

REPORT NUMBER: NCAP305I-MGA-2016-003

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

**TOYOTA MOTOR CORPORATION
2016 Toyota Prius Two 5-Door Hatchback
NHTSA No.: M20165108**

**MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105**



Test Date: March 11, 2016

Report Date: May 9, 2016

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: May 9, 2016

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

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		15. Supplementary Notes			
16. Abstract An FMVSS No. 305 Indicant test, in conjunction with an NCAP frontal barrier impact test was conducted on the subject 2016 Toyota Prius Two 5-Door Hatchback 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.					
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TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	Purpose of Test	1
2	Summary of Test Results	2
3	Data Sheets	3
<u>Data Sheet</u>		<u>Page No.</u>
1	Test Vehicle Specifications	4
2	Pre-Impact Data	6
3	Pre-Impact Electric Isolation Measurements and Calculations	7
4	Post-Impact Data	9
5	Static Rollover Test Data	11
<u>Appendix</u>		
A	Photographs	A-1

SECTION 1

PURPOSE OF TEST

An FMVSS No. 305 Indicant test, in conjunction with an NCAP frontal barrier impact test was conducted on the subject 2016 Toyota Prius Two 5-Door Hatchback.

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 2016 New Car Assessment Program Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract DTNH22-12-D-00258.

SECTION 2 SUMMARY OF TEST RESULTS

A frontal barrier impact test was performed by MGA Research Corporation on a 2016 Toyota Prius Two 5-Door Hatchback on March 11, 2016. 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 2016 Toyota Prius Two 5-Door Hatchback 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

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 3
DATA SHEETS

**DATA SHEET 1
TEST VEHICLE SPECIFICATIONS**

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

TEST VEHICLE INFORMATION

Year/Make/Model/Body Style	2016 Toyota Prius Two 5-Door Hatchback
NHTSA No.	M20165108
Color	Blue Crush Metallic
Odometer Reading	85km / 53mi

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR CORPORATION	GVWR (kg)	1776
Date of Manufacture	12/15	GAWR Front (kg)	1021
VIN:	JTDKBRFU2G3503328	GAWR Rear (kg)	975

ELECTRIC VEHICLE PROPULSION SYSTEM

Type of Electric Vehicle (Electric/Hybrid):	Gasoline/Electric Hybrid
Electric Energy Storage/Device:	Nickel Metal Hydride (NiMH) Battery
Nominal Voltage (V):	201.6 V
Is this vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of the Automatic Propulsion Battery Disconnect:	Physically contained within the hybrid battery system on the passenger side.
Auxiliary Battery Type:	12 V Lead Acid Battery

DATA SHEET 1 (CONTINUED)
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

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

Electrolyte Fluid Type:	Potassium Hydroxide
Electrolyte Fluid Specific Gravity:	1.269 (g/cc)
Electrolyte Kinematic Viscosity (centistokes):	1.906 (mPa·s) 25° C
Electrolyte Fluid Color:	Clear Liquid (APHA $\leq$ 80)
Electric Energy Storage/Conversion System Coolant Type, Color, Specific Gravity (if applicable):	Air Cooled System
Location of Battery Modules:	X Inside Passenger Compartment
	Outside Passenger Compartment
	The high voltage battery is mounted under the rear seat cushion.

ELECTRIC ENERGY STORAGE CONVERSION/DEVICE STATE OF CHARGE

<i>For all battery types:</i>	
Voltage range corresponding to useable energy of the battery:	
Minimum State of Charge:	210 V
Maximum State of Charge:	230 V
95% of Maximum State of Charge:	218.5 V
Test Voltage - No less than 95% of maximum State of Charge:	225.5 V
<i>For batteries that are rechargeable ONLY by an energy source on the vehicle:</i>	
Voltage range corresponding to useable energy of the battery:	
Minimum State of Charge:	210 V
Maximum State of Charge:	230 V
Test Voltage – Maximum practicable State of Charge within Normal Operating Range:	225.5 V

**DATA SHEET 2
PRE-IMPACT DATA**

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	Right Rear Side of Vehicle Body Paint was removed before ground was attached.
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ELECTRIC ENERGY STORAGE/CONVERSION TEST POINTS

Details of Electric Energy Storage/Conversion System Test Points:	+ and – Terminal Used at Terminal Ends of DCDC Controller
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DATA SHEET 3
PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS & CALCULATIONS

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

VOLTMETER INFORMATION

Make:	Fluke
Model:	177
Serial Number:	22600211
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Resolution (V):	.001 Volts
Last Calibration Date:	3/2/2016

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):	225.5
---------	-------

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM TO VEHICLE CHASSIS

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

V1 (V):	111.9
V2 (V):	112.4

**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):	123,000
---------	---------

V1' (V) Pre-Impact:	22.6
V2' (V) Pre-Impact:	22.3

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

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

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):	0.4
$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$	
Ri1 (Ω):	3,225,333
V2' (V):	0.3
$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$	
Ri2 (Ω):	4,310,857
Ri = The lesser of Ri1 and Ri2	
Ri Pre-Test (Ω):	3,225,333
Ri/Vb (Ω/V):	14,303
Minimum Electrical Isolation Value is 500 Ω/V	

Is the measured Electrical Isolation Value:	Yes, Pass	No, Fail
$\geq 500 \Omega/V$ without electrical isolation monitoring	X	
$\geq 100 \Omega/V$ with electrical isolation monitoring		

DATA SHEET 4 POST-IMPACT DATA

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

VOLTMETER INFORMATION

Make:	Fluke
Model:	177
Serial Number:	22600211
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	225.5

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):	0.7
---------	-----

ELECTRIC ENERGY STORAGE/CONVERSION SYSTEM VOLTAGE

V1 =	6.3	V	Impact Time:	0	Minutes	55	s
V2 =	4.9	V	Impact Time:	1	Minutes	5	s
V1' =	0.4	V	Impact Time:	1	Minutes	17	s
V2' =	0.3	V	Impact Time:	1	Minutes	25	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 =	3119400	Ω	Impact Time:	0	Minutes	55	s
$Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']$							
Ri2 =	4852400	Ω	Impact Time:	1	Minutes	5	s
Ri = The lesser of Ri1 and Ri2							
Ri =	3119400	Ω	Impact Time:	0	Minutes	55	s
Ri/Vb = electrical Isolation Value/Nominal Battery Voltage							
Minimum Electrical Value is 500 Ω/V							
Ri/Vb =	9210	Ω/V	Impact Time:	0	Minutes	55	s

