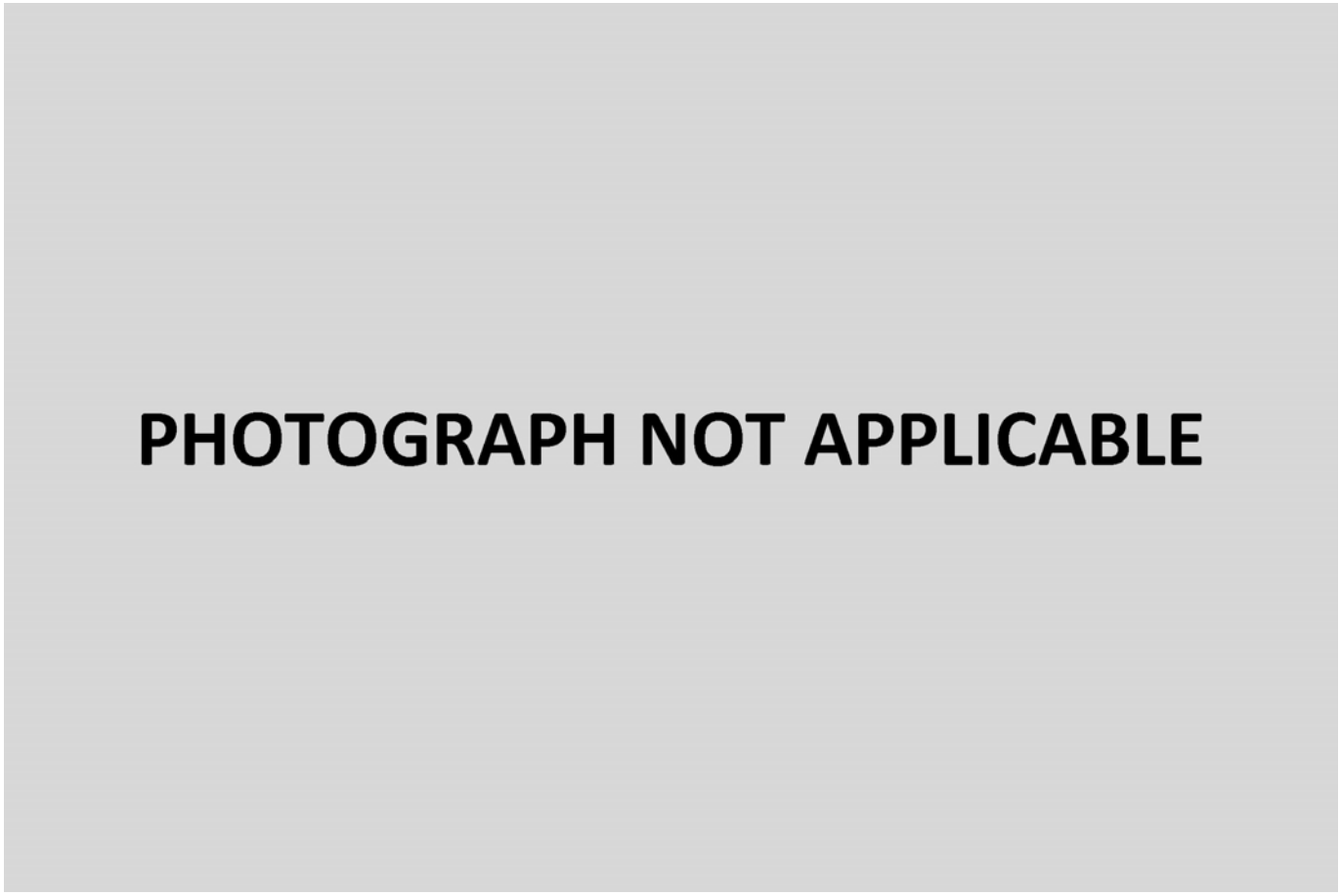


Photo No. 003 - First Responder Warning Label

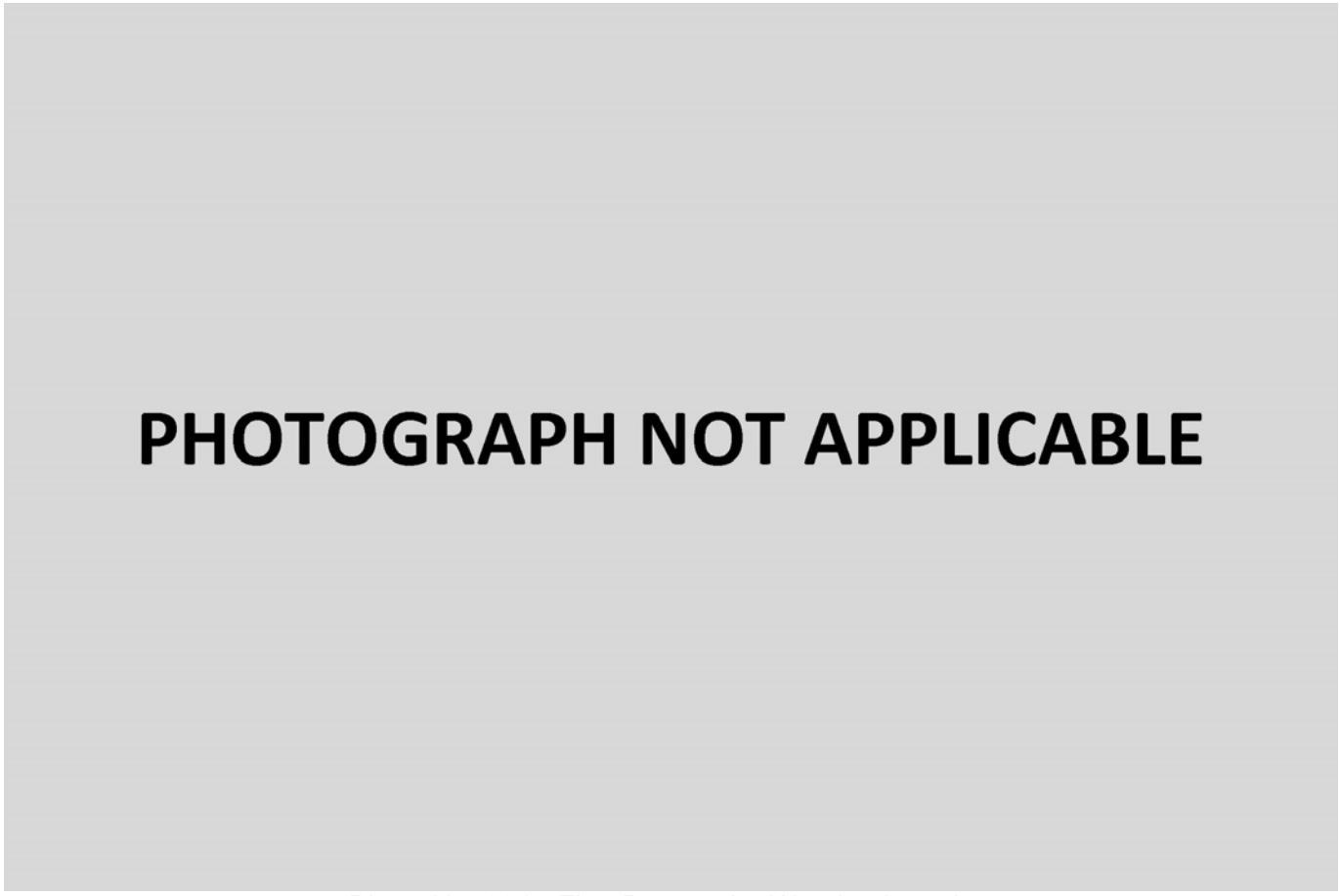


Photo No. 004 - First Responder Warning Location

Photo No. 005 - Other Vehicle Label(s) Related to Electrical Propulsion System

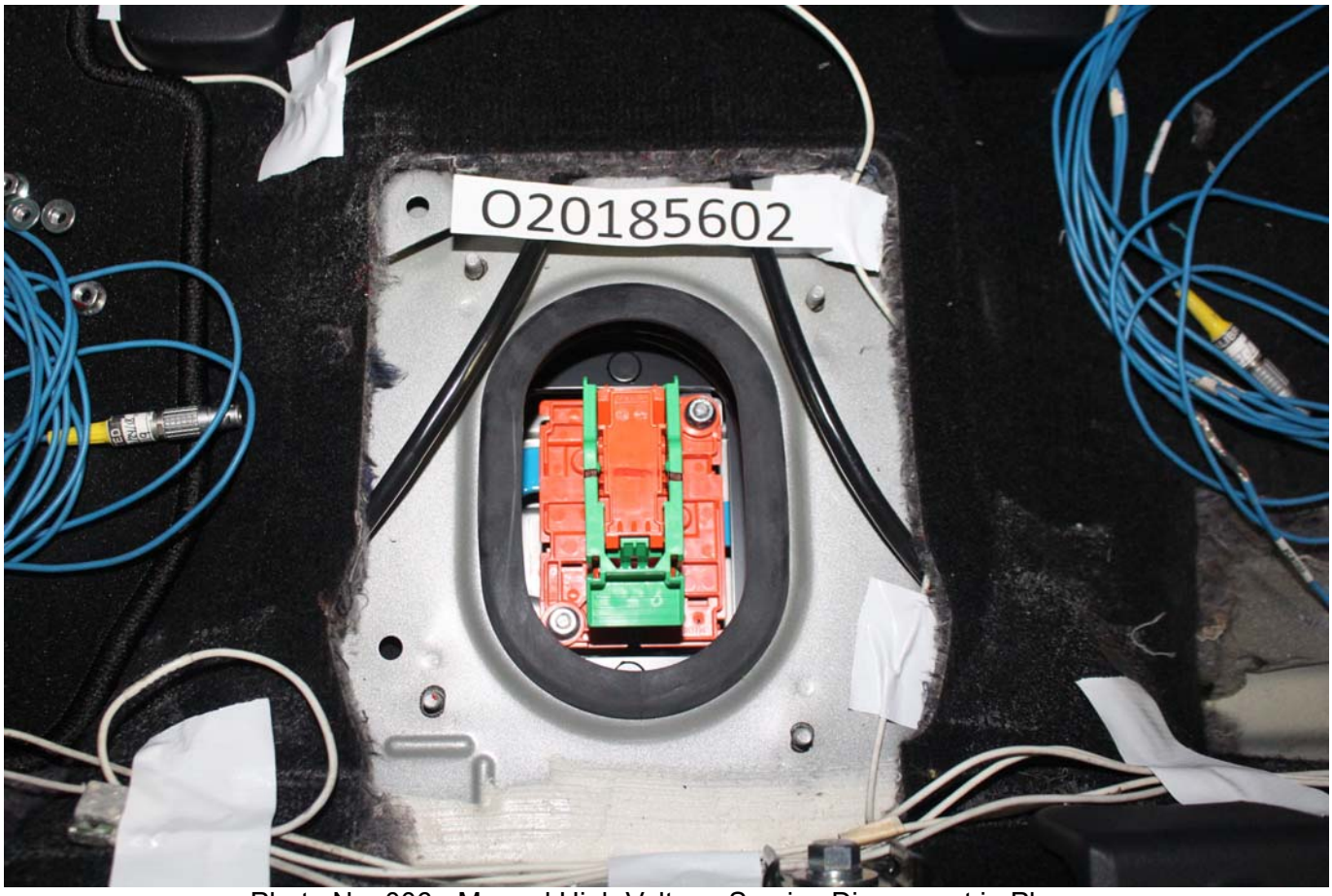


Photo No. 006 - Manual High Voltage Service Disconnect in Place

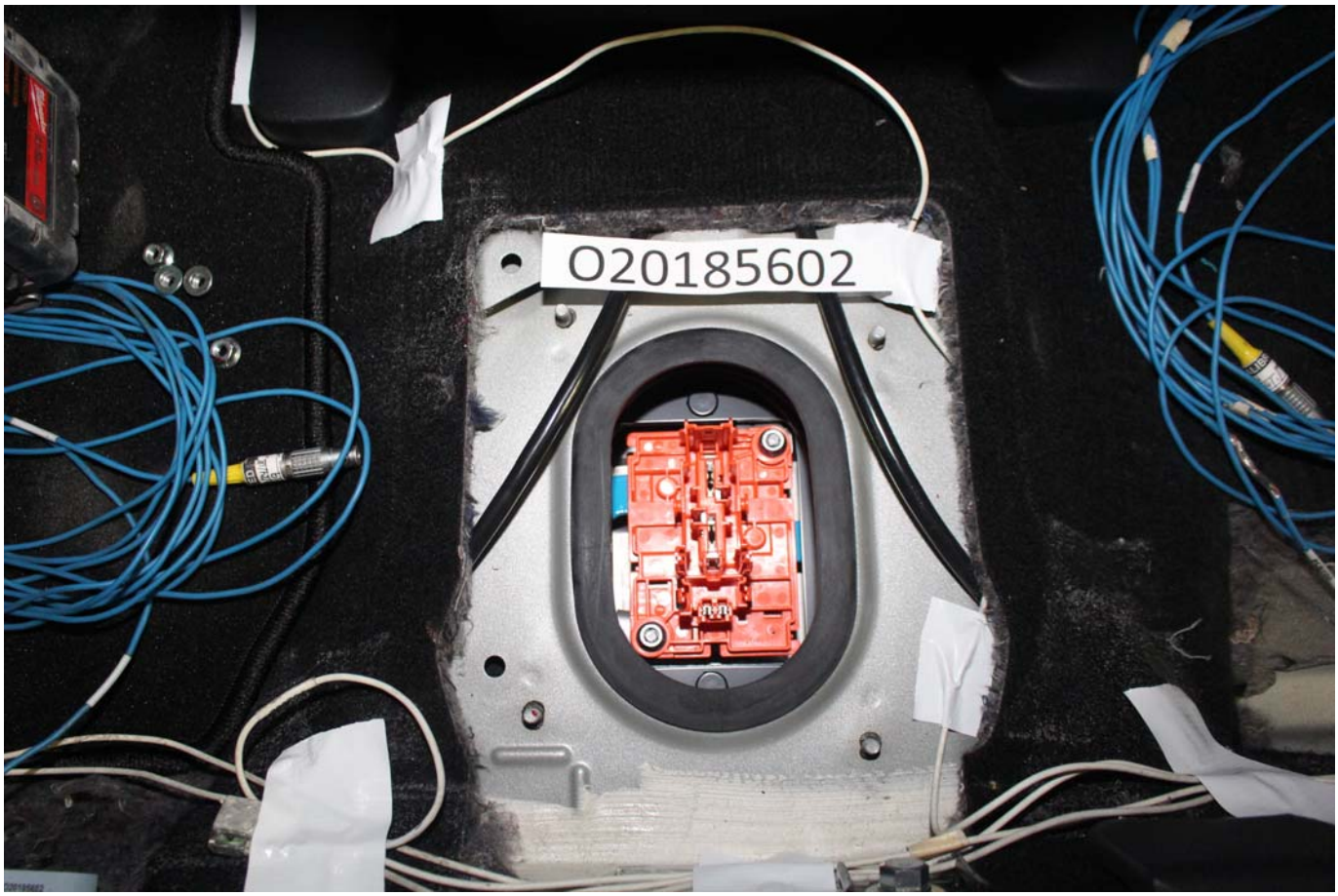


