

REPORT NUMBER: SPNCAP305I-CAL-18-002

**NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE IMPACT POLE TEST
FMVSS No. 305 Indicant Test**

**Toyota Motor Corporation
2018 Toyota Prius C
Five Door Hatchback**

NHTSA No: M20185106

**PREPARED BY:
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December 7, 2017

FINAL REPORT

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FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
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Date: _____

COTR, New Car Assessment Program
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16. Abstract An FMVSS No. 305 Indicant test, in conjunction with Side Impact Pole Test (SPNCAP) was conducted on the subject 2018 Toyota Prius C five 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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SECTION 1

TEST PURPOSE AND PROCEDURE

An FMVSS No. 305 Indicant test, in conjunction with a Side Impact Pole test was conducted on the subject 2018 Toyota Prius C five door hatchback.

The Indicant test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Test Procedure, dated May 2, 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 Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00352.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2018 Toyota Prius C five door hatchback. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.67 km/h. 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 Toyota Prius C five 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.

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 - General Test and Vehicle Parameter Data

Data Sheet No. 2 – Pre-Impact Electric Isolation Measurements and Calculations

Data Sheet No. 3 – Post-Impact Electric Isolation Measurements and Calculations

Data Sheet No. 4 – FMVSS No. 305 Static Rollover Results for Electric Vehicles

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2018 Toyota Prius C five door hatchback
 Test Program: NCAP Side Pole Impact Test - FMVSS No.305

NHTSA No.: M20185106
 Test Date: 11/13/2017

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20185106
Model Year	2018
Make	Toyota
Model	Prius C
Body Style	Five Door Hatchback
VIN	JTDKDTB39J1601764
Body Color	Silver
Odometer Reading (km/mi)	5 mi
Engine Displacement (L)	1.5
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	CVT
Overdrive	Yes
Final Drive	Front Wheel Drive
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	No
Other Optional Feature	--
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Rear Pass. Curtain Airbag	Yes
Rear Pass. Head/Torso Airbag	No
Rear Pass. Torso Airbag	No
Rear Pass. Torso/Pelvis Airbag	No
Rear Pass. Pelvis Airbag	No
Driver Seat Belt Pretensioners	Yes
Rear Pass. Seat Belt Pretensioners	No
Driver Load Limiter	Yes
Rear Pass. Load Limiter	No
Other Safety Restraint	Yes*

*Driver & Fr Passenger cushion

Does owner's manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation
Date of Manufacture	08/17
Vehicle Type	Passenger

GVWR (kg)	1576
GAWR Front (kg)	884
GAWR Rear (kg)	835

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	-	5
Capacity Weight (VCW) (kg)				380
DSC X 68.04 kg				340.2
Cargo Weight (RCLW) (kg)				39.8

(A)

(B)

(A-B)

VEHICLE SEAT TYPE

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X		X		
Third Row seat							

DATA SHEET NO. 1 (Continued)
ELECTRIC VEHICLE PARAMETER DATA

Test Vehicle:	<u>2018 Toyota Prius C five door hatchback</u>	NHTSA No.:	<u>M20185106</u>
Test Program:	<u>NCAP Side Pole Impact Test - FMVSS No.305</u>	Test Date:	<u>11/13/2017</u>

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	Ni-MH
Nominal Voltage (Volts)	144
Is this Vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of Automatic Propulsion Battery Disconnect, if applicable	Physically contained in Hybrid Battery System
Auxiliary Battery Type	Lead-Acid

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED)

Measured Parameter	Value
Electrolyte Fluid Type	KOH
Electrolyte Fluid Specific Gravity	1.269
Electrolyte Fluid Kinematic Viscosity (centistokes)	1.906
Electrolyte Fluid Color	Clear
Propulsion Battery Coolant Type, Color and Specific Gravity (if applicable)	Air
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 useable energy of the battery:		
Minimum State of Charge	V	
Maximum State of Charge	V	
95% of Maximum	V	
Test Voltage *	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	V	144
Maximum State of Charge	V	171
95% of Maximum	V	162.45
Test Voltage *	V	156.2

* 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.