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

DATA SHEET 4 (CONTINUED)
POST-IMPACT DATA

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

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

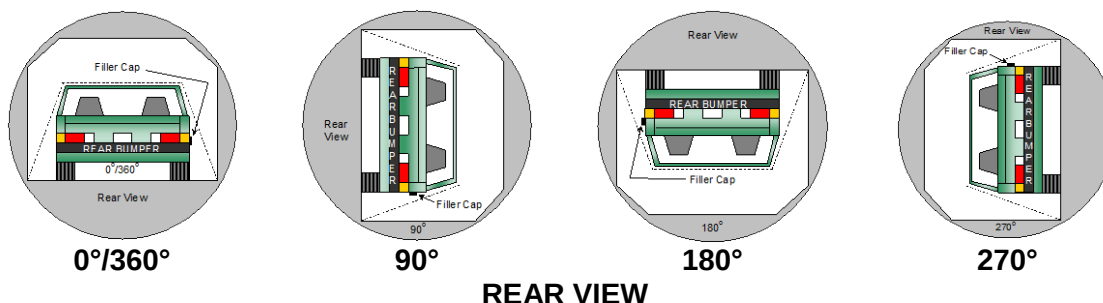
Describe intrusion of an outside Electric Energy Storage/Conversion Device into the passenger compartment [Supply photographs as appropriate]:
No Intrusion

	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: 2016 Toyota Prius Two 5-Door Hatchback
NHTSA No. M20165108



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	56	seconds	5	minutes	6	Minutes	56	seconds	7	minutes
90° - 180°	1	minutes	50	seconds	5	minutes	6	minutes	50	seconds	7	minutes
180° - 270°	1	Minutes	47	seconds	5	minutes	6	minutes	47	seconds	7	minutes
270° - 360°	1	minutes	49	seconds	5	minutes	6	minutes	49	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: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

VOLTMETER INFORMATION

Make:	Fluke
Model:	177
Serial Number:	22600211
Internal Impedance Value (MΩ):	> 10 MΩ < 100 pF
Nominal Electric Energy Storage/Conversion Device Voltage (Vb) (V):	225.5
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 =	2.6	V	0°	Time:		Minutes		s
V1 =	2.6	V	90°	Time:	2	Minutes	4	s
V1 =	2.6	V	180°	Time:	2	Minutes	18	s
V1 =	2.6	V	270°	Time:	2	Minutes	8	s
V1 =	2.6	V	360°	Time:	2	Minutes	12	s
V2 =	2.6	V	0°	Time:		Minutes		s
V2 =	2.6	V	90°	Time:	2	Minutes	8	s
V2 =	2.6	V	180°	Time:	2	Minutes	22	s
V2 =	2.6	V	270°	Time:	2	Minutes	12	s
V2 =	2.6	V	360°	Time:	2	Minutes	20	s
V1' =	0.2	V	0°	Time:		Minutes		s
V1' =	0.2	V	90°	Time:	2	Minutes	15	s
V1' =	0.2	V	180°	Time:	2	Minutes	30	s
V1' =	0.2	V	270°	Time:	2	Minutes	19	s
V1' =	0.2	V	360°	Time:	2	Minutes	25	s
V2' =	0.2	V	0°	Time:		Minutes		s
V2' =	0.2	V	90°	Time:	2	Minutes	22	s
V2' =	0.2	V	180°	Time:	2	Minutes	35	s
V2' =	0.2	V	270°	Time:	2	Minutes	29	s
V2' =	0.2	V	360°	Time:	2	Minutes	31	s
Vb =	0.0	V	0°	Time:		Minutes		s
Vb =	0.0	V	90°	Time:	2	Minutes	1	s
Vb =	0.0	V	180°	Time:	2	Minutes	14	s
Vb =	0.0	V	270°	Time:	2	Minutes	4	s
Vb =	0.0	V	360°	Time:	2	Minutes	10	s

DATA SHEET 5 (CONTINUED)
STATIC ROLLOVER TEST DATA

Test Vehicle: 2016 Toyota Prius Two 5-Door Hatchback

NHTSA No.: M20165108

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.

$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$								
R _{i1} =	2,952,000	Ω	0°	Time:		Minutes		s
R _{i1} =	2,952,000	Ω	90°	Time:	2	Minutes	15	s
R _{i1} =	2,952,000	Ω	180°	Time:	2	Minutes	30	s
R _{i1} =	2,952,000	Ω	270°	Time:	2	Minutes	19	s
R _{i1} =	2,952,000	Ω	360°	Time:	2	Minutes	25	s
$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$								
R _{i2} =	2,952,000	Ω	0°	Time:		Minutes		s
R _{i2} =	2,952,000	Ω	90°	Time:	2	Minutes	22	s
R _{i2} =	2,952,000	Ω	180°	Time:	2	Minutes	35	s
R _{i2} =	2,952,000	Ω	270°	Time:	2	Minutes	29	s
R _{i2} =	2,952,000	Ω	360°	Time:	2	Minutes	31	s
R _i = The lesser of R _{i1} and R _{i2}								
R _i =	2,952,000	Ω	0°	Time:		Minutes		s
R _i =	2,952,000	Ω	90°	Time:	2	Minutes	15	s
R _i =	2,952,000	Ω	180°	Time:	2	Minutes	30	s
R _i =	2,952,000	Ω	270°	Time:	2	Minutes	19	s
R _i =	2,952,000	Ω	360°	Time:	2	Minutes	25	s
R _i /V _b = Electrical Isolation Value/Nominal Battery Voltage Minimum Electrical Isolation Value is 500 Ω /V								
R _i /V _b =	13,090	Ω/V	0°	Time:		Minutes		s
R _i /V _b =	13,090	Ω/V	90°	Time:	2	Minutes	15	s
R _i /V _b =	13,090	Ω/V	180°	Time:	2	Minutes	30	s
R _i /V _b =	13,090	Ω/V	270°	Time:	2	Minutes	19	s
R _i /V _b =	13,090	Ω/V	360°	Time:	2	Minutes	25	s