Photo No. 007 - Manual High Voltage Service Disconnect Removed

Photo No. 007a - Manual High Voltage Service Disconnect Removed

Photo No. 008 - Pre-Impact View of Propulsion Battery

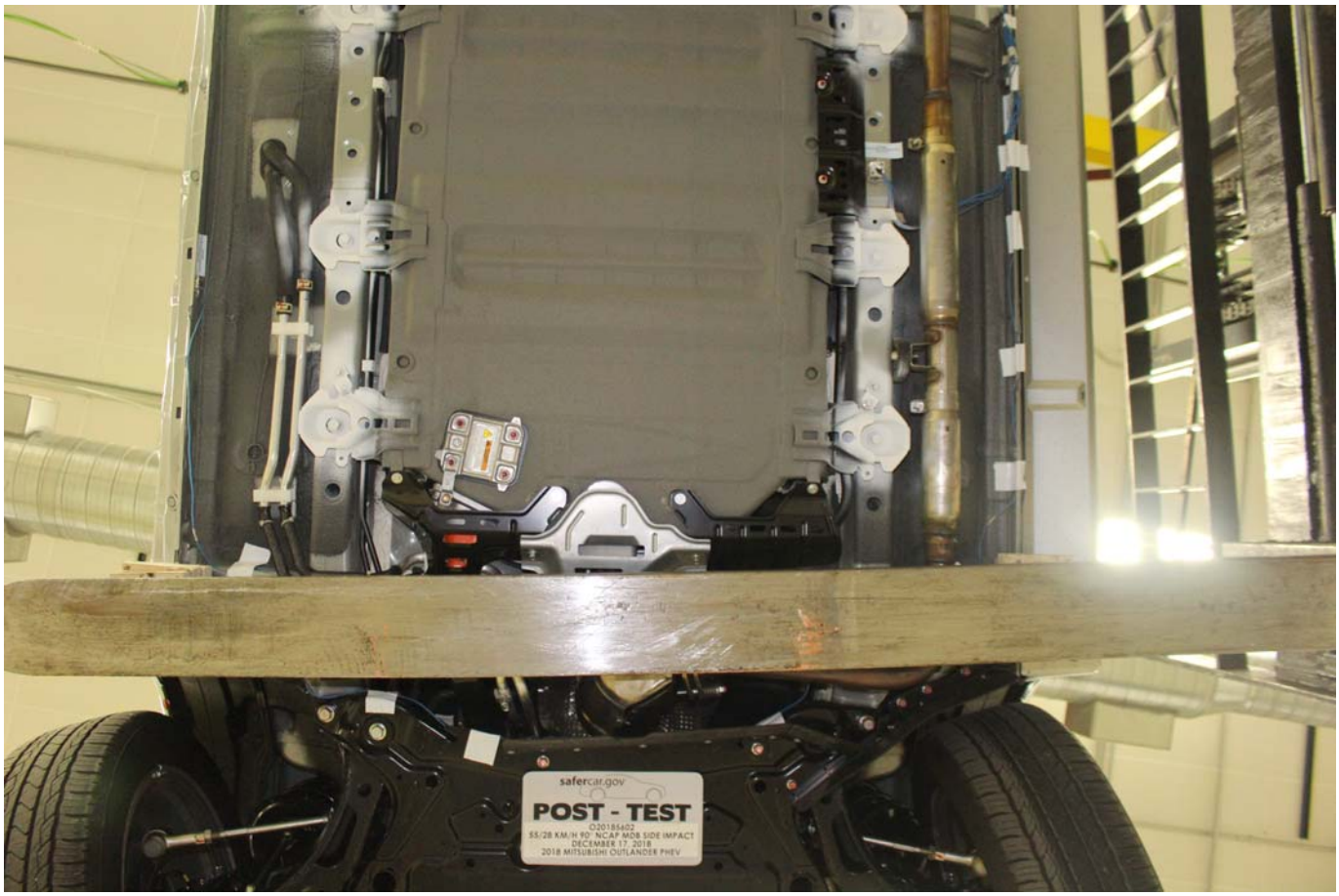


Photo No. 009 - Post-Impact Front View of Propulsion Battery

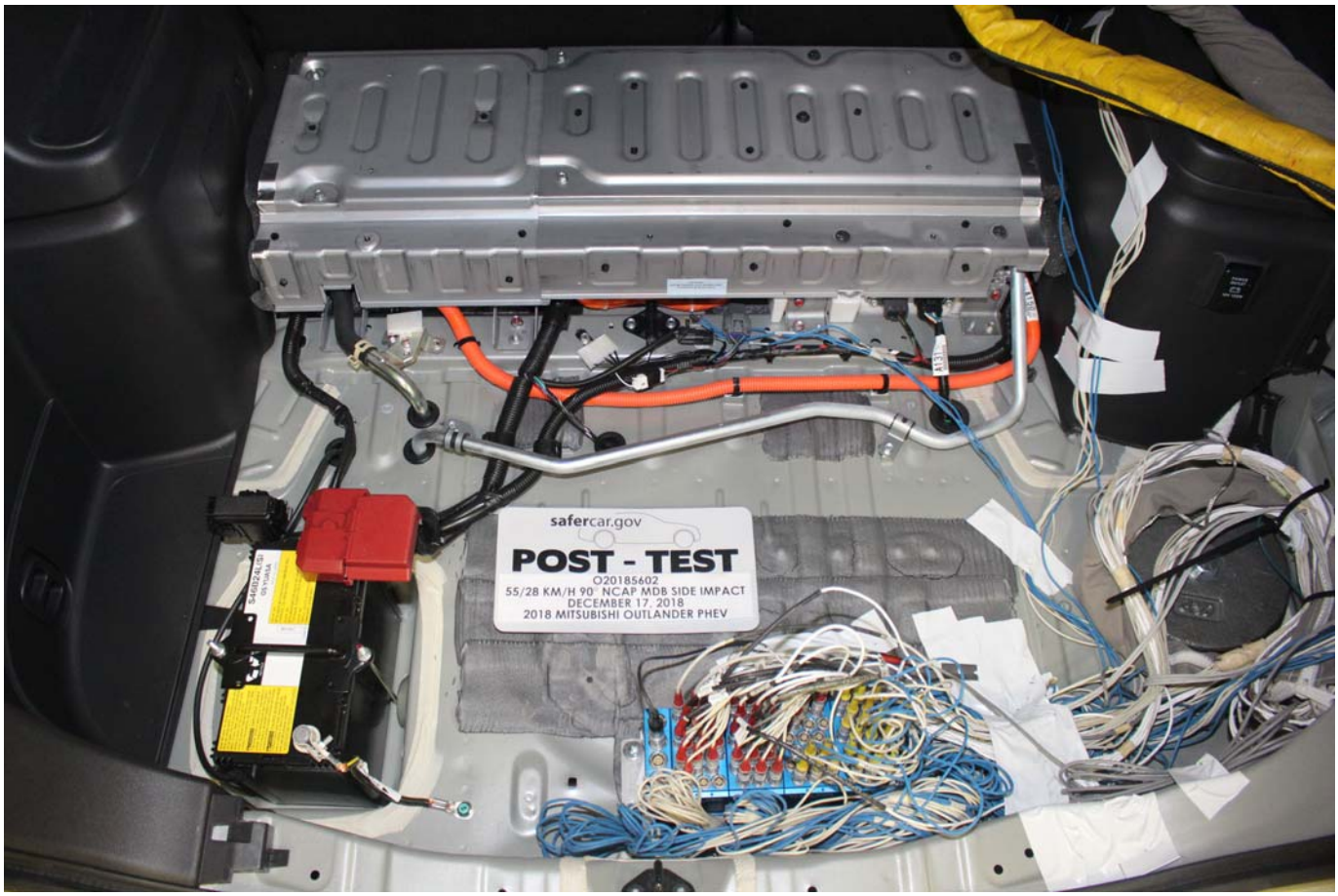


Photo No. 010 - Post-Impact Rear View of Propulsion Battery