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

Measured Parameter	Value
Details of Vehicle Chassis Ground Points & Locations	The ground point is located under the rear seat attached to vehicle body
Details of Propulsion Battery Components	The HV leads are connected to the HV battery located on the side of the battery under the rear passenger seat.

DATA SHEET NO. 2
PRE-IMPACT ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: <u>2018 Toyota Prius C five door hatchback</u>	NHTSA No.: <u>M20185106</u>
Test Program: <u>NCAP Side Pole Impact Test - FMVSS No.305</u>	Test Date: <u>11/13/2017</u>

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 87
Serial No.		65280327
Internal Impedance Value	MΩ	10
Resolution	V	0.001
Last Calibration Date		10/10/2017

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 _b	V	144-171
Propulsion Battery Voltage : (ready to drive position)	V _b	V	156.2
Propulsion Battery to Vehicle Chassis	V ₁	V	60.4
Propulsion Battery to Vehicle Chassis	V ₂	V	73.2
Propulsion Battery to Vehicle Chassis Across Known Resistor	R _o	Ω	76000
Propulsion Battery to Vehicle Chassis with R _o installed	V ₁ '	V	16.48
Propulsion Battery to Vehicle Chassis with R _o installed	V ₂ '	V	22.2
$R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$	R _{i1}	Ω	448000
$R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$	R _{i2}	Ω	319000
Lesser value of R _{i1} and R _{i2}	R _i	Ω	319000
Electrical Isolation Value (Minimum E.I. Value is 500 Ω/V)	R _i /V _b	Ω/V	2040000

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_o (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. 3
POST-IMPACT ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2018 Toyota Prius C five door hatchback
 Test Program: NCAP Side Pole Impact Test - FMVSS No.305

NHTSA No.: M20185106
 Test Date: 11/13/2017

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	0.036

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.

ELECTRICAL ISOLATION MEASUREMENTS & IMPACT CALCULATIONS

Parameter	Value	Units		Value		Value	
V ₁ =	0.072	V	Impact Time:	3	Minutes	15	Seconds
V ₂ =	0.092	V	Impact Time:	3	Minutes	30	Seconds
R ₀ =	76000	Ω	Impact Time:		Minutes		Seconds
V ₁ ' =	0.016	V	Impact Time:	3	Minutes	48	Seconds
V ₂ ' =	0.016	V	Impact Time:	4	Minutes	5	Seconds
R _{i1} =	606000	Ω	Impact Time:	4	Minutes	15	Seconds
R _{i2} =	644000	Ω	Impact Time:	4	Minutes	20	Seconds
R _i =	606000	Ω	Impact Time:	4	Minutes	25	Seconds
R _i /V _b =	21638889	Ω/V	Impact Time:	4	Minutes	30	Seconds

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

NOTES:

- $R_{i1} = R_0 * (1 + V_2/V_1) * [(V_1 - V_1')/V_1]$, $R_{i2} = R_0 * (1 + V_1/V_2) * [(V_2 - V_2')/V_2]$, 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

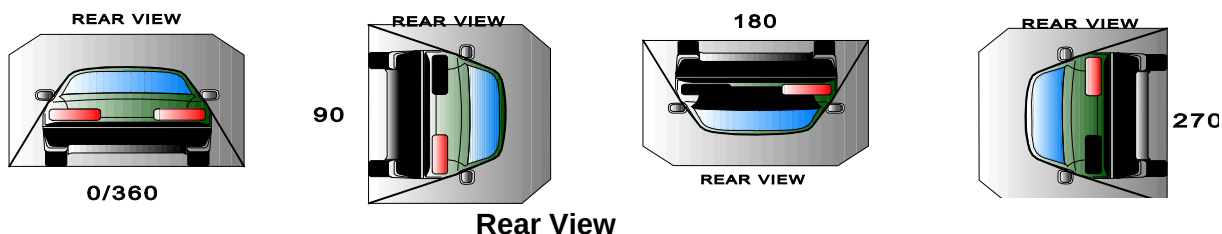
PROPULSION BATTERY SYSTEM COMPONENTS

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 Intrusions	X	
Is propulsion battery electrolyte spillage visible in the passenger compartment?		X	