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

**APPENDIX A
PHOTOGRAPHS**

TABLE OF PHOTOGRAPHS

		<u>Page No.</u>
Photo No. 001	Auxiliary Power Module Warning Label	A-1
Photo No. 002	Power Inverter Warning Label	A-1
Photo No. 003	First Responder Warning Label	A-2
Photo No. 004	First Responder Warning Location	A-2
Photo No. 005	Other Vehicle Label(s) Related to Electrical Propulsion System	A-3
Photo No. 006	Manual High Voltage Service Disconnect in Place	A-3
Photo No. 007	Manual High Voltage Service Disconnect Removed	A-4
Photo No. 007a	Manual High Voltage Service Disconnect Removed	A-4
Photo No. 008	Pre-Impact View of Propulsion Battery	A-5
Photo No. 009	Post-Impact Front View of Propulsion Battery	A-5
Photo No. 010	Post-Impact Rear View of Propulsion Battery	A-6
Photo No. 011	Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules	A-6
Photo No. 012	Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules	A-7
Photo No. 013	Pre-Impact View of Propulsion Battery Module(s)	A-7
Photo No. 014	Post-Impact View of Propulsion Battery Module(s)	A-8
Photo No. 015	Pre-Impact View of Electric Propulsion Drive	A-8
Photo No. 015a	Pre-Impact View of Electric Propulsion Drive	A-9
Photo No. 016	Post-Impact View of Electric Propulsion Drive	A-9
Photo No. 016a	Post-Impact View of Electric Propulsion Drive	A-10
Photo No. 017	Pre-Impact View of High Voltage Interconnect(s)	A-10
Photo No. 018	Pre-Impact View Propulsion Battery Venting System(s)	A-11
Photo No. 019	Pre-Impact View of Other Visible Electric Propulsion Components	A-11
Photo No. 020	Pre-Impact View of Ground Lead Attached	A-12
Photo No. 021	Pre-Impact View of High Voltage Leads Attached	A-12
Photo No. 022	Pre-Impact Close-Up View of High Voltage Leads Attached	A-13
Photo No. 023	Pre-Impact View of Installed Impact Interface Port	A-13
Photo No. 024	Post-Impact View of Installed Impact Interface Port	A-14
Photo No. 025	Pre-Impact View of Other Test Devices	A-14
Photo No. 026	Post-Impact View of Other Test Devices	A-15
Photo No. 027	FMVSS No. 305 Static Rollover at 90°	A-15
Photo No. 028	FMVSS No. 305 Static Rollover at 180°	A-16
Photo No. 029	FMVSS No. 305 Static Rollover at 270°	A-16

		<u>Page No.</u>
Photo No. 030	FMVSS No. 305 Static Rollover at 360°	A-17
Photo No. 031	Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery	A-17
Photo No. 032	Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery	A-18
Photo No. 033	Post-Impact Propulsion Battery System Mounting and/or Intrusion Failure(s)	A-18
Photo No. 034	Post-Impact View of Battery Component Intrusion	A-19
Photo No. 035	Post-Impact View of Battery Module Movement or Retention Loss	A-19
Photo No. 036	Post-Impact View of Propulsion Battery Electrolyte Spillage Location	A-20
Photo No. 037	Post-Test View of Propulsion Battery Electrolyte Spillage Location	A-20
Photo No. 038	As Delivered Right Front $\frac{3}{4}$ View of Impact Vehicle	A-21
Photo No. 039	As Delivered Left Rear $\frac{3}{4}$ View of Impact Vehicle	A-21
Photo No. 040	Vehicle's Certification Label	A-22
Photo No. 041	Vehicle's Tire Information Placard or Label	A-22