PHOTOGRAPH NOT AVAILABLE

Photo No. 011 - Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

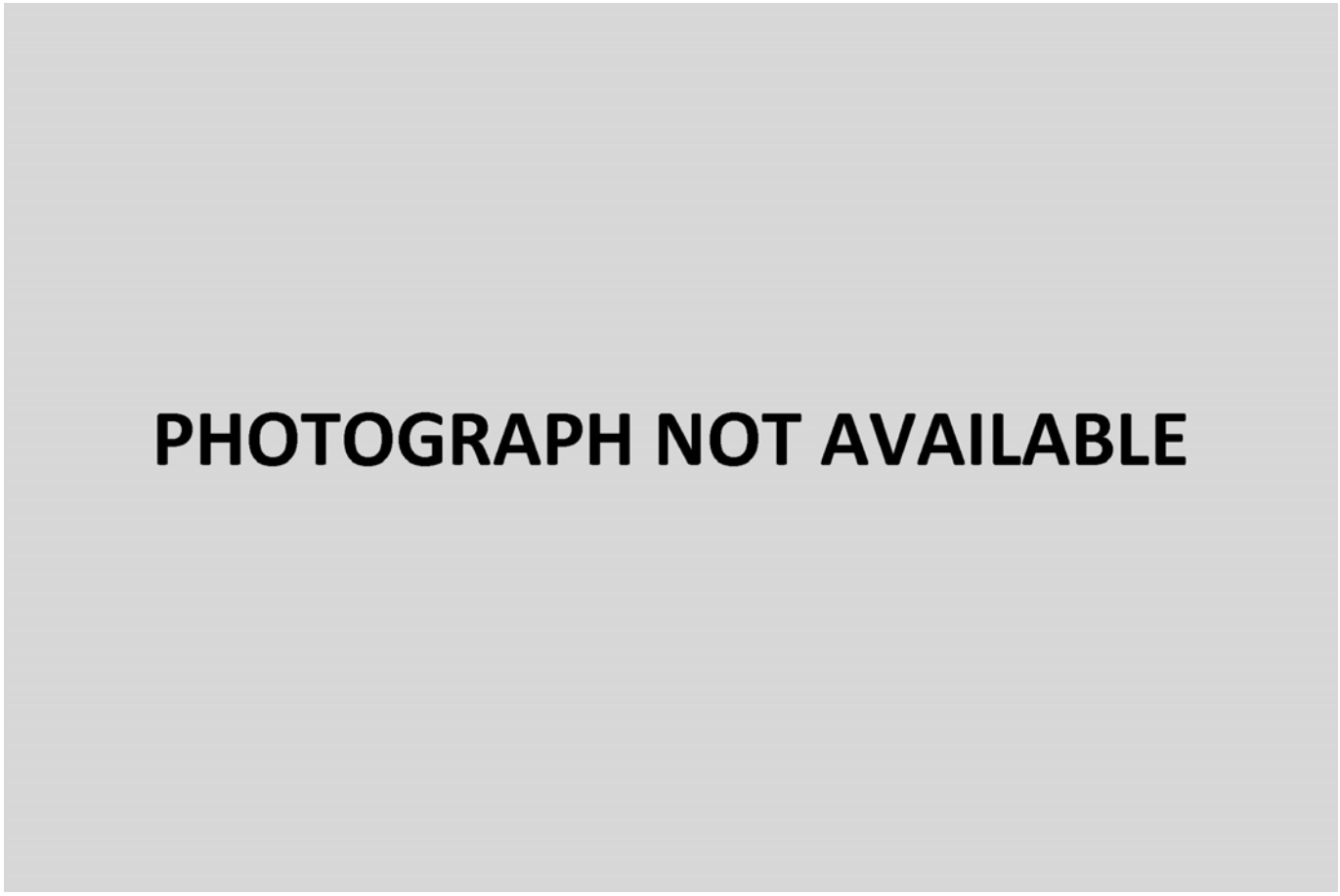


Photo No. 012 - Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

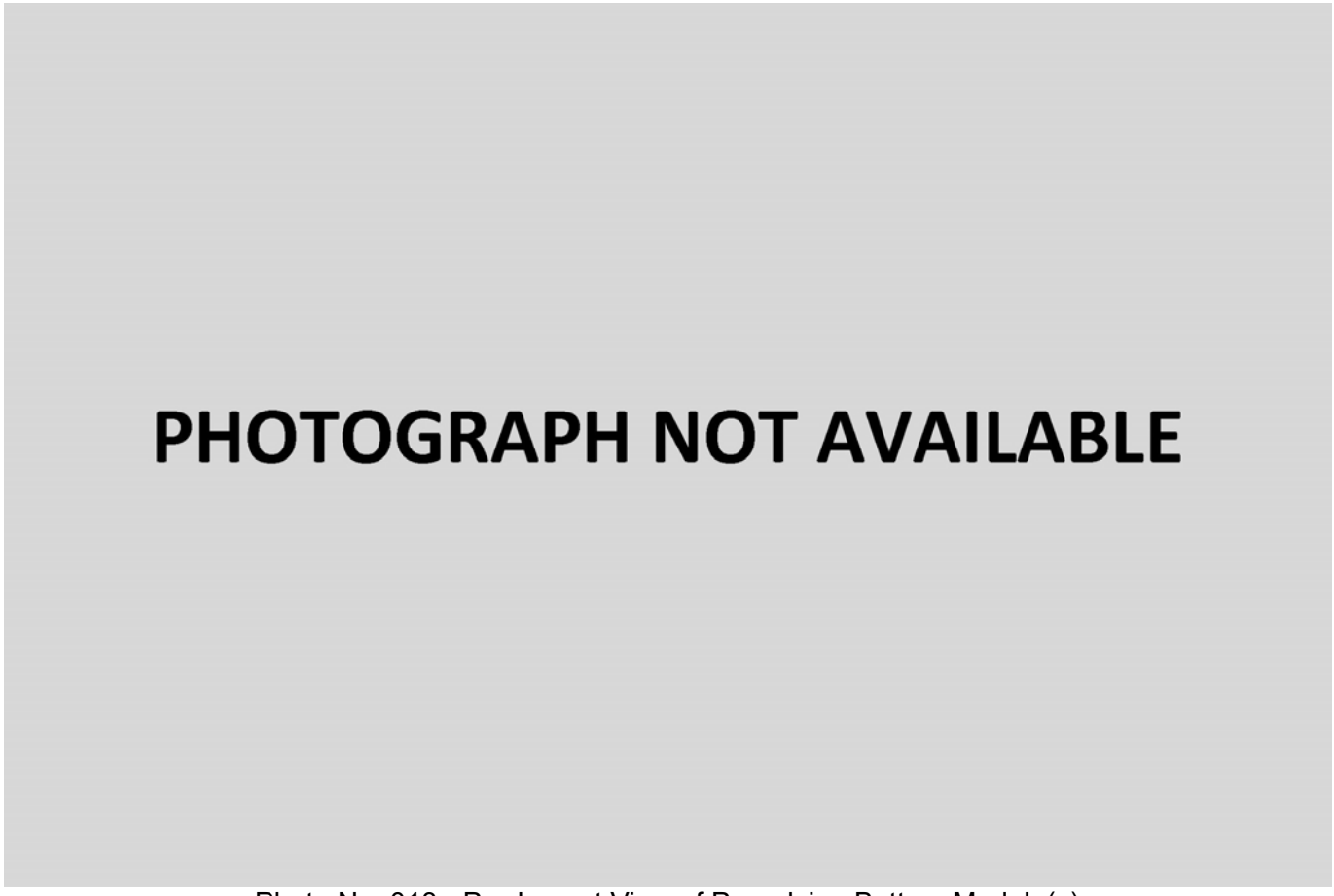


Photo No. 013 - Pre-Impact View of Propulsion Battery Module(s)

PHOTOGRAPH NOT AVAILABLE

Photo No. 014 - Post-Impact View of Propulsion Battery Module(s)

