

REPORT NUMBER: 301-MGA-2008-005

**SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT**

**FORD MOTOR COMPANY
2008 FORD ESCAPE HYBRID
NHTSA NUMBER: C80200**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: September 19, 2008

Final Report Date: October 1, 2008

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, SE
WASHINGTON, D.C. 20590**

Technical Report Documentation Page

<p>1. <i>Report No.</i> 301-MGA-2008-005</p>	<p>2. <i>Government Accession No.</i></p>	<p>3. <i>Recipient's Catalog No.</i></p>	
<p>4. <i>Title and Subtitle</i> Final Report for Fuel System Integrity Test of a 2008 Ford Escape Hybrid NHTSA No.: C80200</p>		<p>5. <i>Report Date</i> September 26, 2008</p>	
		<p>6. <i>Performing Organization Code</i> MGA</p>	
<p>7. <i>Author(s)</i> Joe Fleck, Project Engineer</p>		<p>8. <i>Performing Organization Report No.</i> 301-MGA-2008-005</p>	
<p>9. <i>Performing Organization Name and Address</i> MGA Research Corporation 5000 Warren Road Burlington, WI 53105</p>		<p>10. <i>Work Unit No.</i></p>	
		<p>11. <i>Contract or Grant No.</i> DTNH22-06-C-00030</p>	
<p>12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement, Office of Vehicle Safety Compliance 1200 New Jersey Avenue, SE Washington, D.C. 20590</p>		<p>13. <i>Type of Report and Period Covered</i> Final Report 9/19/2008 – 10/01/2008</p>	
		<p>14. <i>Sponsoring Agency Code</i> NVS-220</p>	
<p>15. <i>Supplementary Notes</i></p>			
<p>16. <i>Abstract</i> A rear impact was conducted on a 2008 Ford Escape Hybrid at MGA Research Corporation on September 19, 2008. This test was conducted to obtain data indicant of FMVSS 301R. The impact velocity was 79.8 km/h. The ambient temperature at the time of impact was 23 degrees Celsius.</p> <p>FMVSS 305 was conducted in conjunction with the FMVSS 301R.</p>			
<p>17. <i>Key Words</i> Fuel System Integrity Test 2008 Ford Escape Hybrid NHTSA No: C80200</p>		<p>18. <i>Distribution Statement</i> Copies of this report are available from: National Highway Traffic Safety Admin., Technical Ref. Division, 1200 New Jersey Avenue, SE Washington, D.C. 20590</p>	
<p>19. <i>Security Classif. (of this report)</i> Unclassified</p>	<p>20. <i>Security Classif. (of this page)</i> Unclassified</p>	<p>21. <i>No. of Pages</i> 79</p>	<p>22. <i>Price</i></p>

TABLE OF CONTENTS

<u>Section</u>		<u>Page No</u>
1	Purpose and Summary of Test	1
2	Data Sheets	2

<u>Data Sheet No.</u>		<u>Page No.</u>
1	Test Vehicle Specifications	2
2	Pre-Test Data	4
3	Moving Barrier Data	6
4	Post-Test Data	7
5	Static Rollover Test Data	8

<u>Form No.</u>		
1	Test Vehicle Information	10

<u>Appendix</u>		
A	FMVSS 305 Information	A
B	Photographs	B

SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This rear impact test is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-C-00030. The purpose of this test is to reduce deaths and injuries occurring from fires that result from fuel spillage during and after motor vehicle crashes and resulting from ingestion of fuels during siphoning.

SUMMARY

A 2008 Ford Escape Hybrid was impacted by a Moving Deformable Barrier (MDB) at a velocity of 79.8 km/h. The test was performed at MGA Research Corporation on September 19, 2008. Appendix A contains FMVSS 305, "Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection" data. Pre-and post-test photographs of the vehicle, dummies, and propulsion system can be found in Appendix B.

One real-time camera and three high-speed cameras were used to document the impact event. In addition, real-time video was taken of the gas cap closing and static rollover.

- Left rear Half 1000 fps
- Right Rear Half 1000 fps
- Overhead Overall 1000 fps
- Real Time Pan 24 fps

Two ballast Part 572E, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

There was no Stoddard Solvent or electrolyte leakage after the event or during any phase of the static rollover.

**SECTION 2
DATA SHEETS**

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

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

TEST VEHICLE INFORMATION

Manufacturer	Ford
Model	Escape
Body Style	Hybrid
Major Options	None
NHTSA No.	C80200
VIN	1FMCU49H68KB41281
Color	Black
Delivery Date	9/6/2008
Odometer Reading (mile)	615.5
Dealer	Ricart Ford
Transmission	Automatic
Final Drive	Front
Number of Cylinders	4
Engine Displacement (L)	2.3
Engine Placement	Lateral

DATA FROM VEHICLE'S CERTIFICATION LABEL

Manufactured By	Ford Motor Company
Date of Manufacture	08/07

GVWR (kg)	2123
GAWR Front (kg)	1107
GAWR Rear (kg)	1089

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				423
Number of Occupants x 68 kg.				340
Cargo Wt. (RCLW) (kg)				83

DATA SHEET NO. 1 (continued)
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

DATA FROM VEHICLE'S TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	900	900
Cold Pressure (kPa)	240	240
Recommended Tire Size	P235/70R16	P235/70R16
Recommended Load Range	Not Listed	Not Listed
Tire Size on Vehicle	P235/70R16	P235/70R16
Tire Manufacturer	Continental	Continental
Location of Placard of Vehicle	Lower B Pillar Facing Outboard	
Type of Spare Tire (full size/space saver)	Space Saver	

DATA SHEET NO. 2

PRE-TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

WEIGHT OF TEST VEHICLE

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	488.1	377.8		535.7	440.4	
Right	kg	459.0	360.2		510.3	423.7	
Ratio	%	56.2	43.8		54.8	45.2	
Totals	kg	947.1	738.0	1685.1	1046.0	864.1	1910.1

CALCULATION OF TARGET TEST WEIGHT (TTW)

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1685.1
Rated Cargo/Luggage Weight (RCLW)	kg	83
Weight of 2 P572E ATDs	kg	148
Calculated Vehicle Target Weight (TVTW)	kg	1916.1

Vehicle Wheelbase	2625 mm
Weight of Ballast Secured	68 kg
Method of Securing Ballast	Ratchet Straps
Vehicle Components Removed for Weight Reduction	None

VEHICLE ATTITUDES

	Units	LF	RF	LR	RR
As Delivered	mm	806	815	843	856
As Tested	mm	794	799	822	837

DATA SHEET NO. 2 (continued)

PRE-TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

FUEL SYSTEM DATA

	Units: Liters
Usable Capacity of "Standard Tank" (Owner's Manual)	56.8
Usable Capacity Figure Furnished by COTR	56.8
Usable Capacity of "Optional" Tank	
90-95% of Usable Capacity	51.1 to 54.0
Actual Test Volume (entire fuel system filled)	52.6

Test Fluid Type	Stoddard Solvent
Test Fluid Kinematic Viscosity (centistokes)	2.1 cSt @ 20° C
Test Fluid Color	Purple
Type of Vehicle Fuel Pump	Electrical
Activate Electric Fuel Pump Operation with Ignition Switch ON, but Engine OFF	Yes

Comments (noticeable attributes of fuel system components, capacity, etc.)	None
--	------

DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

MOVING BARRIER'S TEST WEIGHT

	Units	Front	Rear	Total
Left	kg	374.2	308.8	
Right	kg	389.5	291.2	
Ratio	%	56.0	44.0	
Totals	kg	763.7	600.0	1363.7

Tires (Mfr, line, size)	Yokohama
Tire Pressure (kPa)	207
Brake Abort System (Yes/No)?	Yes
Date of Last Calibration	8/6/2008

DATA SHEET NO. 4

POST-TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

IMPACT VELOCITY

	Units: km/h
Required Impact Velocity	80.0
Actual Impact Velocity (Trap No. 1)	79.8
Actual Impact Velocity (Trap No. 2)	79.4
Average Impact Speed	79.6