Photo No. 001 - Auxiliary Power Module Warning Label

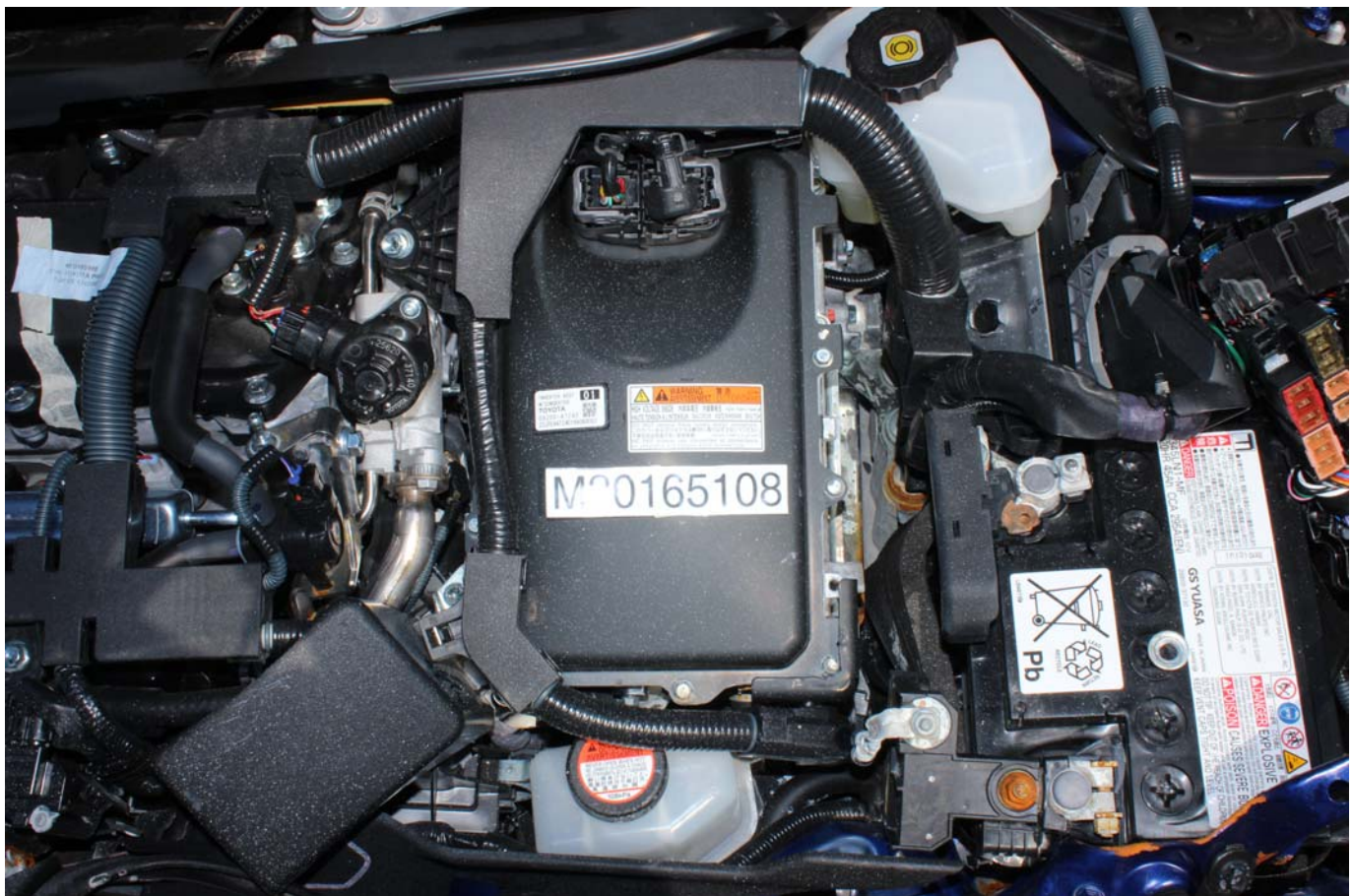


Photo No. 002 - Power Inverter Warning Label

PHOTOGRAPH NOT APPLICABLE

Photo No. 003 - First Responder Warning Label

PHOTOGRAPH NOT APPLICABLE

Photo No. 004 - First Responder Warning Location

PHOTOGRAPH NOT AVAILABLE

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

PHOTOGRAPH NOT AVAILABLE

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



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

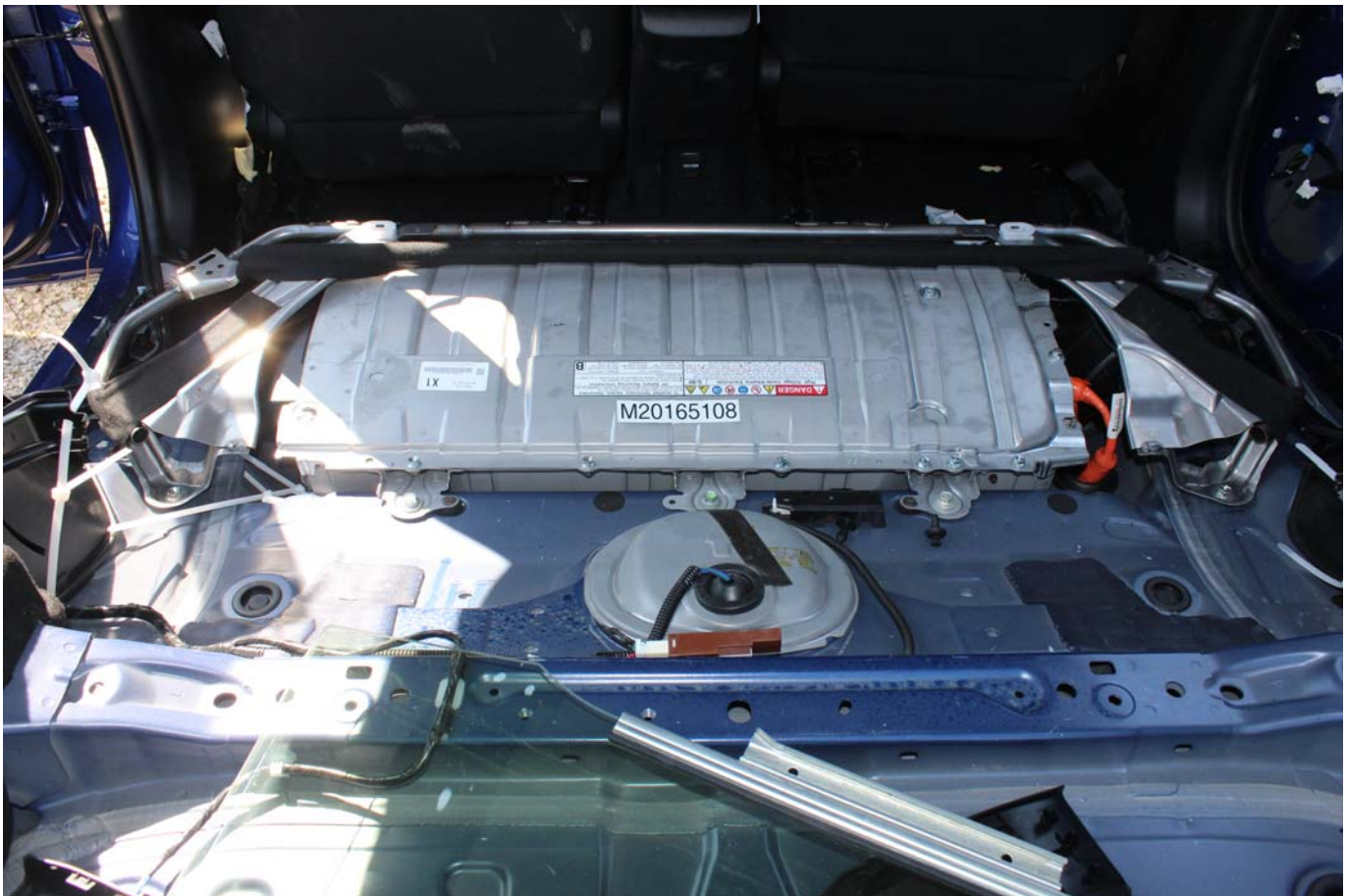