Photo No. 015 - Pre-Impact View of Electric Propulsion Drive

Photo No. 015a - Pre-Impact View of Electric Propulsion Drive

PHOTOGRAPH NOT AVAILABLE

Photo No. 016 - Post-Impact View of Electric Propulsion Drive

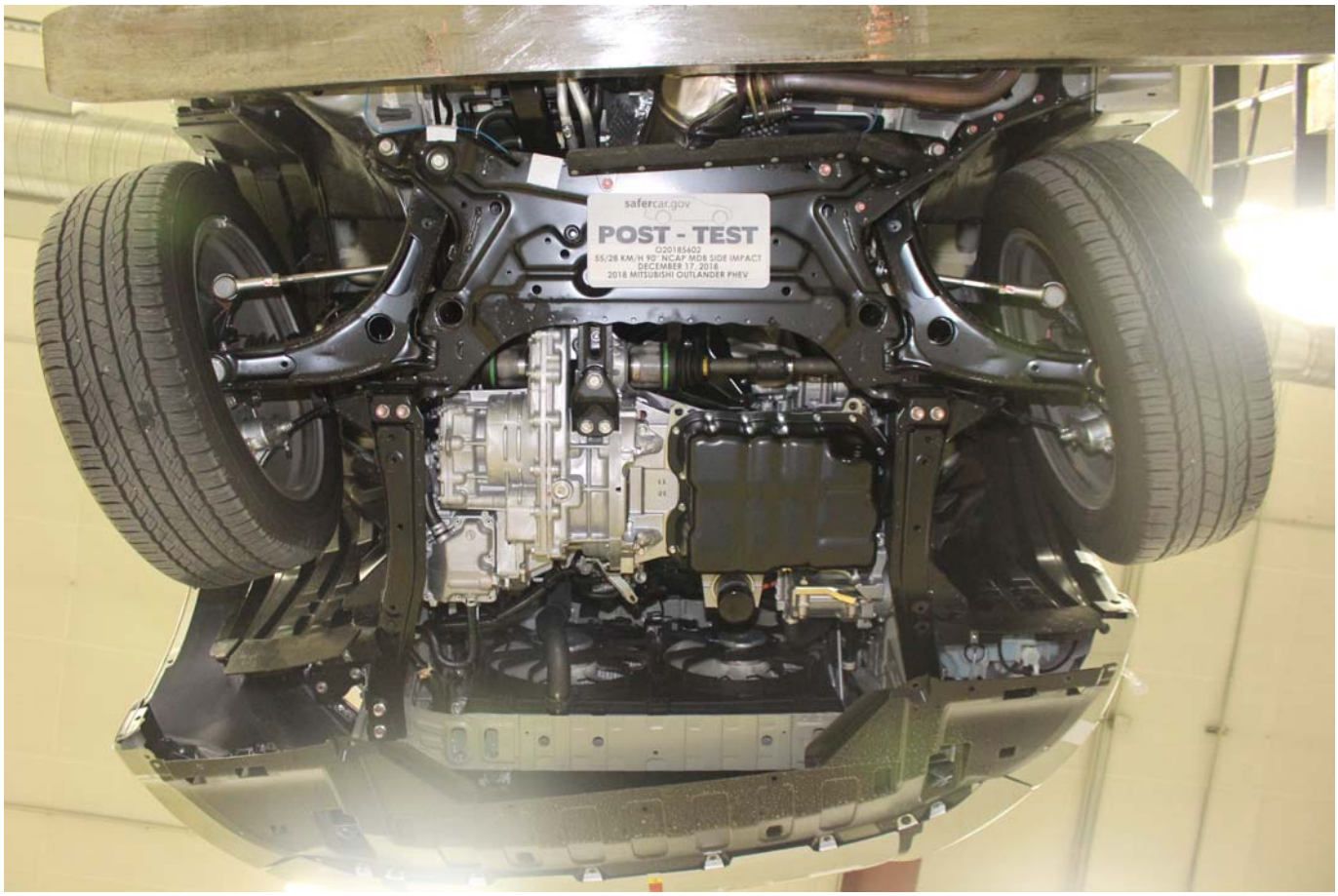


Photo No. 016a - Post-Impact View of Electric Propulsion Drive

PHOTOGRAPH NOT AVAILABLE

Photo No. 017 - Pre-Impact View of High Voltage Interconnect(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 018 - Pre-Impact View Propulsion Battery Venting System(s)