Temperature at Time of Impact (°C)	23
Test Time	3:00 pm

WELDING ROD IMPACT POINT

	Units: mm
Vertical distance from target center (+ above target / - below target)	3 mm
Horizontal distance from target center (+ to the right / - to the left)	-3 mm

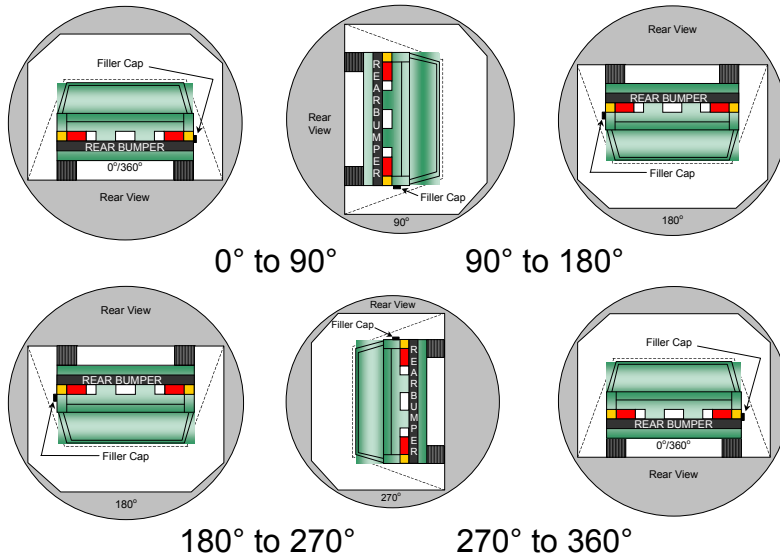
DATA SHEET NO. 5
STATIC ROLLOVER TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

STODDARD SOLVENT SPILLAGE MEASUREMENT

- A. From impact until vehicle motion ceases: 0 g
 (Maximum Allowable = 28 grams)
- B. For the 5 minute period after motion ceases: 0 g
 (Maximum Allowable = 28 grams)
- C. For the following 25 minutes: 0 g
 (Maximum Allowable = 28 grams/minute)
- D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations: **Not Applicable**

DATA SHEET NO. 5 (continued)
STATIC ROLLOVER TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

STODDARD SOLVENT SPILLAGE MEASUREMENT
Hold Time = 5 minutes at all intervals

0° TO 90° Rotation Time (sec) = 122 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

90° TO 180° Rotation Time (sec) = 119 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

180° TO 270° Rotation Time (sec) = 121 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

270° TO 360° Rotation Time (sec) = 119 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

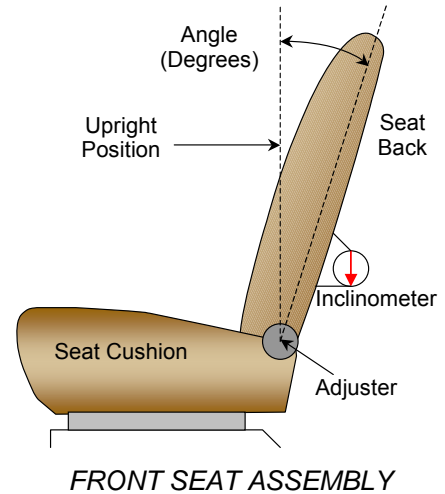
FORM 1
TEST VEHICLE INFORMATION

Test Vehicle: 2008 Ford Escape Hybrid
Test Program: FMVSS 301 Fuel System Integrity

NHTSA No.: C80200
Test Date: 9/19/2008

NORMAL DESIGN RIDING POSITION

The seat back angle is measured relative to the rocker sill. Remove the seatback panel and position the inclinometer 13 inches above the back pivot on the rear outboard seat frame. Avoid taking the measurement on the reinforcement plate. If the seat is equipped with SAB, take seatback angle measurement on the inboard side.



Driver Seat Back Angle	17.5°
Passenger Seat Back Angle	17.5°

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	279	139
Passenger Seat	25 notches	13 notches of 25

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position.

APPENDIX A

FMVSS 305

ELECTRIC POWERED VEHICLES: ELECTROLYTE SPILLAGE AND ELECTRICAL SHOCK PROTECTION

This hybrid vehicle, a 2008 Ford Escape Hybrid (NHTSA No. C80200), in conjunction with the rear impact, was tested to FMVSS 305.

The test was performed in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedures TP-305-01 to determine compliance to the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 305, "Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection".

Based on the test results, the 2008 Ford Escape Hybrid appears to meet the requirements of FMVSS 305 testing.

If a measured voltage was zero and resulted in a division by zero "Zero Volts" was reported. This condition is considered being compliant as stated in TP-305-01 12.4 F.

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-06-C-00030.

The following data sheets document the results of the FMVSS 305 test.

DATA SHEET 1
ELECTRIC VEHICLE PROPULSION SYSTEM

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

Type of Electric Vehicle (Electric/Hybrid):	Gas-Electric
Propulsion Battery Type:	NiMH (Nickel Metal Hydride)
Nominal Voltage (V):	330 V
Physical Location of Automatic Propulsion Battery Disconnect:	The connectors (+, -, and pre charge) are located inside of the battery system.
Auxiliary Battery Type:	Lead Acid

**DATA SHEET 2
PRE-TEST DATA**

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED DATA)

Electrolyte Fluid Type:	Alkaline Liquid Solution	
Electrolyte Fluid Specific Gravity:	1.29 g/m ³	
Electrolyte Kinematic Viscosity:	2.4 mPas	
Electrolyte Fluid Color:	Clear	
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable):	Air	
Location of Battery Modules:	X	Inside Passenger Compartment
		Outside Passenger Compartment
Propulsion Battery State of Charge:		Maximum State of Charge
	X	Range of Normal Operating Voltage
Maximum State of Charge:		
Test Voltage No less than 95% of maximum state of charge:		
Range of Normal Operating Voltage:	216 to 397 V	
Test Voltage Within normal operative voltage range:	311.7 V	

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Locations(s) [Supply photographs as appropriate]:	12 mm bolt located on right rear inner panel above wheel well. See photo B-47
--	---

PROPULSION BATTERY SYSTEM

Details of Propulsion Battery Components [Supply photographs as appropriate]:	High voltage service disconnect located at right rear battery pack, see photo B-48. High voltage disconnect insert switch located in right rear D-pillar, see photo B-49. Right and left side battery pack tether, see photo B-50.
---	--

DATA SHEET 3

PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENT & CALCULATIONS

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

VOLTMETER INFORMATION

The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10MΩ.

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make:	Fluke
Model:	Fluke 11
Serial Number:	68541895
Internal Impedance Value (MΩ):	10 MΩ < 100 pF
Resolution (V):	0.001
Last Calibration Date:	9/10/08

PROPULSION BATTERY VOLTAGE

Measurement shall be made with propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (Propulsion motor(s) activated) 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):	311.7
---------	-------

PROPULSION BATTERY TO VEHICLE CHASSIS

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

V1 (V):	161.8
V2 (V):	185.8

DATA SHEET 3 (Continued)

PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENT & CALCULATIONS

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

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

Ro (Ω):	118 K Ω
---------	---------

ELECTRICAL ISOLATION MEASUREMENT

V1' (V):	17.4 V
$R_{i1} = R_0 (1 + V_2/V_1) [(V_1 - V_1')/V_1']$	
Ri1 (Ω):	1746 K Ω
V2' (V):	17.4 V
$R_{i2} = R_0 (1 + V_1/V_2) [(V_2 - V_2')/V_2']$	
Ri2 (Ω):	2136 K Ω
$R_i = \text{The lesser of } T_{i1} \text{ and } R_{i2}$	
Ri Pre-Test ((Ω):	1746 K Ω
Ri/Vb (Ω/V):	5602 Ω/V (Electrical Isolation Value)
Minimum Electrical Isolation Value is 500 Ω/V	

Note: Measured 6 minutes 24 seconds before impact.