Photo No. 010 - Post-Impact Rear View of Propulsion Battery

PHOTOGRAPH NOT AVAILABLE

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

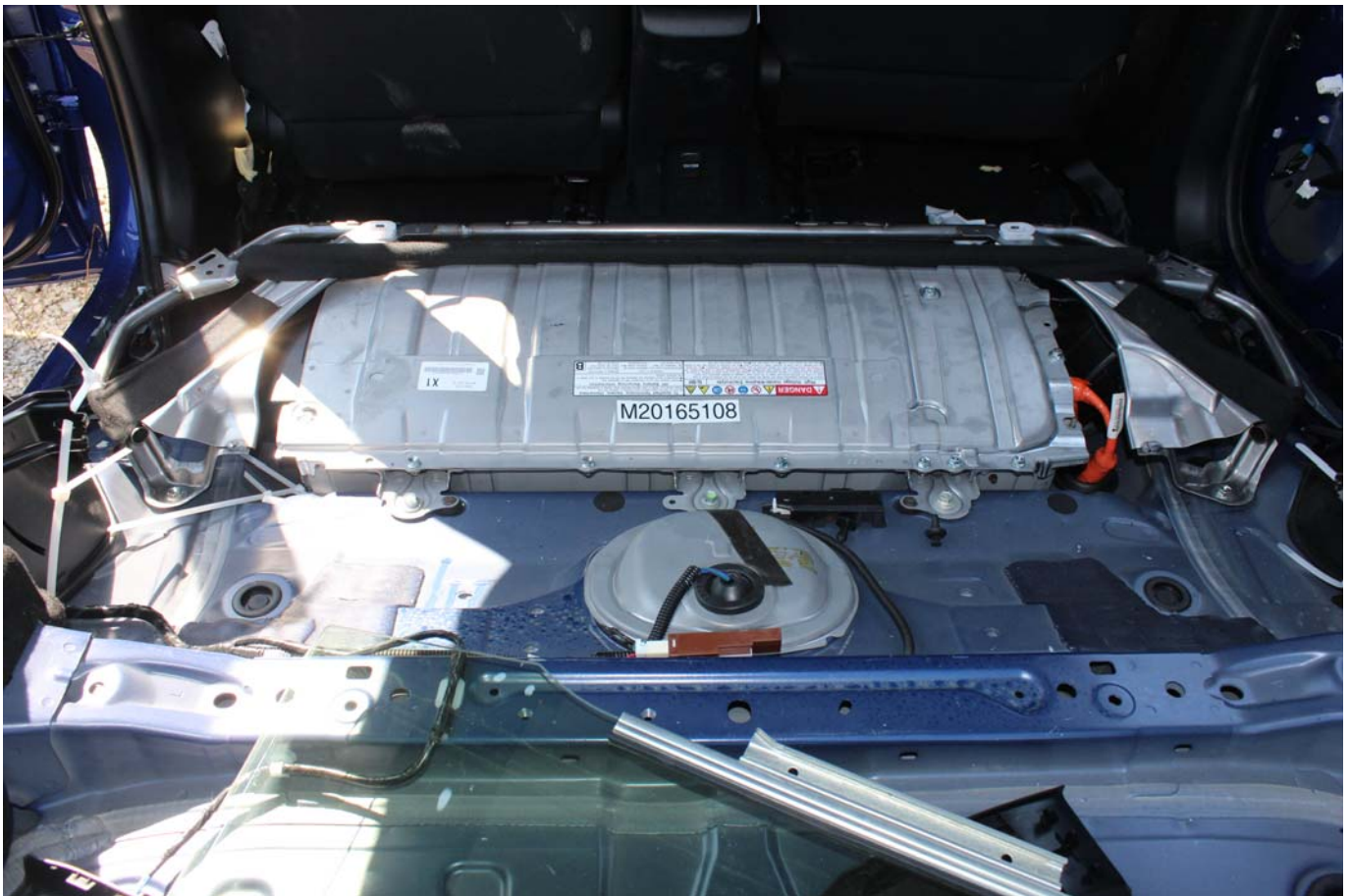


Photo No. 012 - Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

PHOTOGRAPH NOT APPLICABLE

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

PHOTOGRAPH NOT APPLICABLE

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

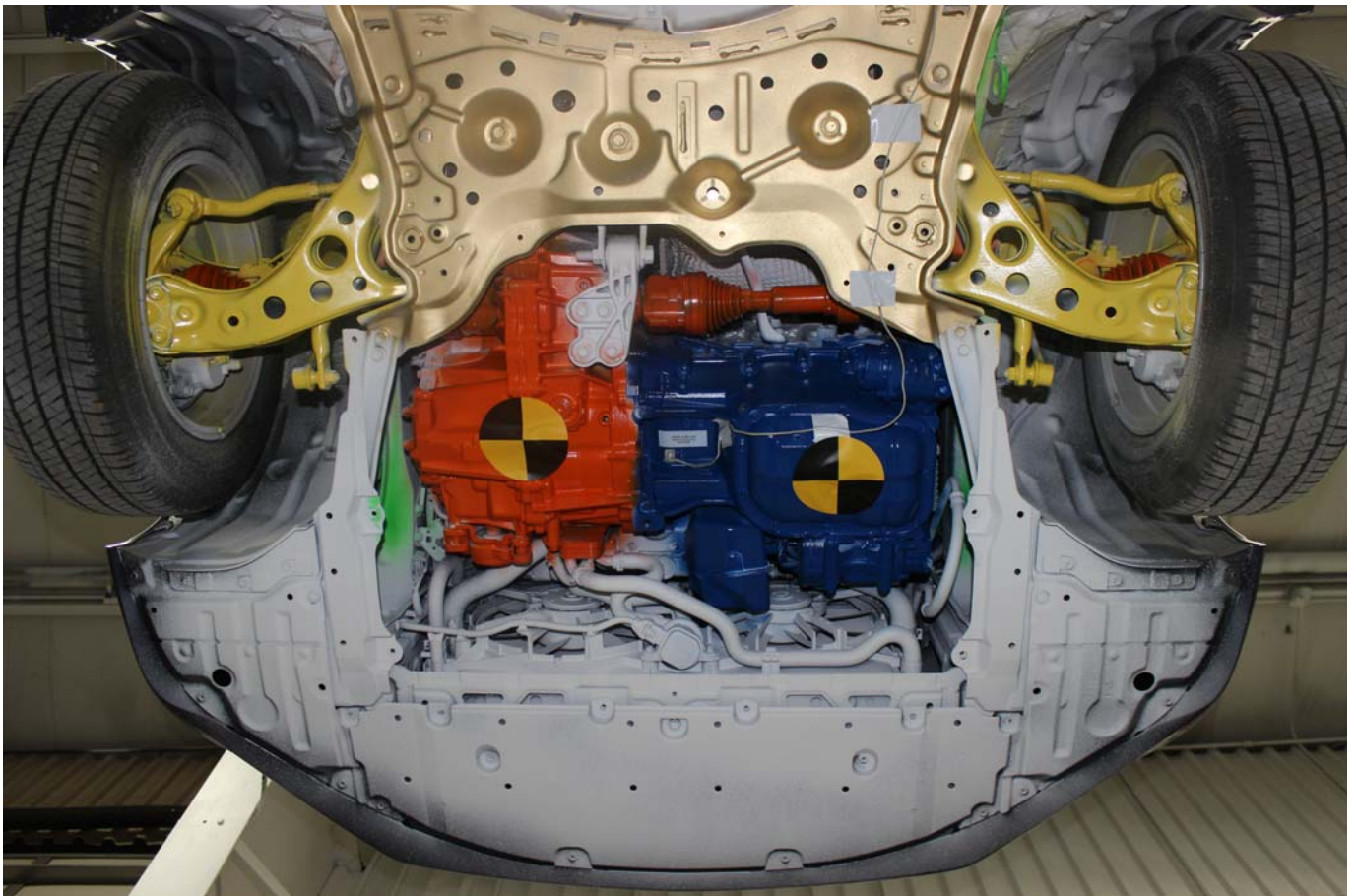


Photo No. 015 - Pre-Impact View of Electric Propulsion Drive



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