Photo No. 019 - Pre-Impact View of Other Visible Electric Propulsion Components

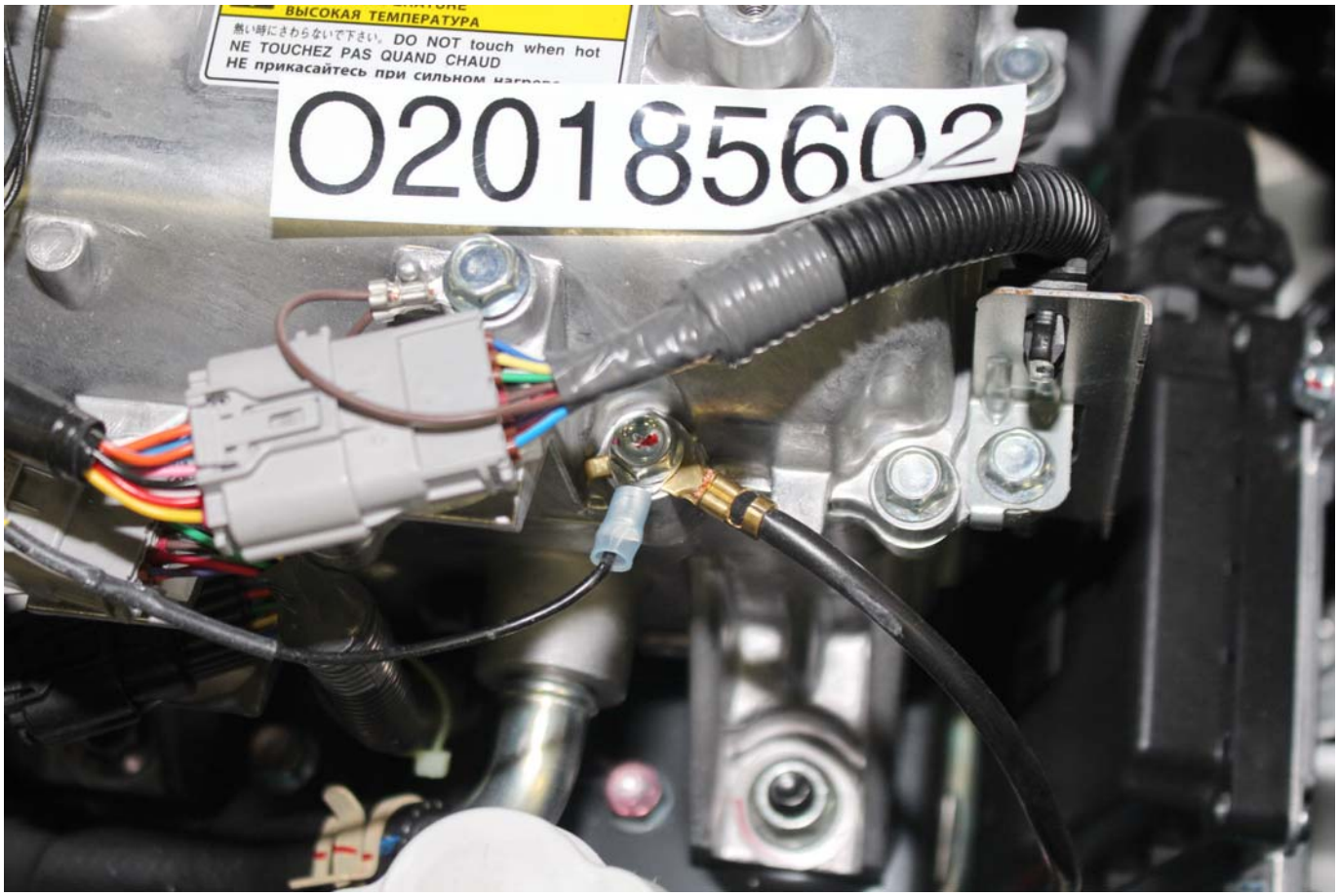


Photo No. 020 - Pre-Impact View of Ground Lead Attached

Photo No. 021 - Pre-Impact View of High Voltage Leads Attached

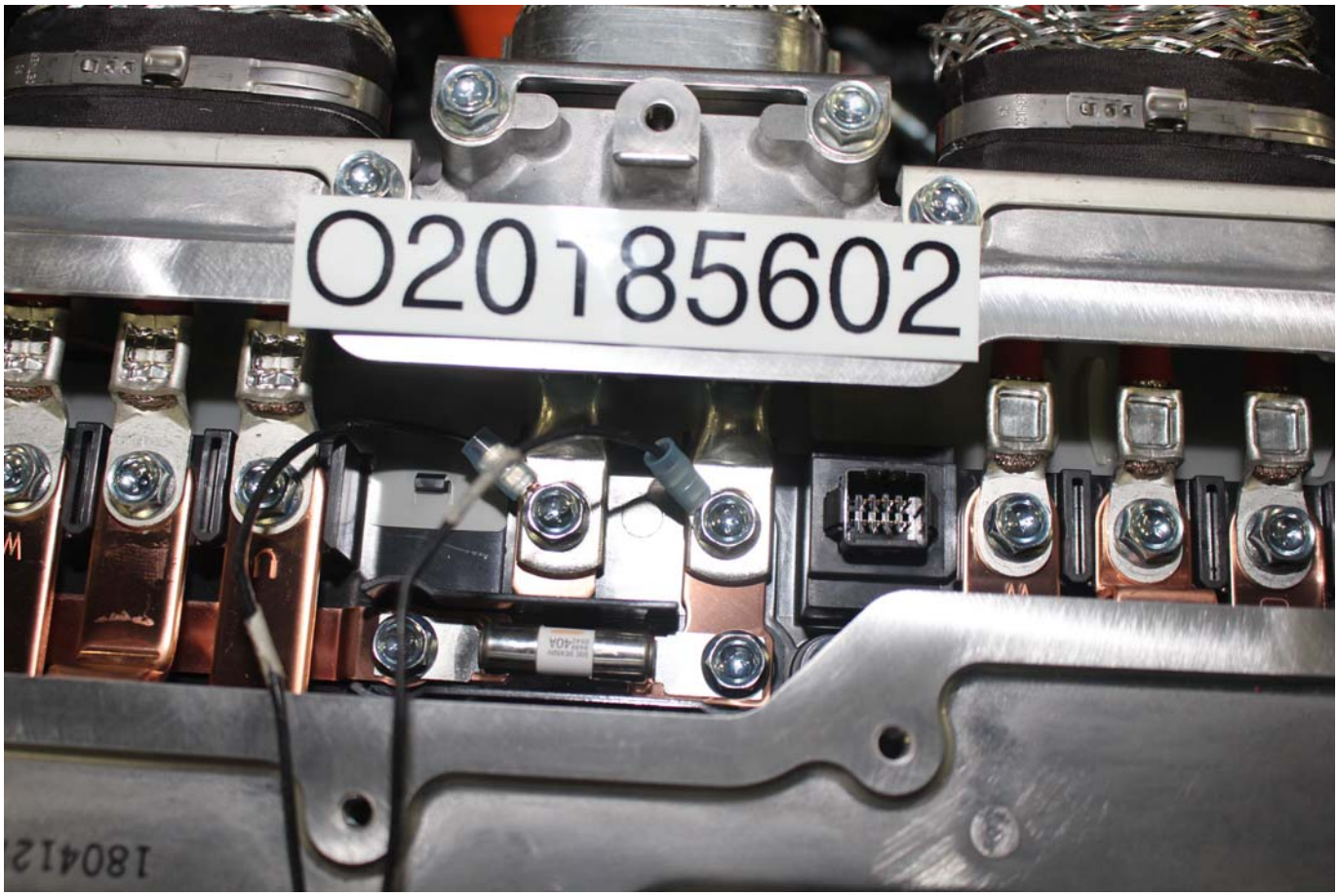


Photo No. 022 - Pre-Impact Close-Up View of High Voltage Leads Attached

PHOTOGRAPH NOT AVAILABLE