	Yes (Pass)	No (Fail)
Is the measured Electrical Isolation Value \geq 500 Ω/V?	X	

DATA SHEET 4
POST-TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

VOLTMETER INFORMATION

The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10MΩ.

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make:	Fluke
Model:	Fluke 11
Serial Number:	68541895
Internal Impedance Value (MΩ):	100 MΩ < 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	0.002
Record V1, V2, V1', V2' voltage measurements immediately after the impacted vehicle comes to rest .	

PROPULSION BATTERY VOLTAGE

V1 =	0.10	V Impact	Time:	1	Minutes	10	s
V2 =	0.47	V Impact	Time:	1	Minutes	35	s
V1' =	0.000	V Impact	Time:	2	Minutes	15	s
V2' =	0.016	V Impact	Time:	2	Minutes	35	s
Attach complete data acquisition to final test report							

ELECTRICAL ISOLATION MEASUREMENT

$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$							
Ri1 =	Zero Volts	Ω Impact		2		35	s
$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$							
Ri2 =	3.41 E6	Ω Impact		2		35	s
Ri = The lesser of Ri1 and Ri2							
Ri =	3.41 E6	Ω Impact		2		35	s
Ri/Vb = electrical Isolation Value/Nominal Battery Voltage							
Minimum Electrical Value is 500 Ω/V							
Ri/Vb =	1.7 E9	Ω/V Impact		2		35	s

DATA SHEET 4 (Continued)

POST-TEST DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

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

PROPULSION BATTERY SYSTEM COMPONENTS

Describe Propulsion Battery Module movement within the passenger compartment [Supply photographs as appropriate]:
Battery pack moved up and forward in cargo area. Right side tether was taut and left side tether was about 50% taut. See Photos B-51 and B-52.

	Yes (Fail)	No (Pass)
Has the Propulsion Battery Module moved within the passenger compartment?		X

Describe intrusion of an outside Propulsion Battery Component into the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes (Fail)	No (Pass)
Has an outside Propulsion Battery Component intruded into the passenger compartment?		X

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

DATA SHEET 5
FUEL SYSTEM DATA

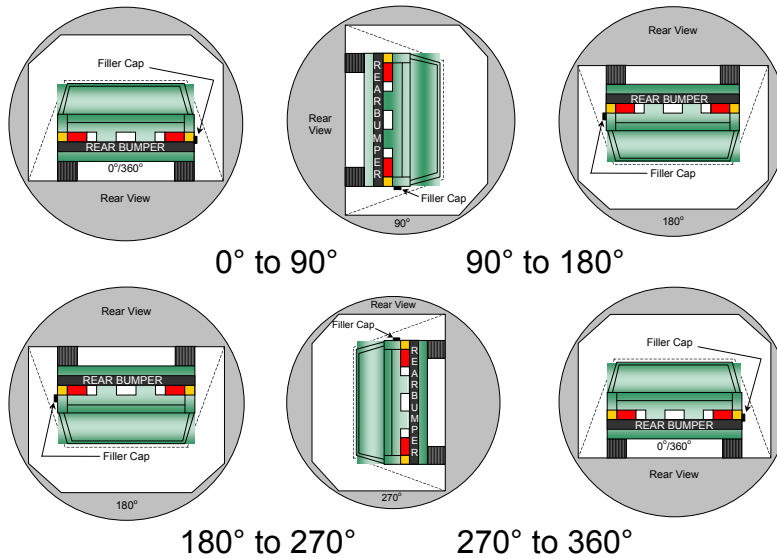
Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

STODDARD SOLVENT SPILLAGE MEASUREMENT

- A. From impact until vehicle motion ceases: 0 oz.
 B. For the 5 minute period after motion ceases: 0 oz.
 C. For the following 25 minutes: 0 oz.
 D. Spillage: None

STATIC ROLLOVER TEST DATA

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



Rollover Stage	Rotation Time (sec)	Hold Time (sec)	Total Time (sec)	Next Whole Minute Interval
0° to 90°	124	300	424	8
90° to 180°	119	300	419	7
180° to 270°	121	300	421	8
270° to 360°	119	300	419	7

DATA SHEET 5 (Continued)

FUEL SYSTEM DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

Rollover Stage	Propulsion Battery 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 (L): 0

	Yes (Fail)	No (Pass)
Is the total spillage of propulsion battery electrolyte greater than 5.0 L?		X

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

VOLTMETER INFORMATION

The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10MΩ.

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make:	Fluke
Model:	Fluke 11
Serial Number:	68541895
Internal Impedance Value (MΩ):	100 MΩ > 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	0.001

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.

DATA SHEET 5 (Continued)

FUEL SYSTEM DATA

Test Vehicle: 2008 Ford Escape Hybrid
 Test Program: FMVSS 301 Fuel System Integrity

NHTSA No.: C80200
 Test Date: 9/19/2008

ELECTRICAL ISOLATION MEASUREMENT

V1 =	0.000	V 90°	Time:	2	Minutes	10	s
V1 =	0.000	V 180°	Time:	9	Minutes	20	s
V1 =	0.000	V 270°	Time:	16	Minutes	30	s
V1 =	0.000	V 360°	Time:	23	Minutes	15	s
V2 =	0.502	V 90°	Time:	0	Minutes	22	s
V2 =	0.000	V 180°	Time:	9	Minutes	27	s
V2 =	0.000	V 270°	Time:	16	Minutes	35	s
V2 =	0.000	V 360°	Time:	23	Minutes	31	s
V1' =	0.000	V 90°	Time:	2	Minutes	30	s
V1' =	0.001	V 180°	Time:	9	Minutes	33	s
V1' =	0.001	V 270°	Time:	16	Minutes	42	s
V1' =	0.001	V 360°	Time:	23	Minutes	40	s
V2' =	0.012	V 90°	Time:	2	Minutes	45	s
V2' =	0.001	V 180°	Time:	9	Minutes	37	s
V2' =	0.000	V 270°	Time:	16	Minutes	53	s
V2'' =	0.000	V 360°	Time:	23	Minutes	52	s
Attach complete data acquisition to final test report of governing barrier test.							

DATA SHEET 5 (Continued)

FUEL SYSTEM DATA

Test Vehicle: 2008 Ford Escape Hybrid NHTSA No.: C80200
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 9/19/2008

ELECTRICAL ISOLATION CALCULATION

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']								
Ri1 =	Zero Volts	KΩ 90°		Time:	2	Minutes	2	s
Ri1 =	Zero Volts	KΩ 180°		Time:	59	Minutes	59	s
Ri1 =	Zero Volts	KΩ 270°		Time:	52	Minutes	52	s
Ri1 =	Zero Volts	KΩ 360°		Time:	47	Minutes	47	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']								
Ri2 =	4818	KΩ 90°		Time:	2	Minutes	2	s
Ri2 =	Zero Volts	KΩ 180°		Time:	59	Minutes	59	s
Ri2 =	Zero Volts	KΩ 270°		Time:	52	Minutes	52	s
Ri2 =	Zero Volts	KΩ 360°		Time:	47	Minutes	47	s
Ri = The lesser of Ri1 and Ri2								
Ri =	4818	KΩ 90°		Time:	2	Minutes	2	s
Ri =	Zero Volts	KΩ 180°		Time:	59	Minutes	59	s
Ri =	Zero Volts	KΩ 270°		Time:	52	Minutes	52	s
Ri =	Zero Volts	KΩ 360°		Time:	47	Minutes	47	s
Ri/Vb = Electrical Isolation Value/Nominal Battery Voltage Minimum Electrical Isolation Value is 500 Ω/V								
Ri/Vb =	4818	M Ω/V 90°		Time:	2	Minutes	2	s
Ri/Vb =	Zero Volts	Ω/V 180°		Time:	59	Minutes	59	s
Ri/Vb =	Zero Volts	Ω/V 270°		Time:	52	Minutes	52	s
Ri/Vb =	Zero Volts	Ω/V 360°		Time:	47	Minutes	47	s
Attach complete data acquisition to final test report of governing barrier test.								