DATA SHEET NO. 4
FMVSS NO. 305 STATIC ROLLOVER RESULTS FOR ELECTRIC POWERED VEHICLES

Test Vehicle: 2018 Toyota Prius C five door hatchback
 Test Program: NCAP Side Pole Impact Test - FMVSS No.305

NHTSA No.: M20185106
 Test Date: 11/13/2017



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	9	5	6	9	7
90° to 180°	1	4	5	6	4	7
180° to 270°	1	2	5	6	2	7
270° to 360°	1	8	5	6	8	7

ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

Rollover Stage	Propulsion Battery Electrolyte Spillage	Units	Spillage Location
0° to 90°	0.0	Liters	None
90° to 180°	0.0	Liters	None
180° to 270°	0.0	Liters	None
270° to 360°	0.0	Liters	None
Total Spillage	0.0	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) ☒ 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 _b)	V	0.600

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. 4 (Continued)
FMVSS NO. 305 STATIC ROLLOVER RESULTS FOR ELECTRIC POWERED VEHICLES

Test Vehicle: 2018 Toyota Prius C five door hatchback NHTSA No.: M20185106
 Test Program: NCAP Side Pole Impact Test - FMVSS No.305 Test Date: 11/13/2017

ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

Parameter	Rollover Stage	Value	Units		Minutes	Seconds
$V_1 =$	90°	0.076	V	Time:	3	5
	180°	0.092	V		7	25
	270°	0.092	V		13	40
	360°	0.092	V		20	36
$V_2 =$	90°	0.084	V	Time:	3	10
	180°	0.092	V		7	12
	270°	0.092	V		13	48
	360°	0.092	V		20	41
$V_1' =$	90°	0.016	V	Time:	3	20
	180°	0.016	V		7	22
	270°	0.02	V		13	56
	360°	0.02	V		20	46
$V_2' =$	90°	0.016	V	Time:	3	25
	180°	0.02	V		7	27
	270°	0.02	V		14	5
	360°	0.02	V		20	58
$R_{i1} =$	90°	600000	Ω	Time:	3	40
	180°	722000	Ω		7	34
	270°	547000	Ω		14	10
	360°	547000	Ω		21	6
$R_{i2} =$	90°	615000	Ω	Time:	3	45
	180°	547000	Ω		7	46
	270°	547000	Ω		14	15
	360°	547000	Ω		21	13
$R_i =$	90°	600000	Ω	Time:	3	50
	180°	547000	Ω		7	48
	270°	547000	Ω		14	18
	360°	547000	Ω		21	19
$R_i/V_b =$	90°	21428571	Ω/V	Time:	3	56
	180°	19542857	Ω/V		7	56
	270°	19542857	Ω/V		14	21
	360°	19542857	Ω/V		21	25

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

DATA SHEET NO. 4 (Continued)
FMVSS NO. 305 STATIC ROLLOVER RESULTS FOR ELECTRIC POWERED VEHICLES

Test Vehicle:	<u>2018 Toyota Prius C five door hatchback</u>	NHTSA No.:	<u>M20185106</u>
Test Program:	<u>NCAP Side Pole Impact Test - FMVSS No.305</u>	Test Date:	<u>11/13/2017</u>

NOTES:

- $R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$, $R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$, $R_i = \text{Lesser value of } R_{i1} \text{ and } R_{i2}$,
 $R_i/V_b = \text{Electrical Isolation Value/ Nominal Battery Voltage}$
- 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 Ω/V

COMMENTS: None

APPENDIX A
PHOTOGRAPHS

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Figure A-1: Auxiliary Power Module Warning Label