Photo No. 023 - Pre-Impact View of Installed Impact Interface Port

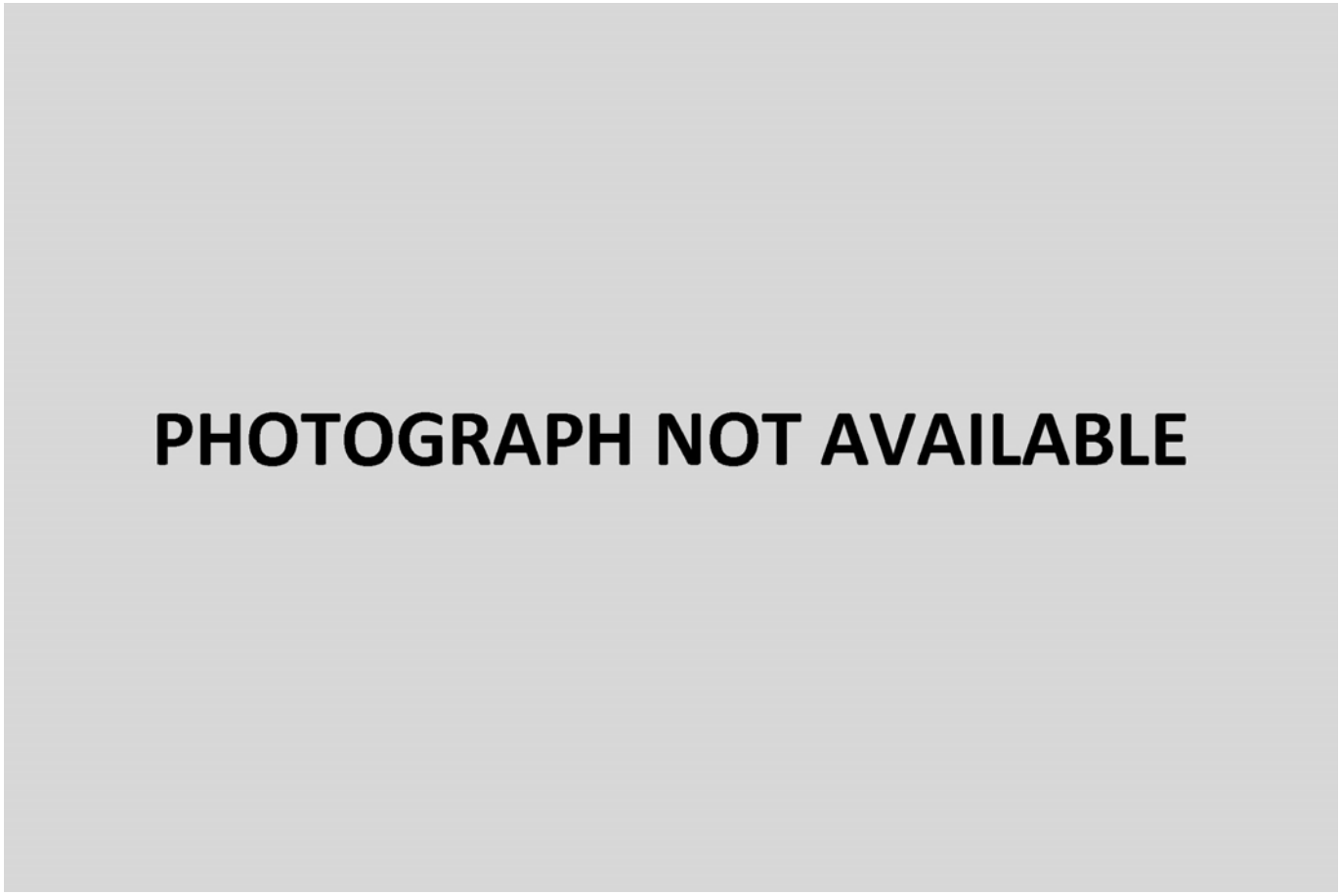


Photo No. 024 - Post-Impact View of Installed Impact Interface Port

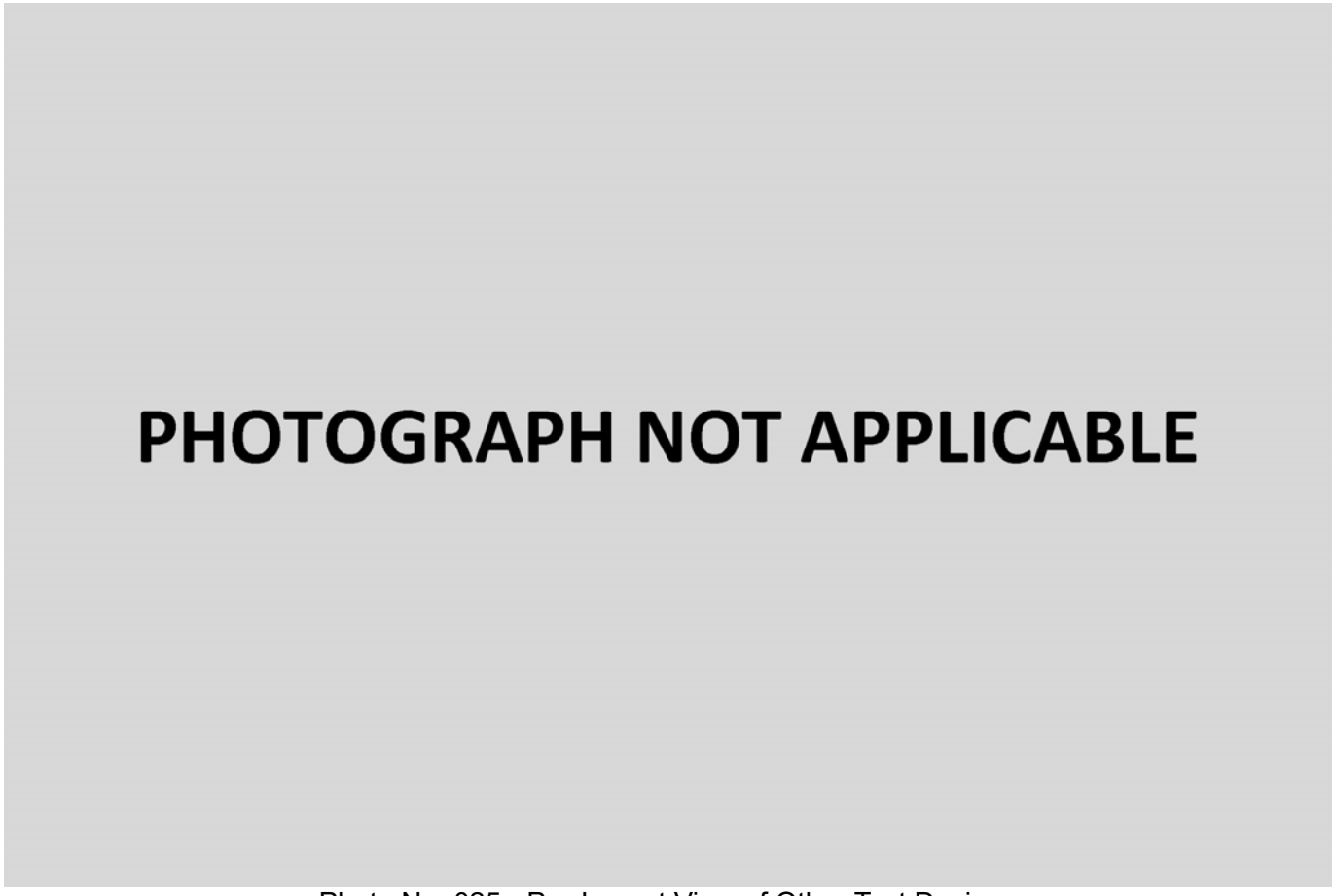


Photo No. 025 - Pre-Impact View of Other Test Devices

PHOTOGRAPH NOT APPLICABLE

Photo No. 026 - Post-Impact View of Other Test Devices

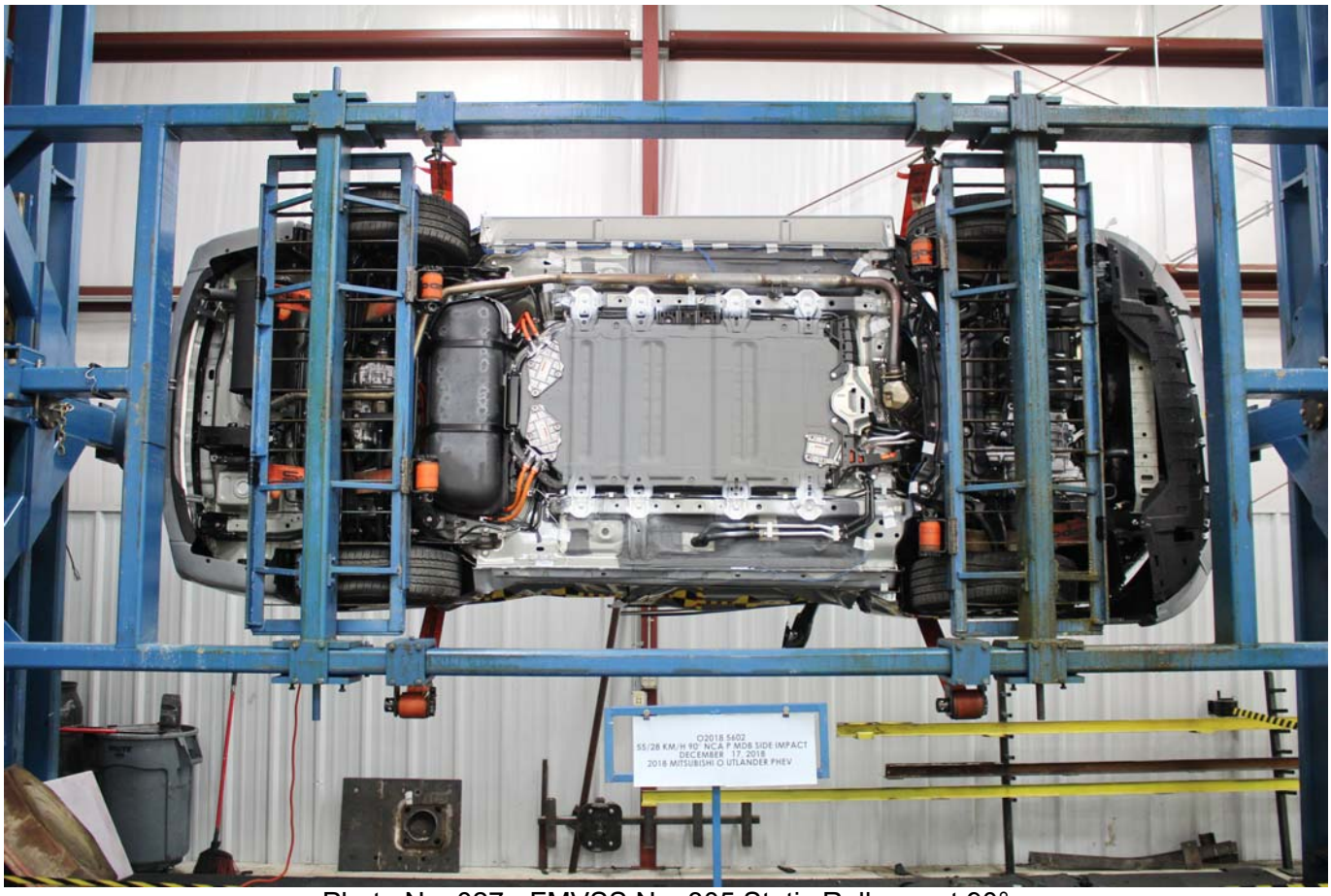