	Yes (Pass)	No (Fail)
Is the measured Electrical Isolation Value \geq 500 Ω/V?	X	

APPENDIX B
TABLE OF PHOTOGRAPHS

		<u>Page No.</u>
Photo No. 1.	Vehicle's Certification Label	B-1
Photo No. 2.	Vehicle's Tire Placard	B-2
Photo No. 3.	Pre-Test Front View of Vehicle	B-3
Photo No. 4.	Post-Test Front View of Vehicle	B-4
Photo No. 5.	Pre-Test Left Side View of Test Vehicle	B-5
Photo No. 6.	Post-Test Left Side View of Test Vehicle	B-6
Photo No. 7.	Pre-Test Left Rear Closeup View of Vehicle	B-7
Photo No. 8.	Post-Test Left Rear Closeup View of Vehicle	B-8
Photo No. 9.	Pre-Test Right Side View of Vehicle	B-9
Photo No. 10.	Post-Test Right Side View of Vehicle	B-10
Photo No. 11.	Pre-Test Right Rear Closeup View of Vehicle	B-11
Photo No. 12.	Post-Test Right Rear Closeup View of Vehicle	B-12
Photo No. 13.	Pre-Test Rear View of Vehicle	B-13
Photo No. 14.	Post-Test Rear View of Vehicle	B-14
Photo No. 15.	Pre-Test $\frac{3}{4}$ Frontal View From Right Side of Vehicle	B-15
Photo No. 16.	Post-Test $\frac{3}{4}$ Frontal View From Right Side of Vehicle	B-16
Photo No. 17.	Pre-Test $\frac{3}{4}$ Rear View From Left Side of Vehicle	B-17
Photo No. 18.	Post-Test $\frac{3}{4}$ Rear View From Left Side of Vehicle	B-18
Photo No. 19.	Pre-Test Impact Point	B-19
Photo No. 20.	Post-Test Impact Point	B-20
Photo No. 21.	Pre-Test Underbody View 1	B-21
Photo No. 22.	Post-Test Underbody View 1	B-22
Photo No. 23.	Pre-Test Underbody View 2	B-23
Photo No. 24.	Post-Test Underbody View 2	B-24
Photo No. 25.	Pre-Test Underbody View 3	B-25
Photo No. 26.	Post-Test Underbody View 3	B-26
Photo No. 27.	Pre-Test Underbody View 4	B-27
Photo No. 28.	Post-Test Underbody View 4	B-28

		<u>Page No.</u>
Photo No. 29.	Pre-Test Front View of MDB	B-29
Photo No. 30.	Post-Test Front View of MDB	B-30
Photo No. 31.	Pre-Test $\frac{3}{4}$ Right Side View of MDB	B-31
Photo No. 32.	Post-Test $\frac{3}{4}$ Right Side View of MDB	B-32
Photo No. 33.	Pre-Test $\frac{3}{4}$ Left Side View of MDB	B-33
Photo No. 34.	Post-Test $\frac{3}{4}$ Left Side View of MDB	B-34
Photo No. 35.	Pre-Test Top View of MDB	B-35
Photo No. 36.	Post-Test Top View of MDB	B-36
Photo No. 37.	Static Rollover at 90 Degrees	B-37
Photo No. 38.	Static Rollover at 180 Degrees	B-38
Photo No. 39.	Static Rollover at 270 Degrees	B-39
Photo No. 40.	Static Rollover at 360 Degrees	B-40
Photo No. 41.	Pre-Test Propulsion Battery Module	B-41
Photo No. 42.	Pre-Test High Voltage Interconnect	B-42
Photo No. 43.	Pre-Test Installed Test Interface Port	B-43
Photo No. 44.	Pre-Test Vehicle Pass. Compartment Adjacent to Propulsion Battery	B-44
Photo No. 45.	Post-Test Vehicle Pass. Compartment Adjacent to Propulsion Battery	B-45
Photo No. 46.	Post-Test Vehicle Pass. Compartment Adjacent to Propulsion Battery	B-46
Photo No. 47.	Pre-Test Vehicle Chassis Ground Points Location	B-47
Photo No. 48.	Pre-Test Service Switch Disconnect	B-48
Photo No. 49.	Pre-Test Inertia Cut Off Switch	B-49
Photo No. 50.	Pre-Test Propulsion Battery Tether	B-50
Photo No. 51.	Post-Test Propulsion Battery Module View 1	B-51
Photo No. 52.	Post-Test Propulsion Battery Module View 2	B-52

MFD. BY FORD MOTOR CO.

DATE: 08/07	GVWR: 4680LB/ 2123KG
FRONT GAWR: 2440LB	REAR GAWR: 2400LB
1107KG	WITH 1089KG
P235/70R16	TIRES P235/70R16
16x7.0J	RIMS 16x7.0J
AT 240 kPa/ 35 PSI COLD	AT 240 kPa/ 35 PSI COLD

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: 1FMCU49H68KB41281
TYPE: MPV

F0111
T0201



EXT PNT: UA	RC: 47	DSO:
WB INT TR TP/PS R AXLE TR SPR 8M71A		
103 5S 8 96 H AAHH H05		
1200708242421	UTC	▽5U5A-1520472-BA

B-1.

Vehicle's Certification Label



TIRE AND LOADING INFORMATION

SEATING CAPACITY TOTAL : 5 FRONT: 2 REAR: 3

The combined weight of occupants and cargo should never exceed : 423 kg or 934 lbs.

▽ 5U5A-1532-AA (TLU)

TIRE	SIZE	COLD TIRE PRESSURE
FRONT	P235/70R16	240 KPA, 35 PSI
REAR	P235/70R16	240 KPA, 35 PSI
SPARE	T165/80D17	415 KPA, 60 PSI

SEE OWNERS MANUAL FOR ADDITIONAL INFORMATION

1FMCU49H68KB41281



B-2.

Vehicle's Tire Placard

B-3.



Pre-Test Front View of Vehicle

B-4.



Post-Test Front View of Vehicle

B-5.



Pre-Test Left Side View of Test Vehicle

B-6.



Post-Test Left Side View of Test Vehicle

B-7.



Pre-Test Left Rear Closeup View of Vehicle

B-8.



Post-Test Left Rear Closeup View of Vehicle

B-9.



Pre-Test Right Side View of Vehicle

B-10.



Post-Test Right Side View of Vehicle

B-11.



Pre-Test Right Rear Closeup View of Vehicle

B-12.



Post-Test Right Rear Closeup View of Vehicle

B-13.



Pre-Test Rear View of Vehicle



B-14.

Post-Test Rear View of Vehicle

B-15.



Pre-Test ¾ Frontal View From Right Side of Vehicle

B-16.



Post-Test ¾ Frontal View From Right Side of Vehicle

B-17.



Pre-Test ¾ Rear View From Left Side of Vehicle



Post-Test ¾ Rear View From Left Side of Vehicle

B-19.