Figure A-2: Power Inverter Warning Label

Photo Not Applicable

Figure A-3 First Responder Warning Label

Photo Not Applicable

Figure A-4: First Responder Warning Location



Figure A-5: Other Vehicle Label(s) Related to Electrical Propulsion System



Figure A-6: Manual High Voltage Service Disconnect in Place



Figure A-7: Manual High Voltage Service Disconnect Removed (Show Plug)



Figure A-8: Manual High Voltage Service Disconnect Removed Location

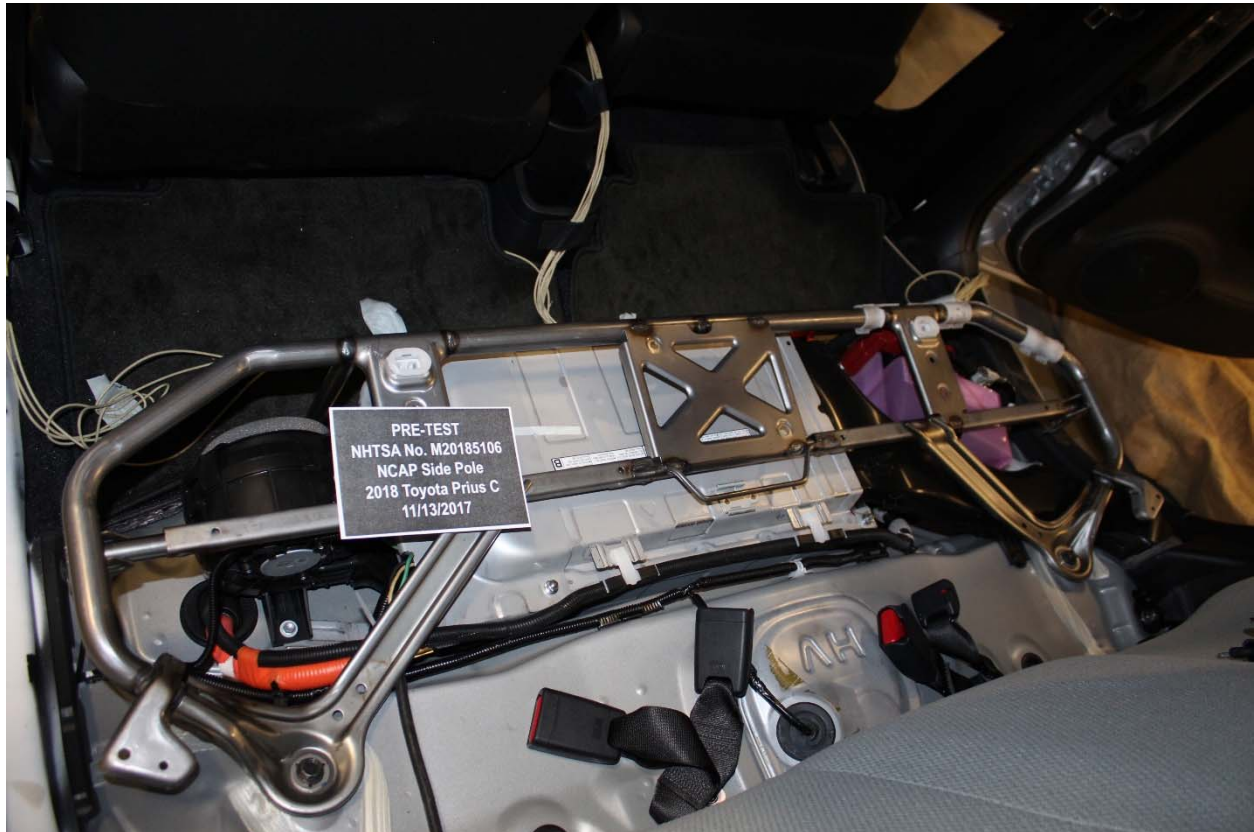


Figure A-9: Pre-Impact View of Propulsion Battery



Figure A-10: Post-Impact Front View of Propulsion Battery

Photo Not Applicable

Figure A-11: Post-Impact Rear View of Propulsion Battery (if any part of it is visible)