Photo No. 027 - FMVSS No. 305 Static Rollover at 90°

Photo No. 028 - FMVSS No. 305 Static Rollover at 180°

Photo No. 029 - FMVSS No. 305 Static Rollover at 270°

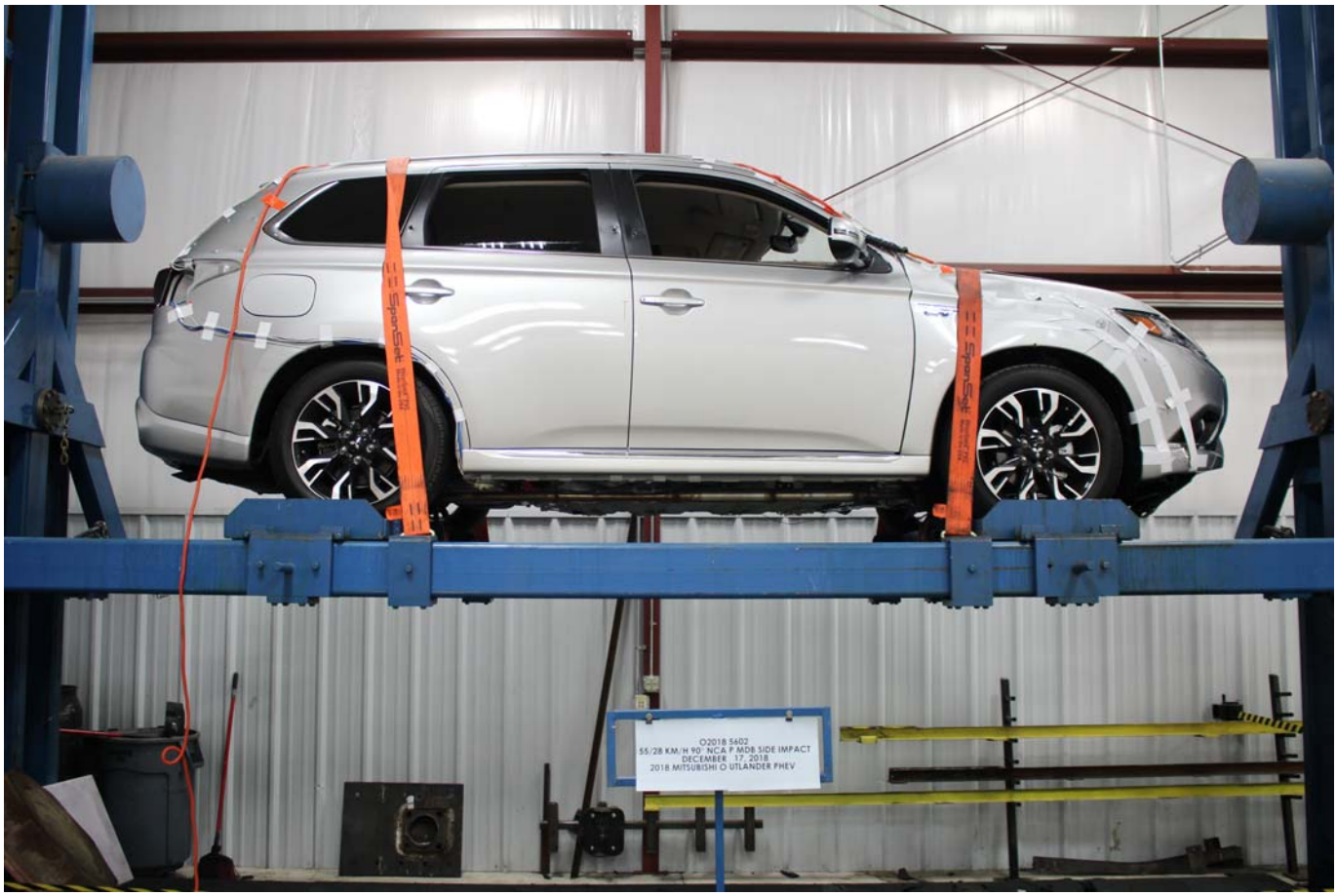


Photo No. 030 - FMVSS No. 305 Static Rollover at 360°

Photo No. 031 - Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo No. 032 - Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