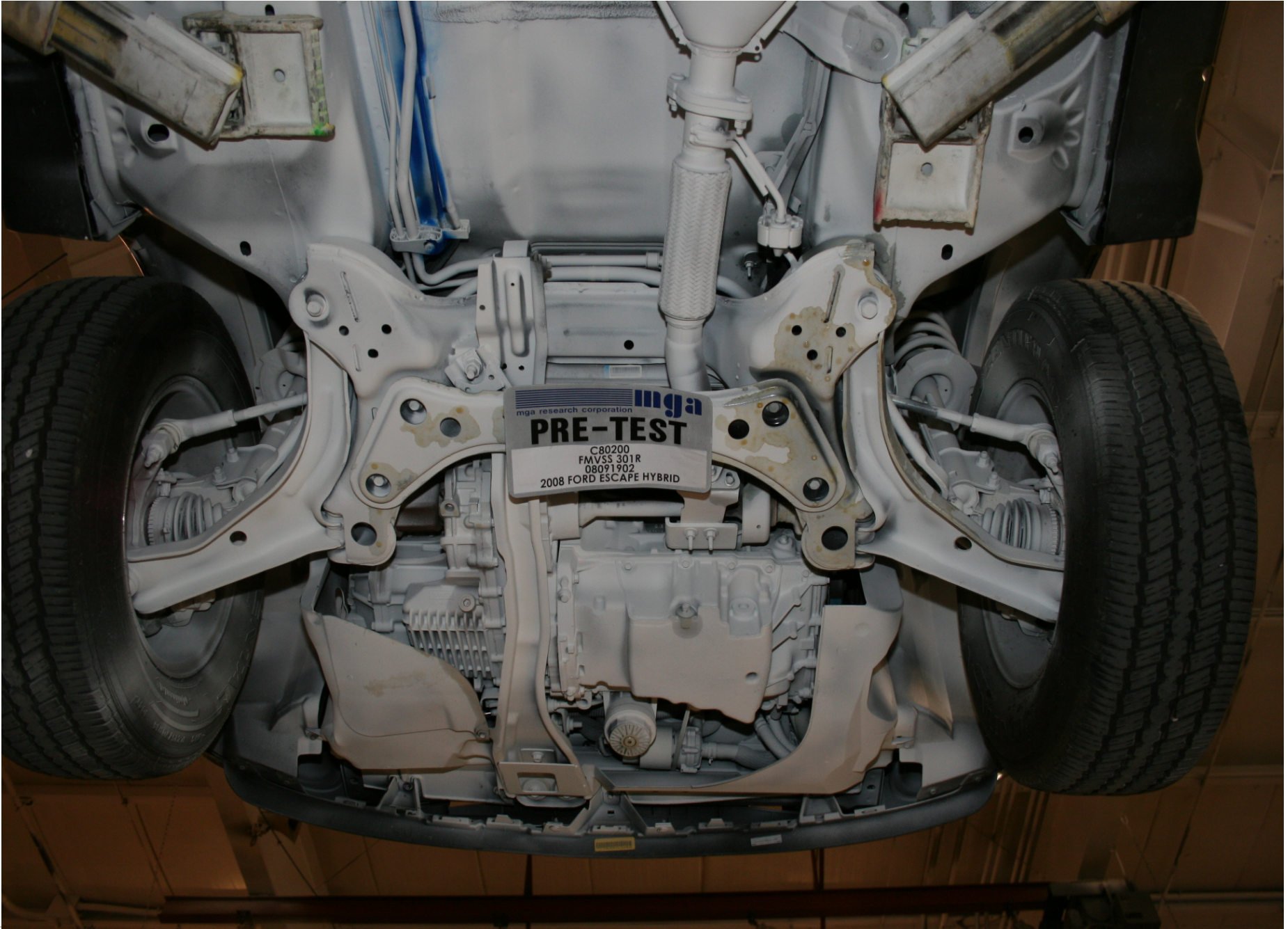


Pre-Test Impact Point

B-20.

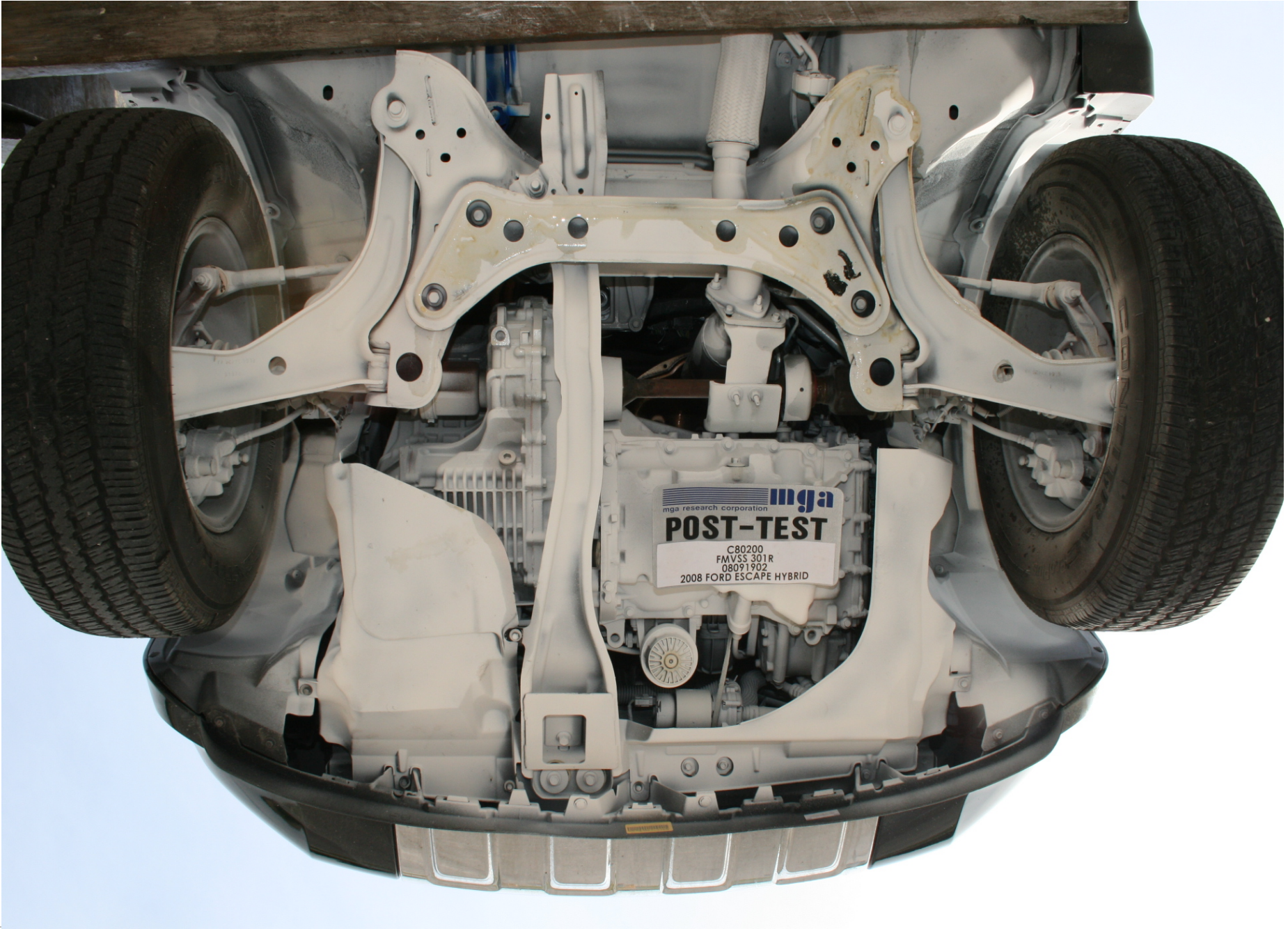


Post-Test Impact Point



B-21.