Photo Not Applicable

Figure A-12: Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

Photo Not Applicable

Figure A-13: Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

Photo Not Applicable

Figure A-14: Pre-Impact View of Propulsion Battery Module(s)

Photo Not Applicable

Figure A-15: Post-Impact View of Propulsion Battery Module(s)



Figure A-16: Pre-Impact View of Electric Propulsion Drive



Figure A-17: Post-Impact View of Electric Propulsion Drive

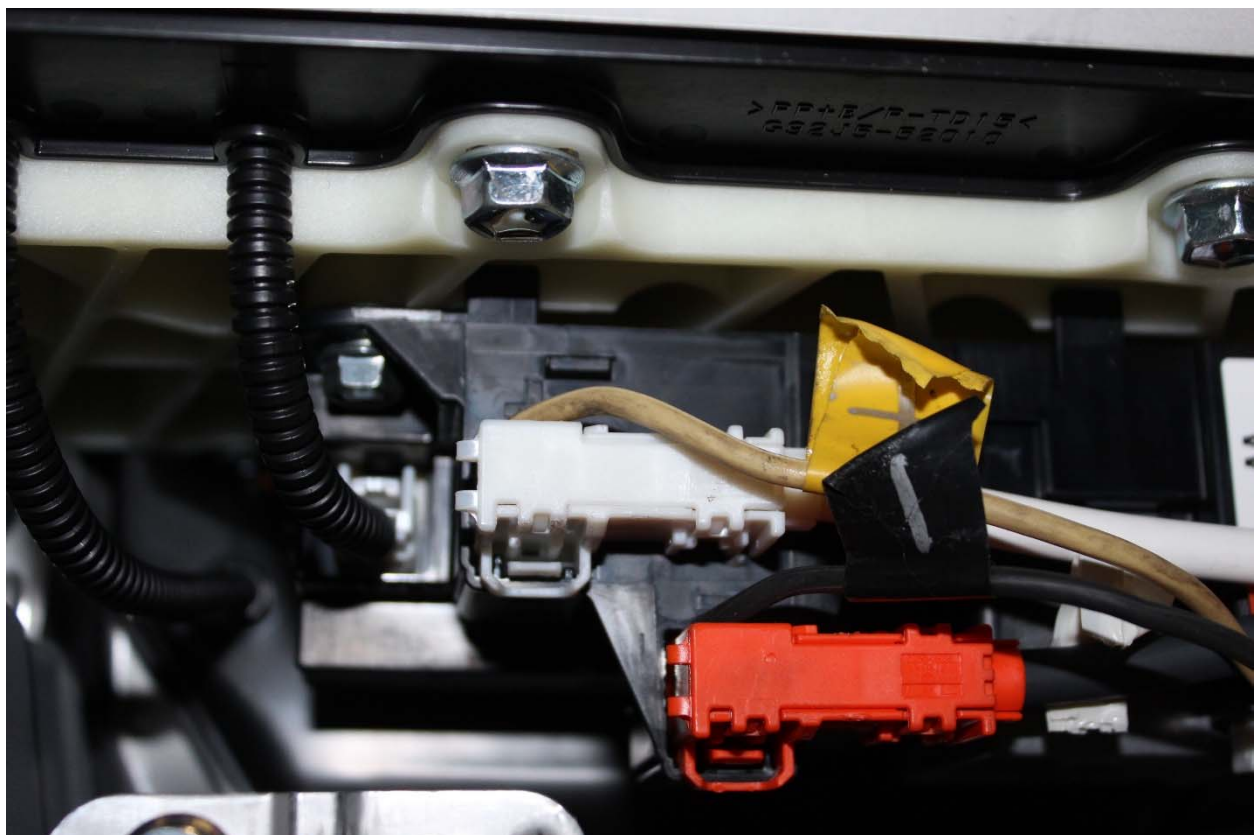


Figure A-18: Pre-Impact View of High Voltage Interconnects



Figure A-19: Pre-Impact View Propulsion Battery Venting System(s)