PHOTOGRAPH NOT APPLICABLE

Photo No. 033 - Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 034 - Post-Impact View of Battery Component Intrusion

Photo No. 035 - Post-Impact View of Battery Module Movement or Retention Loss

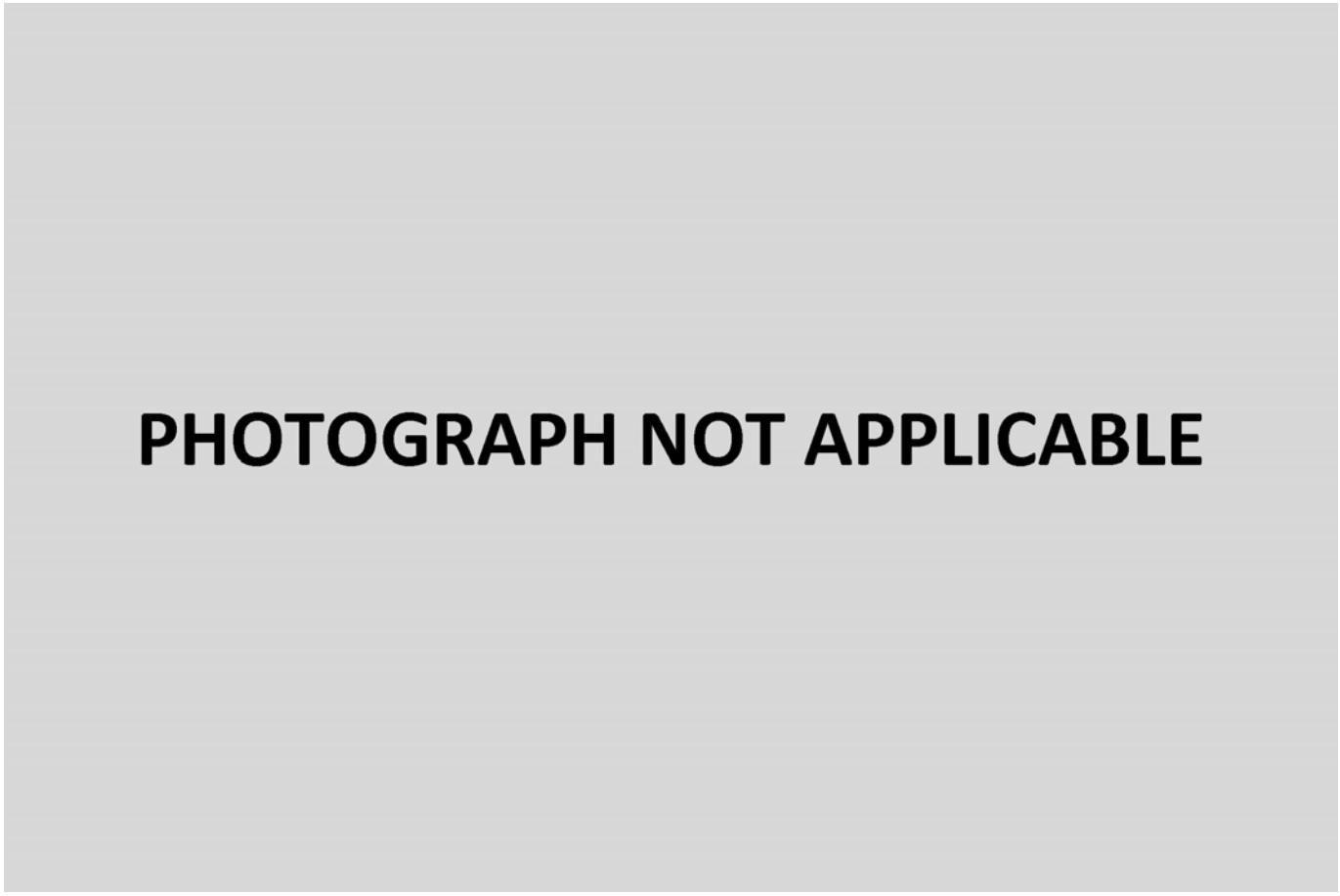


Photo No. 036 - Post-Impact View of Propulsion Battery Electrolyte Spillage Location

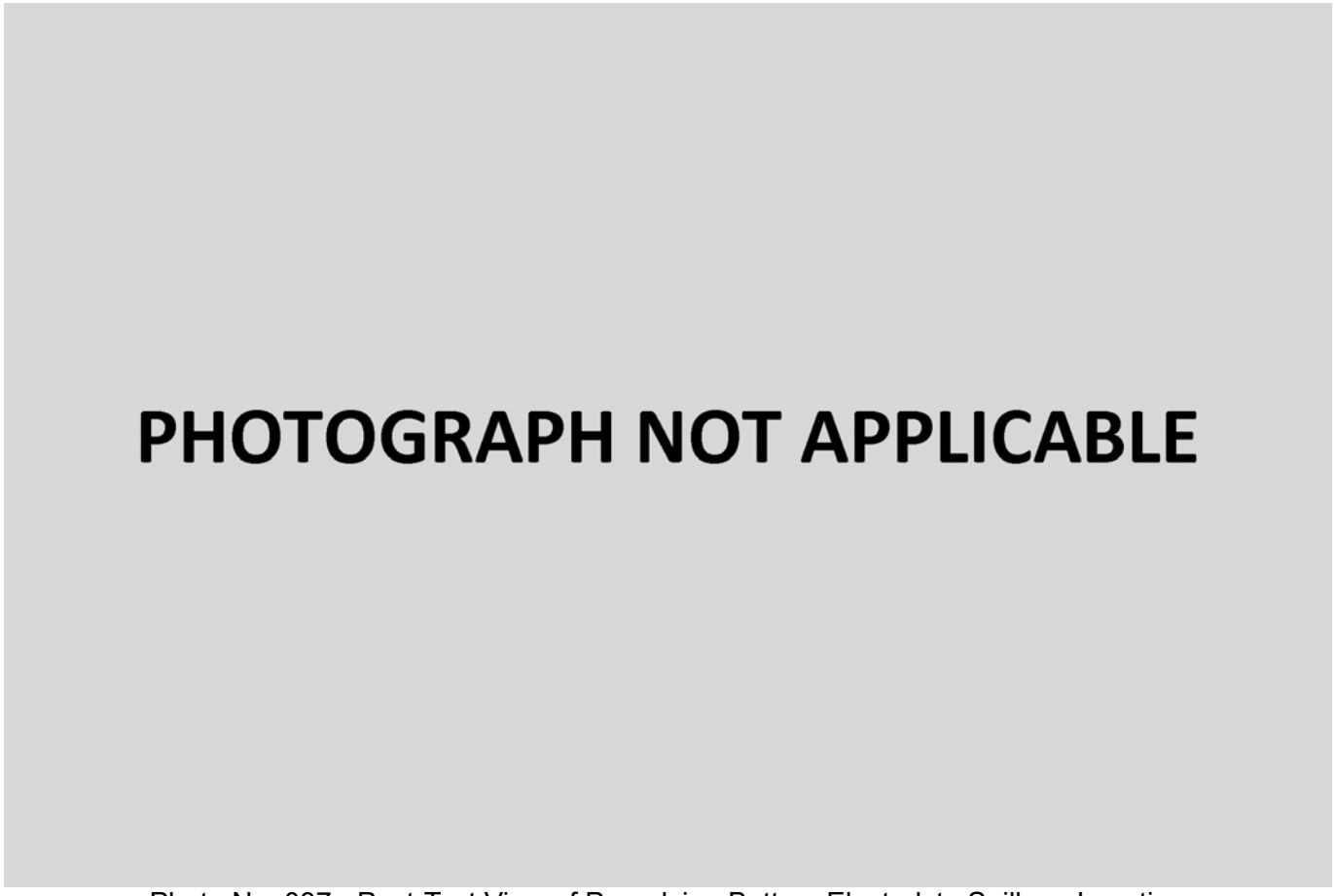


Photo No. 037 - Post-Test View of Propulsion Battery Electrolyte Spillage Location

Photo No. 038 - As Delivered Right Front Three-Quarter View of Impact Vehicle

Photo No. 039 - As Delivered Left Rear Three-Quarter View of Impact Vehicle

Photo No. 040 - Vehicle's Certification Label

Photo No. 041 - Vehicle's Tire Information Placard or Label