Pre-Test Underbody View 1



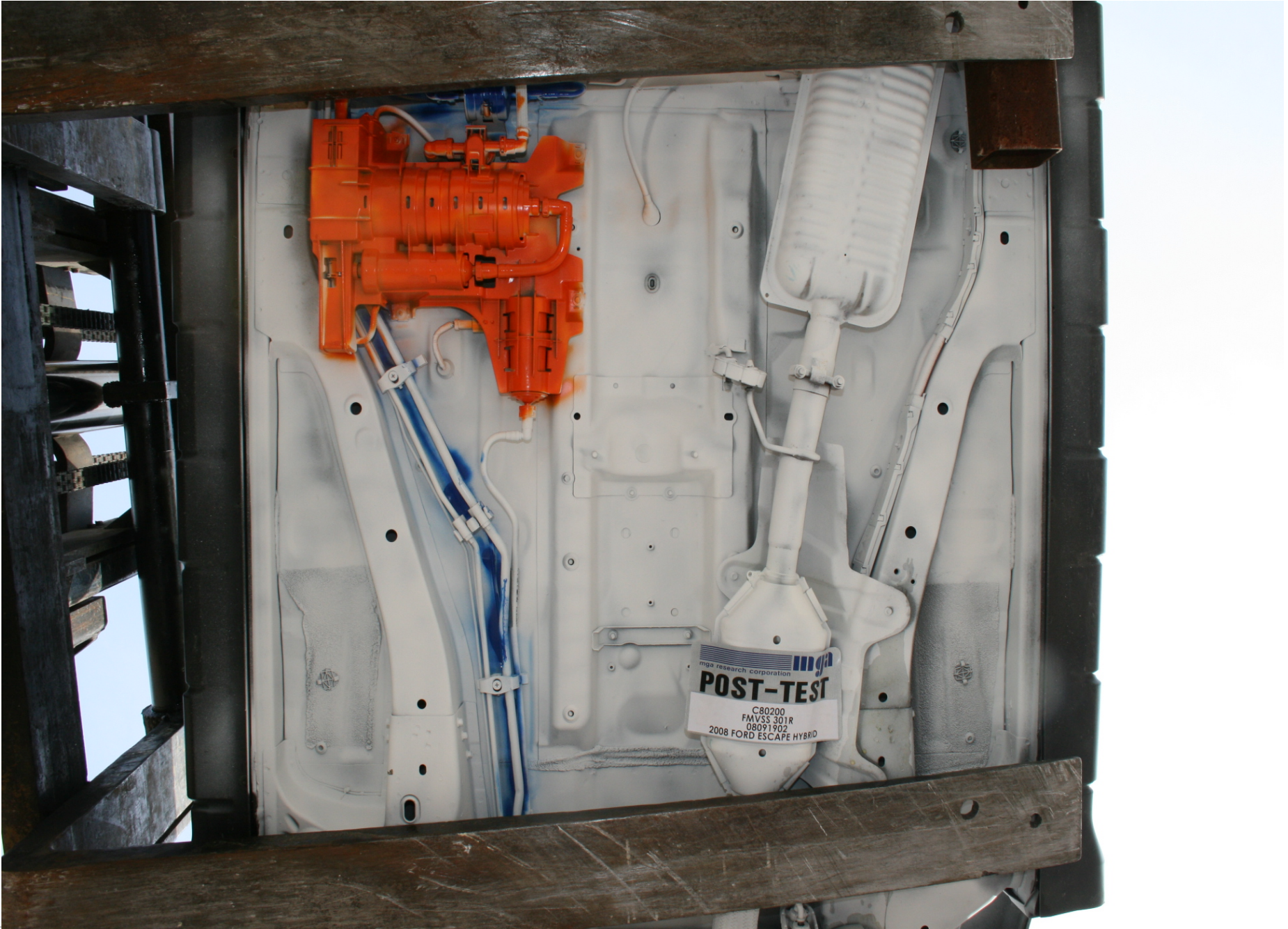
B-22.

Post-Test Underbody View 1

B-23.



Pre-Test Underbody View 2



B-24.

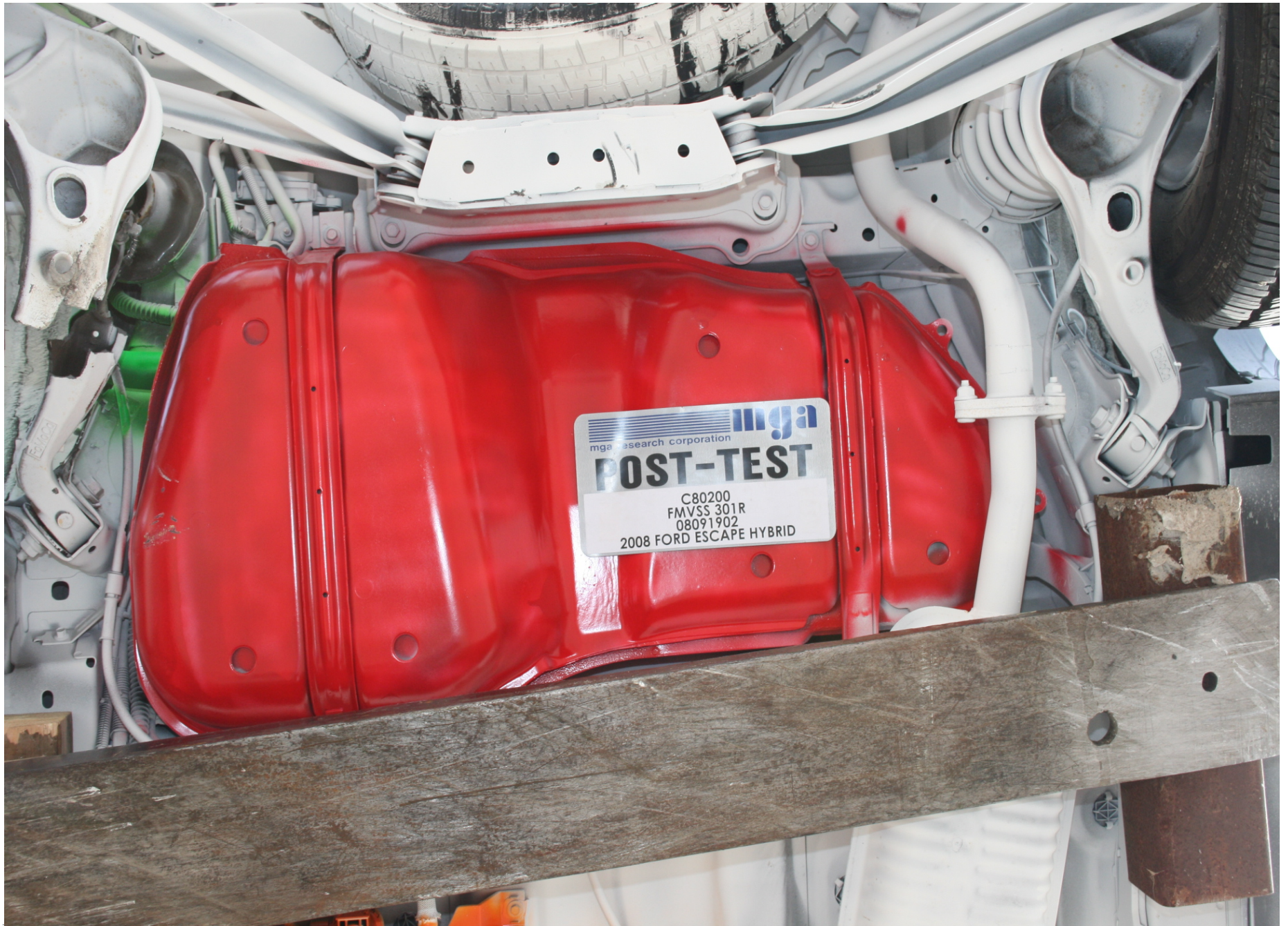
Post-Test Underbody View 2

B-25.



Pre-Test Underbody View 3

B-26.