Photo Not Applicable

Figure A-20: Pre-Impact View of other Visible Electric Propulsion Components

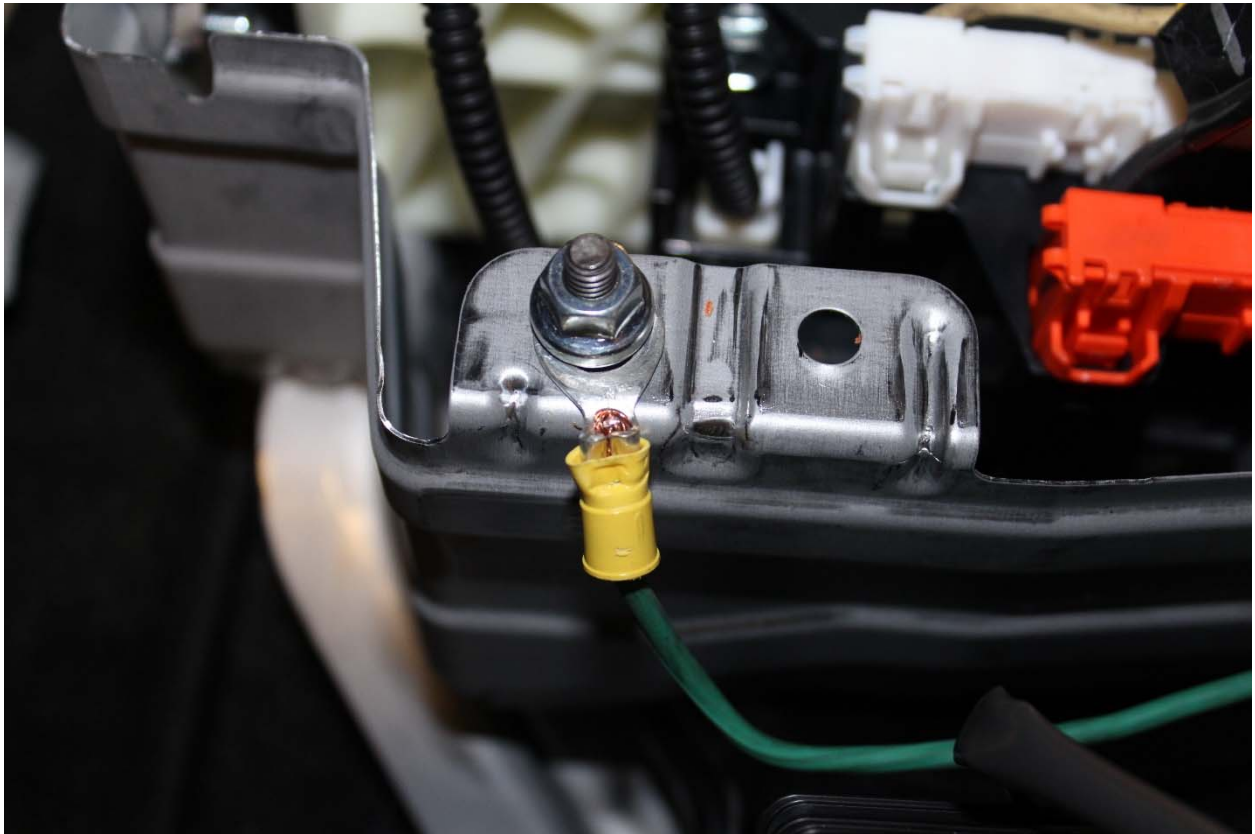


Figure A-21: Pre-Impact View of Ground Lead Attached



Figure A-22: Pre-Impact View of High Voltage Leads Attached

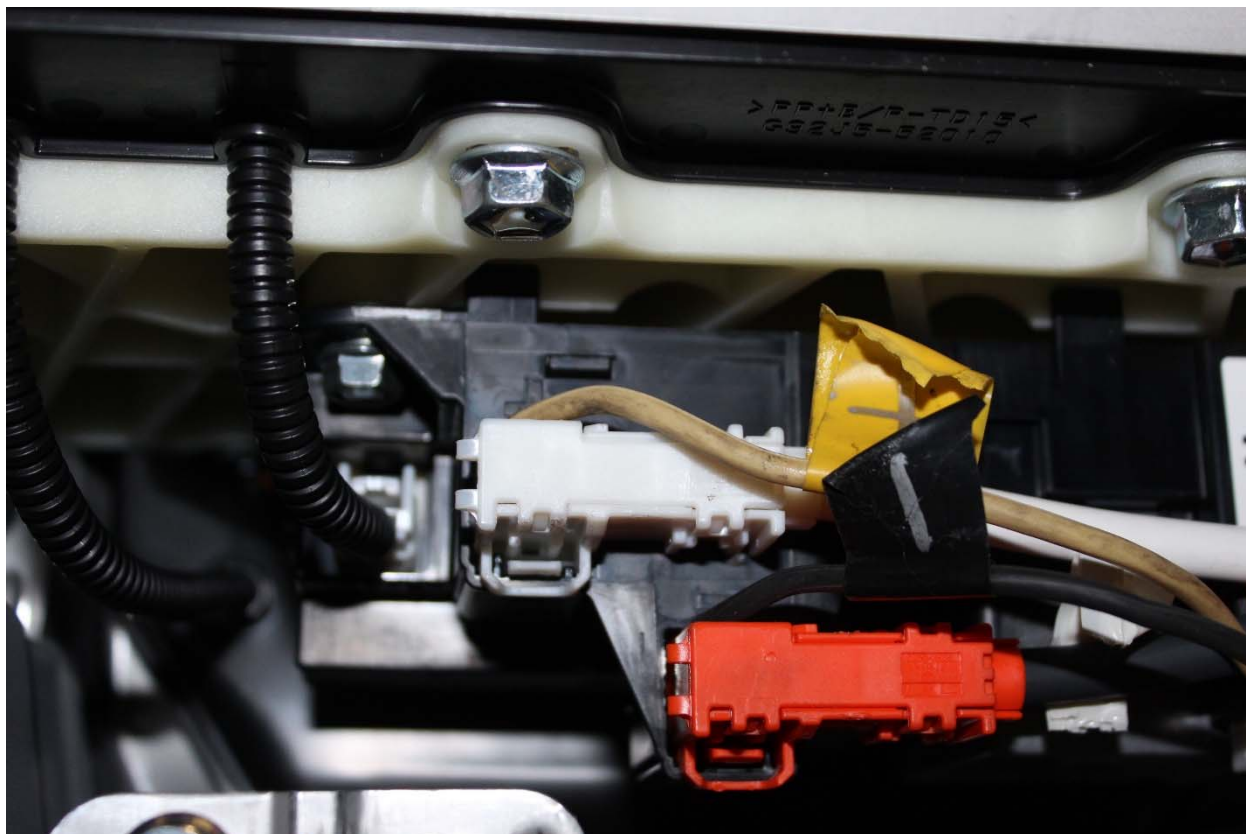


Figure A-23: Pre-Impact Close Up View of High Voltage Leads Attached

Photo Not Applicable

Figure A-24: Pre-Impact View of Installed Test Interface Port

Photo Not Applicable

Figure A-25: Post-Impact View of Installed Test Interface Port