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

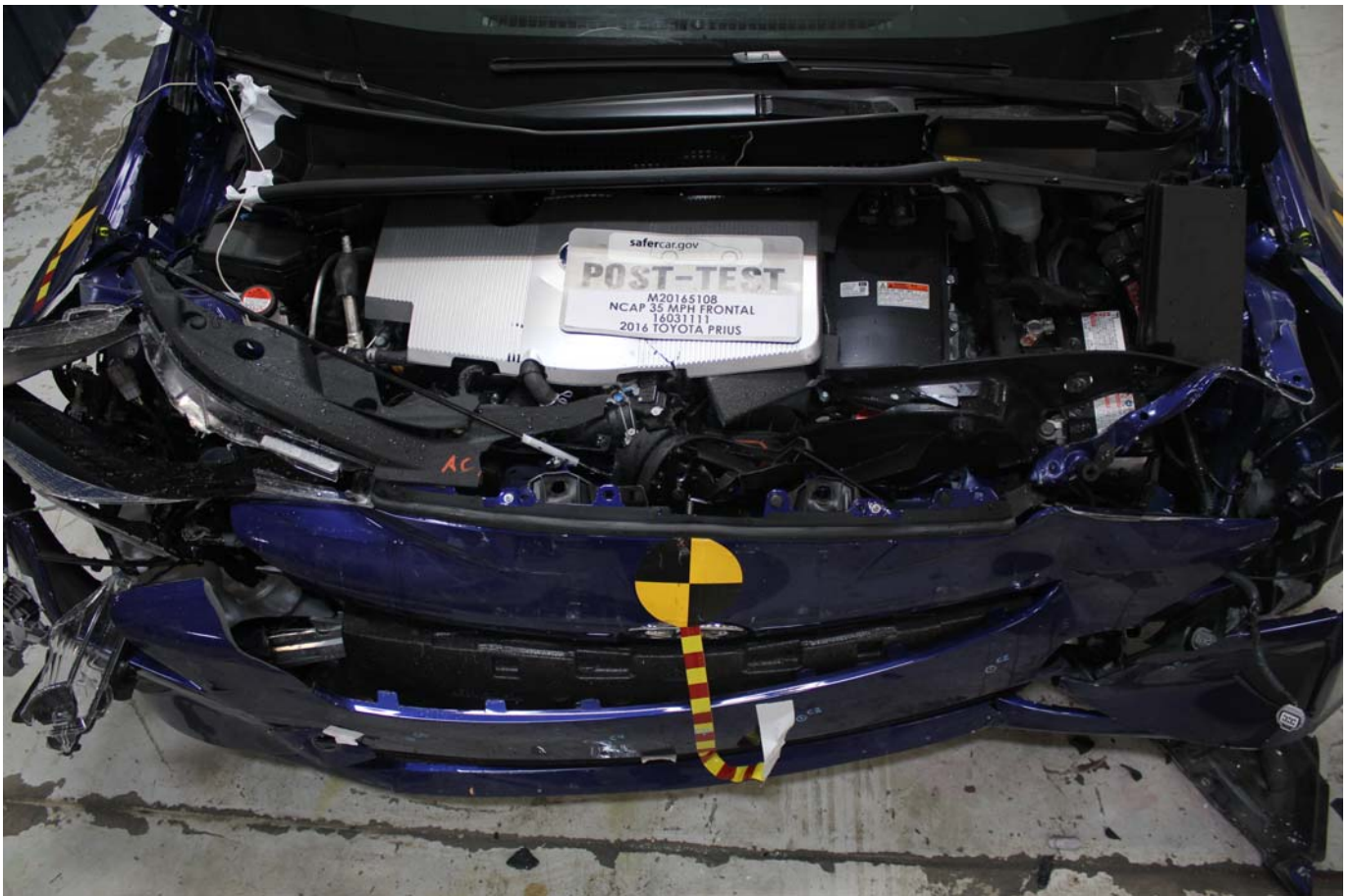


Photo No. 016a - Post-Impact View of Electric Propulsion Drive

PHOTOGRAPH NOT AVAILABLE

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

PHOTOGRAPH NOT AVAILABLE

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

PHOTOGRAPH NOT APPLICABLE

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

PHOTOGRAPH NOT AVAILABLE

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

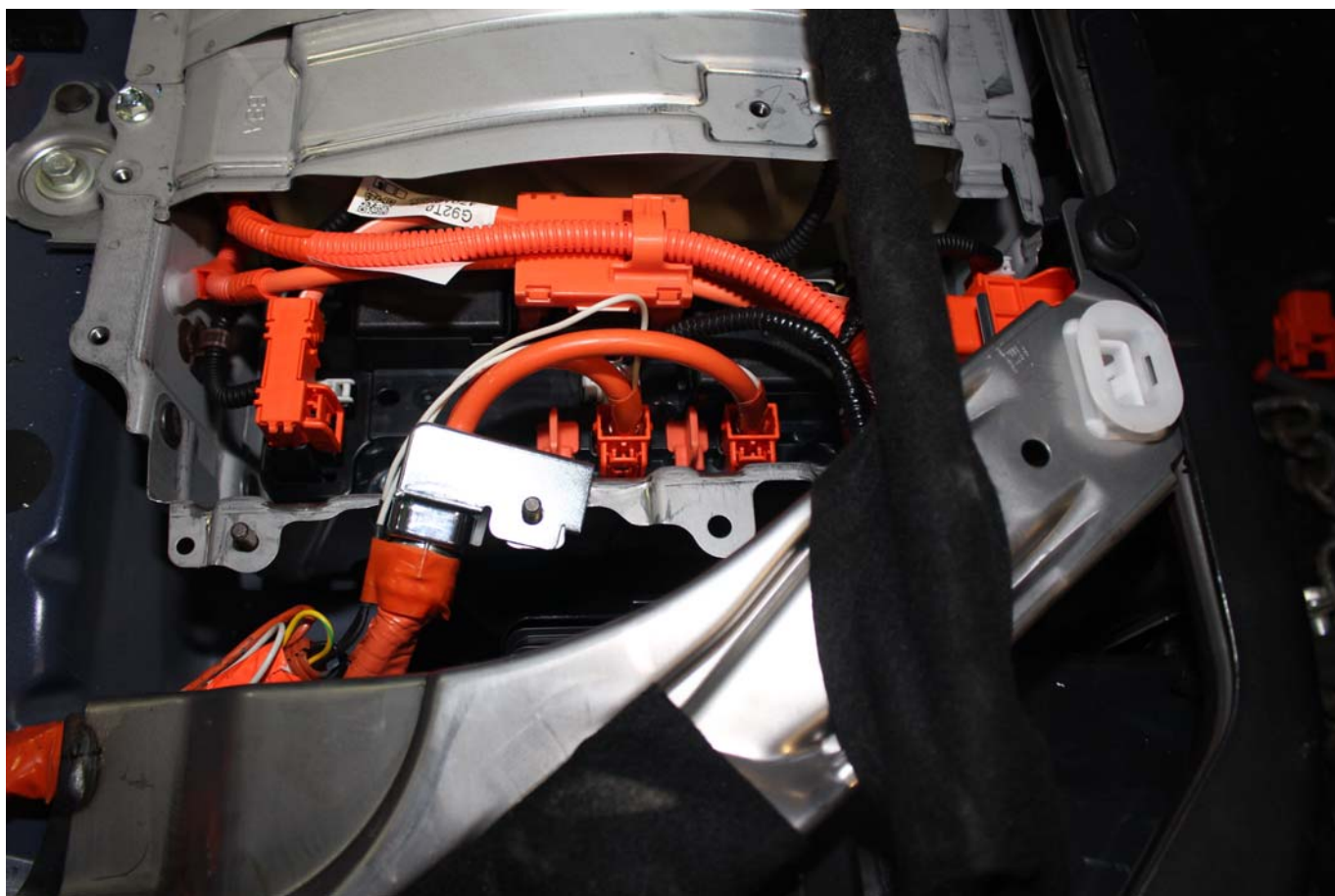