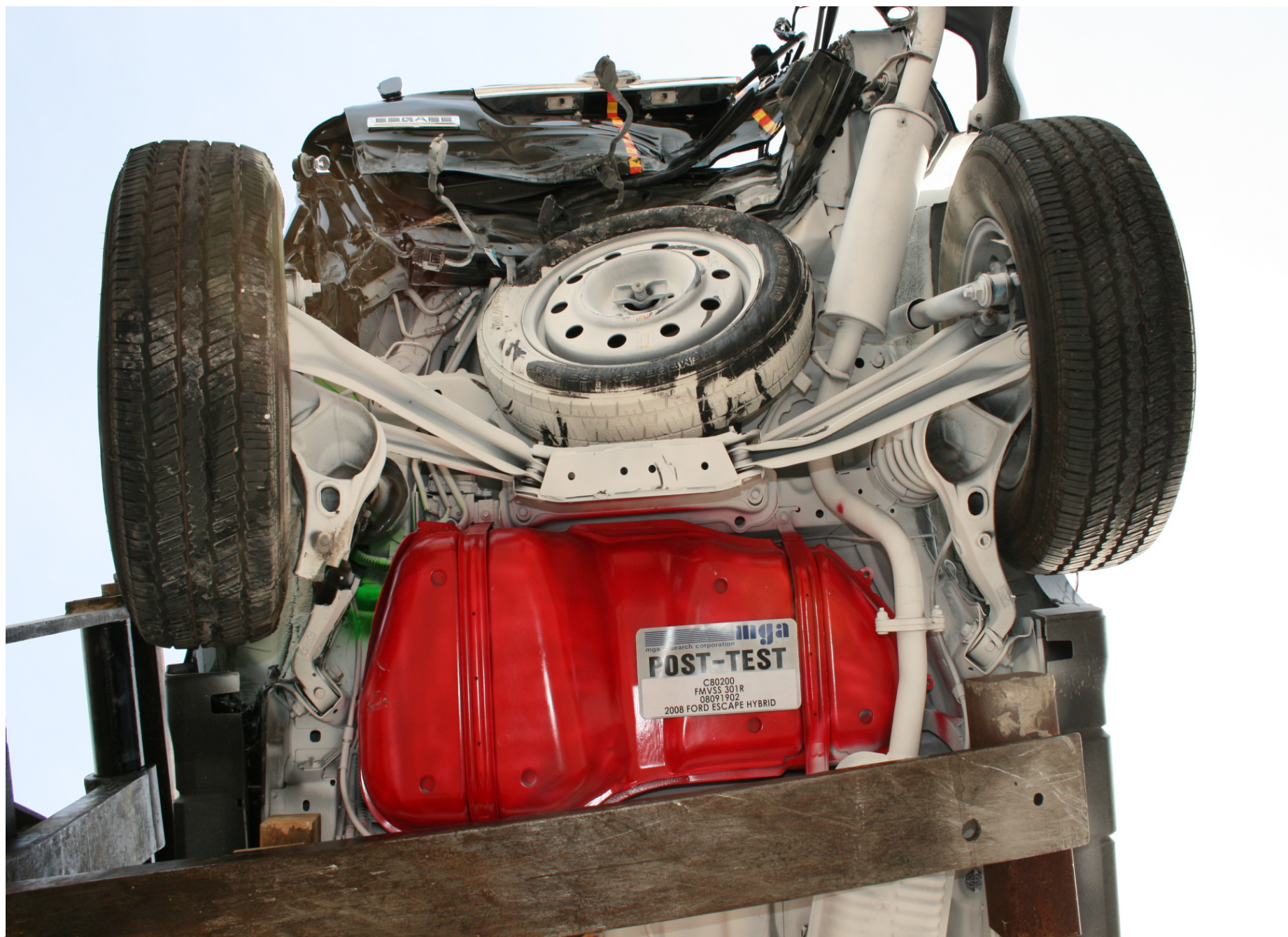
Post-Test Underbody View 3



B-27.

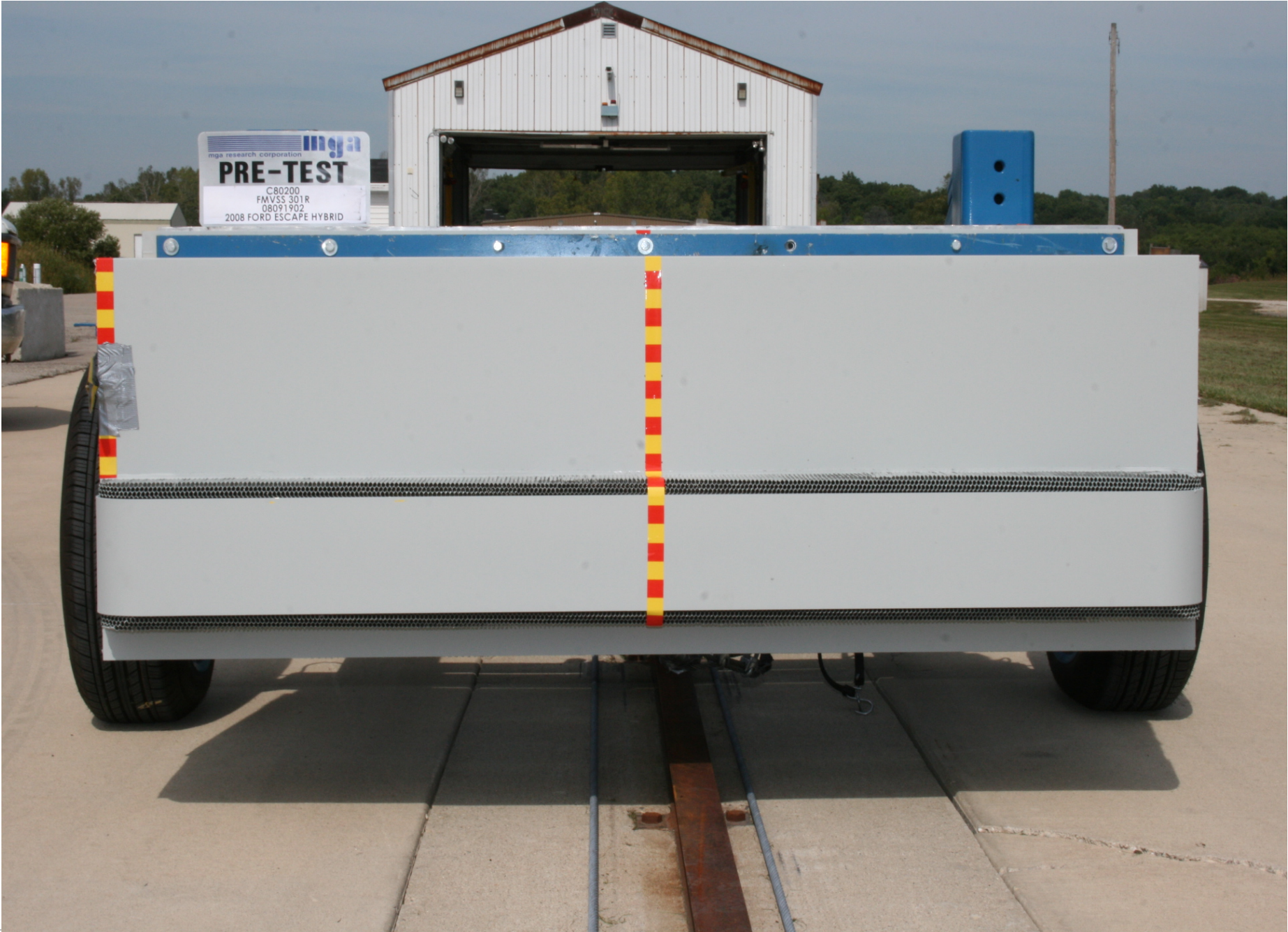
Pre-Test Underbody View 4

B-28.



Post-Test Underbody View 4

B-29.



Pre-Test Front View of MDB

B-30.



Post-Test Front View of MDB

B-31.



Pre-Test $\frac{3}{4}$ Right Side View of MDB

B-32.



Post-Test ¾ Right Side View of MDB



B-33.

Pre-Test ¾ Left Side View of MDB

B-34.



Post-Test $\frac{3}{4}$ Left Side View of MDB

B-35.