Photo Not Applicable

Figure A-26: Pre-Impact View of Other Test Devices

Photo Not Applicable

Figure A-27: Post-Impact View of Other Test Devices



Figure A-28: FMVSS No. 305 Static Rollover 90 Degrees



Figure A-29: FMVSS No. 305 Static Rollover 180 Degrees

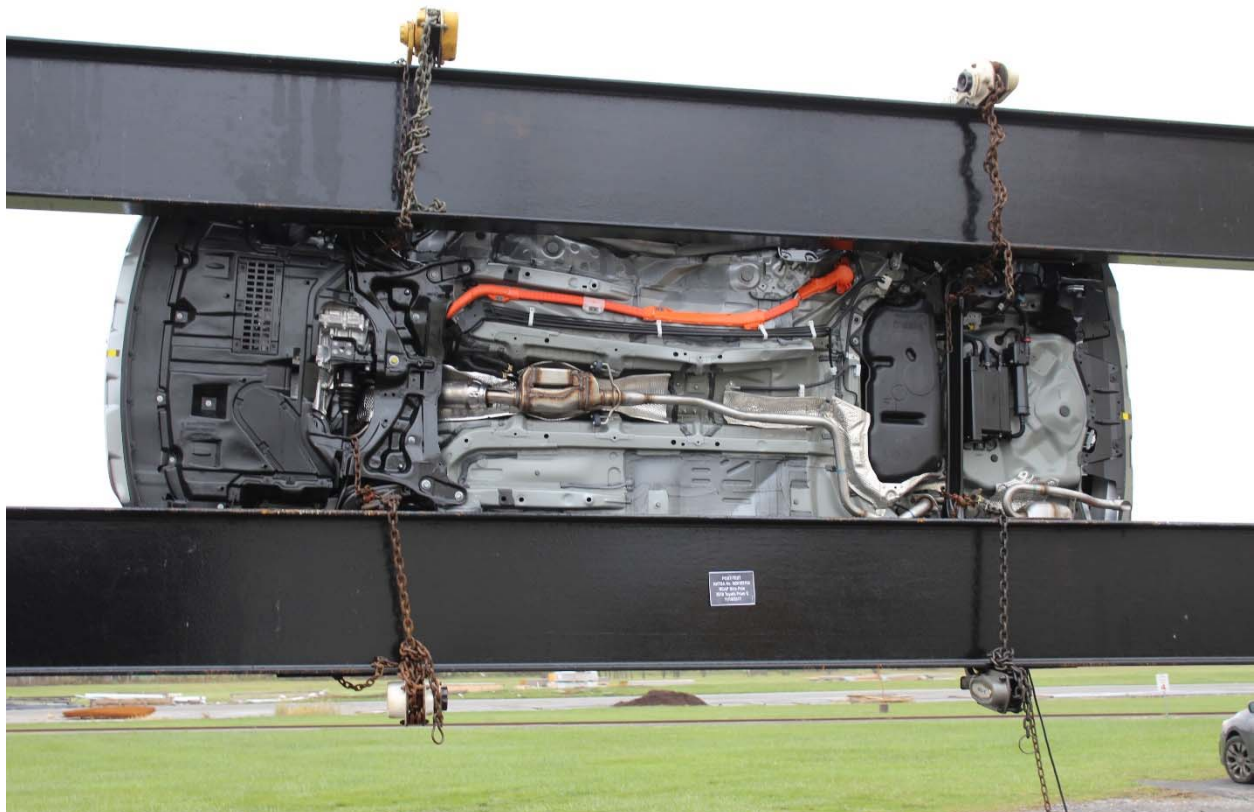


Figure A-30: FMVSS No. 305 Static Rollover 270 Degrees



Figure A-31: FMVSS No. 305 Static Rollover 360 Degrees



Figure A-32: Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery



Figure A-33: Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo Not Applicable

Figure A-34: Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

Photo Not Applicable

Figure A-35: Post-Impact View of Battery Component Intrusion (if applicable)

Photo Not Applicable

Figure A-36: Post-Impact View of Battery Module Movement or Retention Loss (if applicable)

Photo Not Applicable

Figure A-37: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (if applicable)

Photo Not Applicable

Figure A-38: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (if applicable)