Photo No. 021 - Pre-Impact View of High Voltage Leads Attached

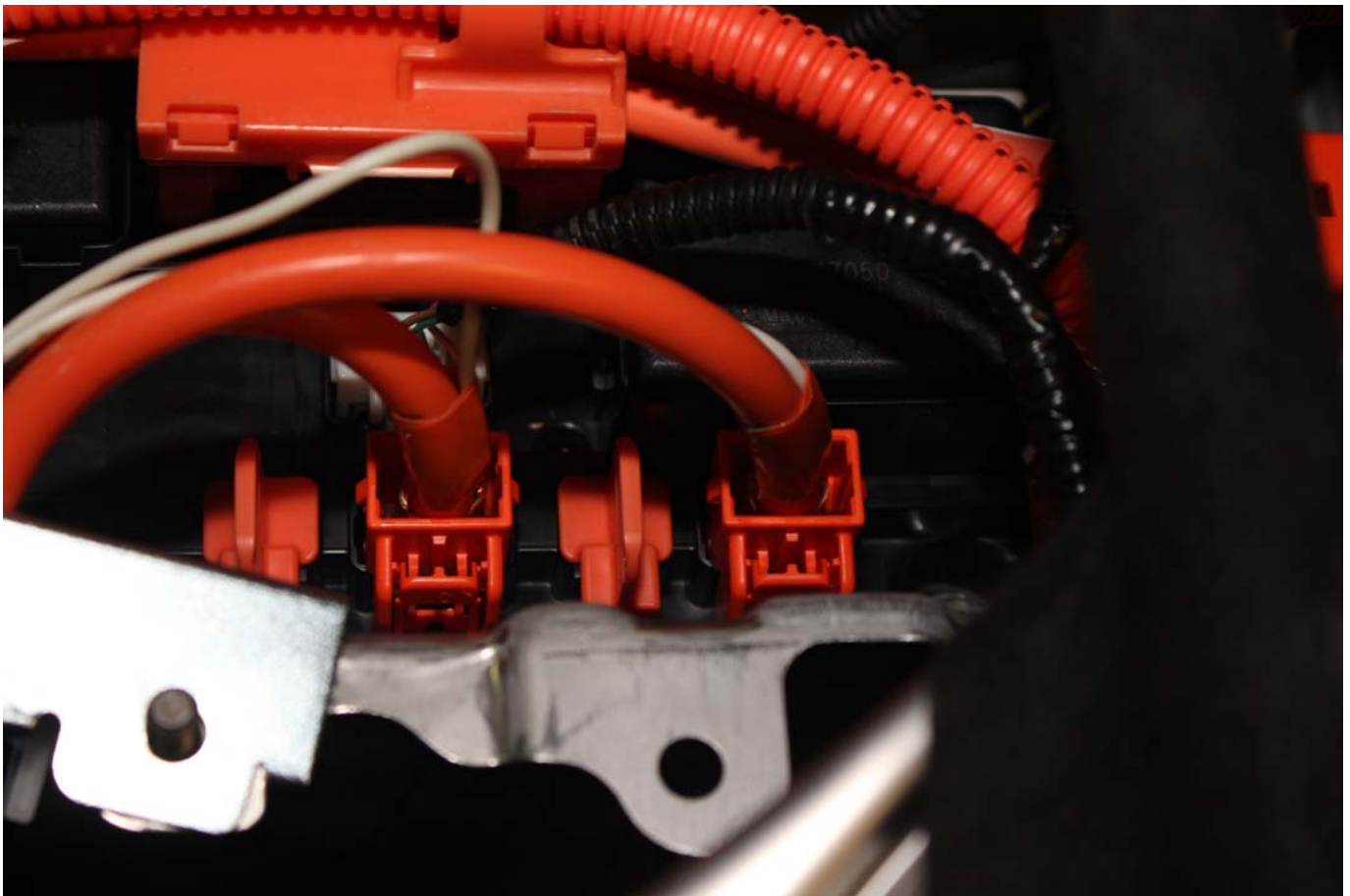


Photo No. 022 - Pre-Impact Close-Up View of High Voltage Leads Attached

PHOTOGRAPH NOT AVAILABLE

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

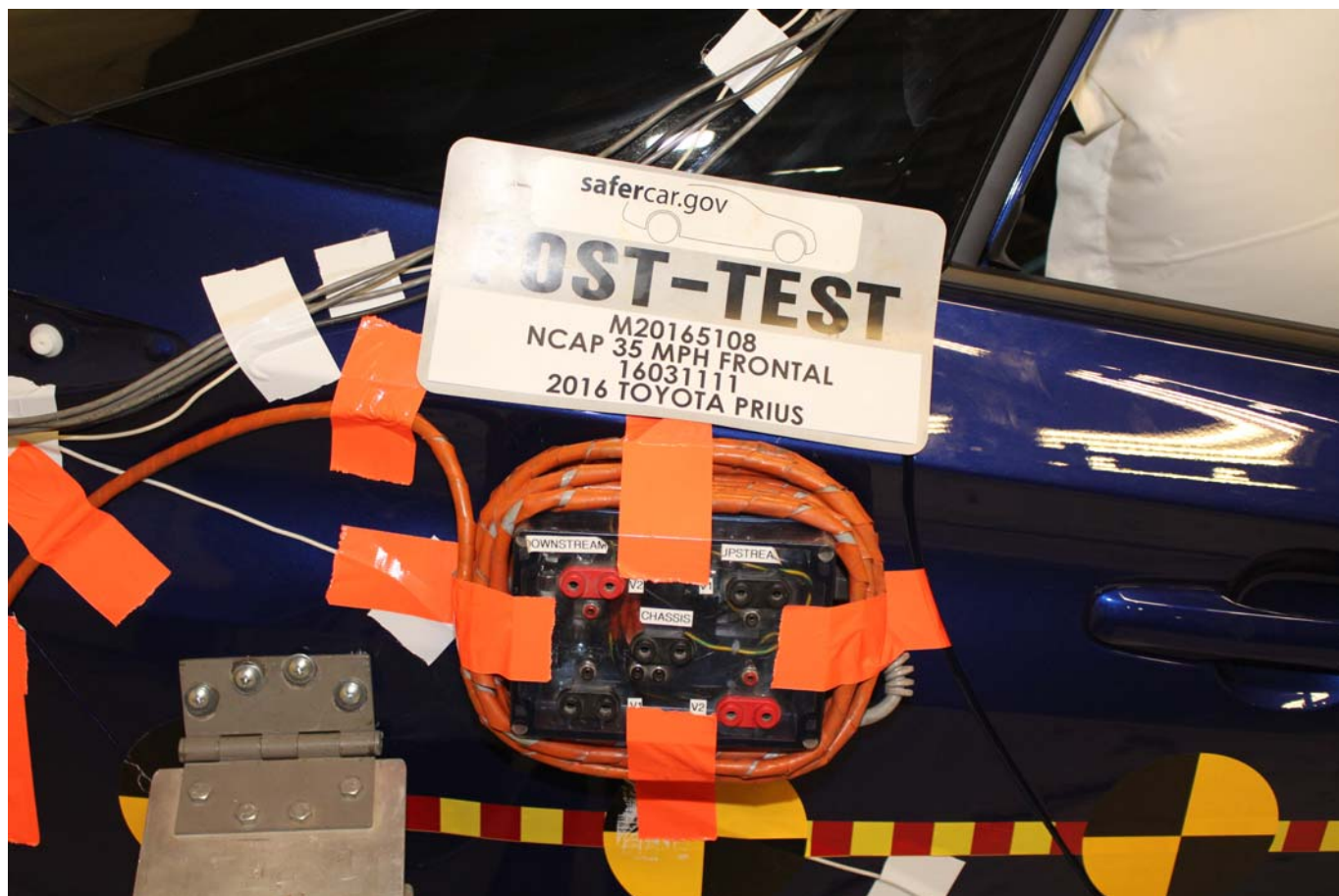


Photo No. 024 - Post-Impact View of Installed Impact Interface Port

PHOTOGRAPH NOT APPLICABLE

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°

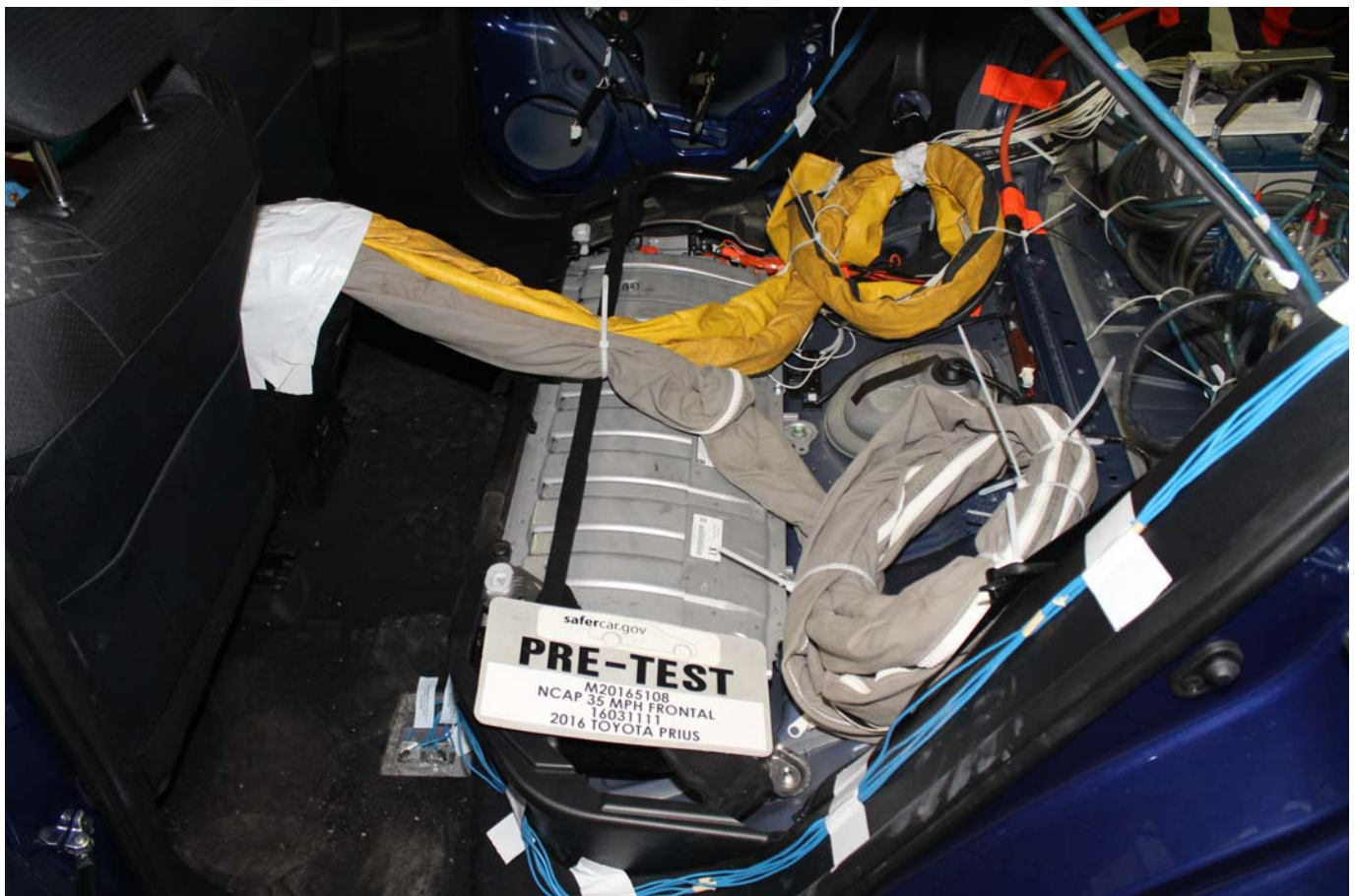


Photo No. 031 - Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery



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

PHOTOGRAPH NOT APPLICABLE

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

PHOTOGRAPH NOT APPLICABLE

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

PHOTOGRAPH NOT APPLICABLE

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



Photo No. 038 - As Delivered Right Front $\frac{3}{4}$ View of Impact Vehicle



Photo No. 039 - As Delivered Left Rear $\frac{3}{4}$ View of Impact Vehicle



Photo No. 040 - Vehicle's Certification Label



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