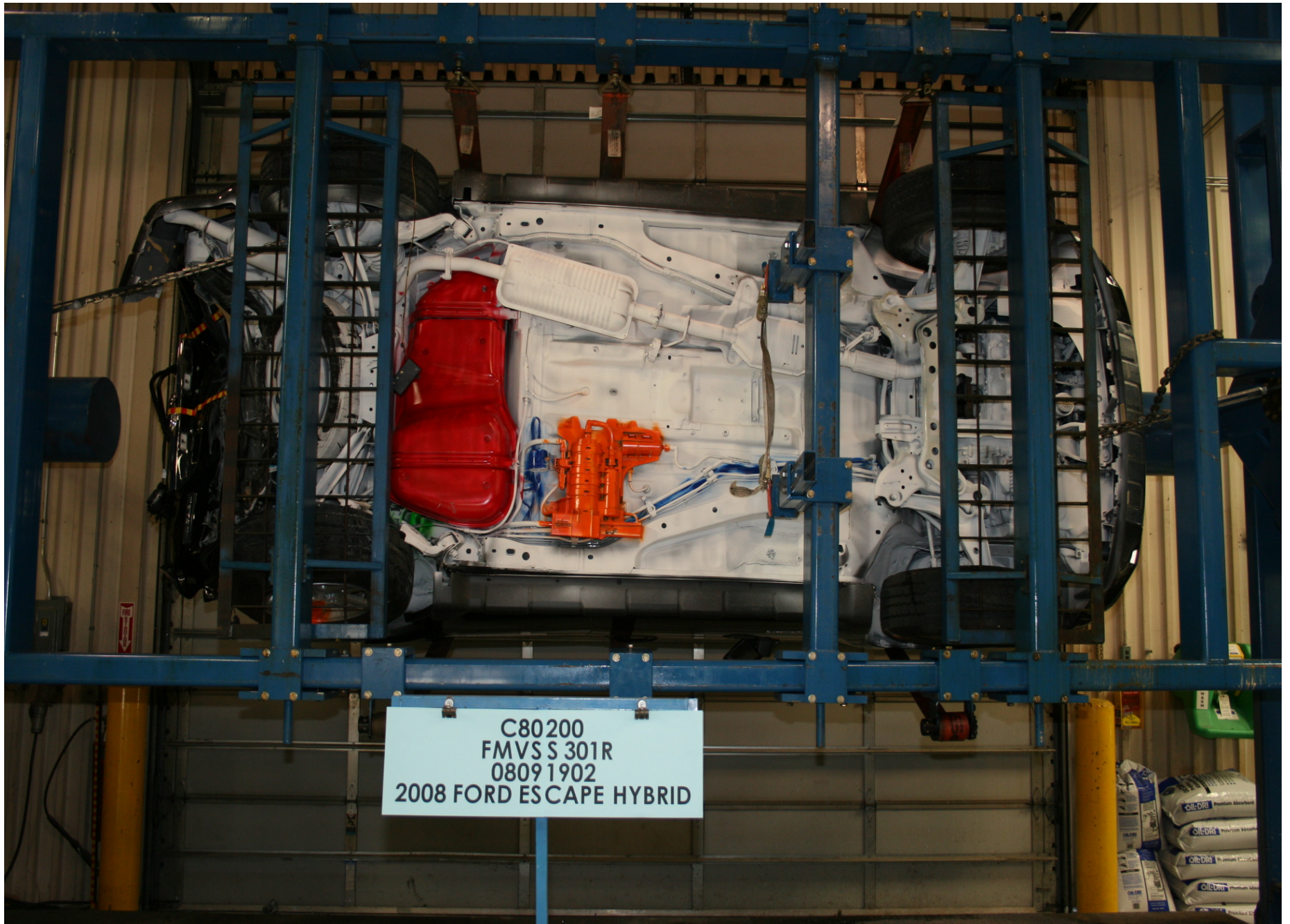
Pre-Test Top View of MDB

B-36.



Post-Test Top View of MDB

B-37.



Static Rollover at 90 Degrees

B-38.



Static Rollover at 180 Degrees



C80200
FMVSS 301R
08091902
2008 FORD ESCAPE HYBRID

2008 Ford Escape Hybrid
C80200
FMVSS 301R
08091902
2008 FORD ESCAPE HYBRID

B-39.

Static Rollover at 270 Degrees

B-40.



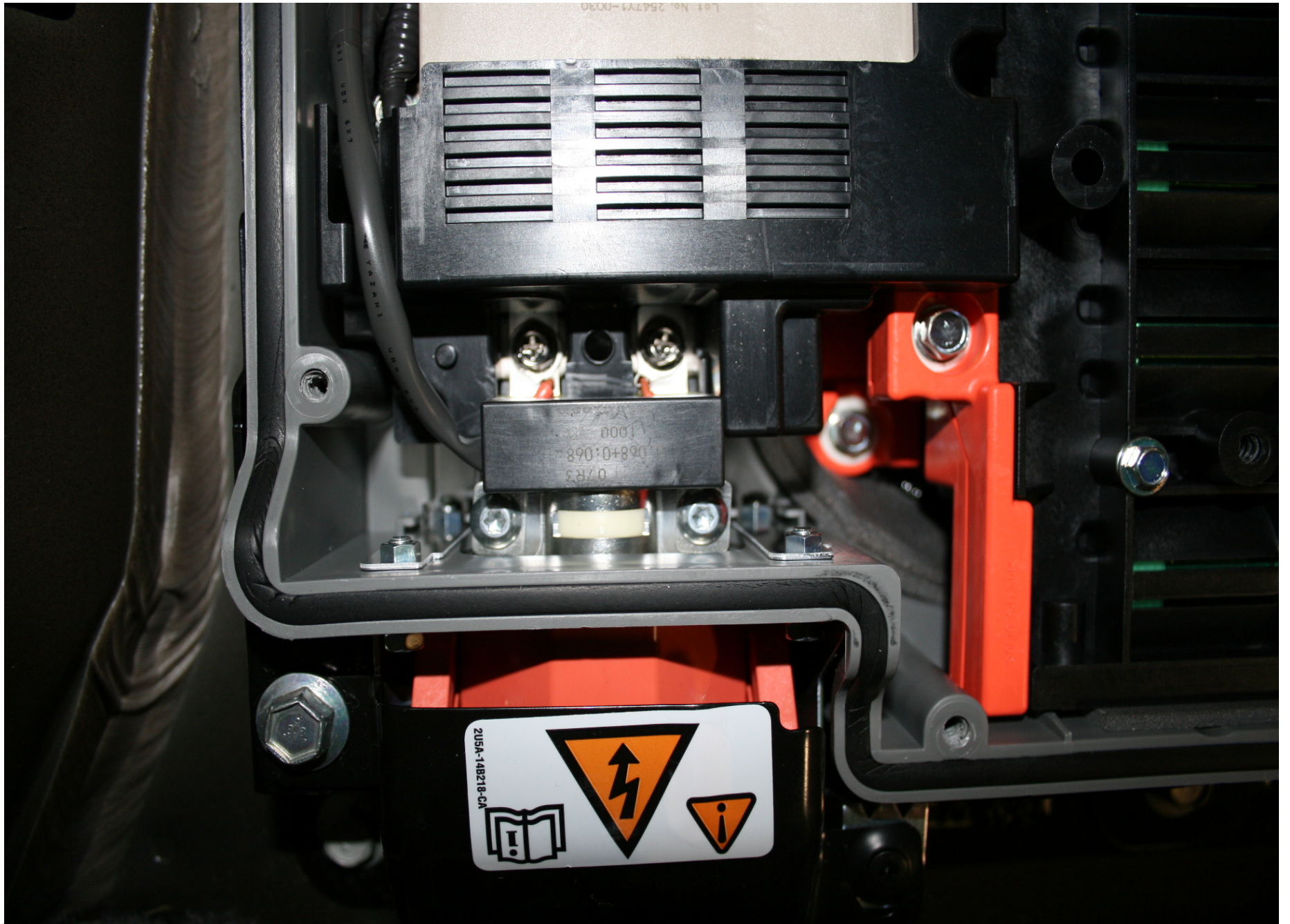
Static Rollover at 360 Degrees

B-41.



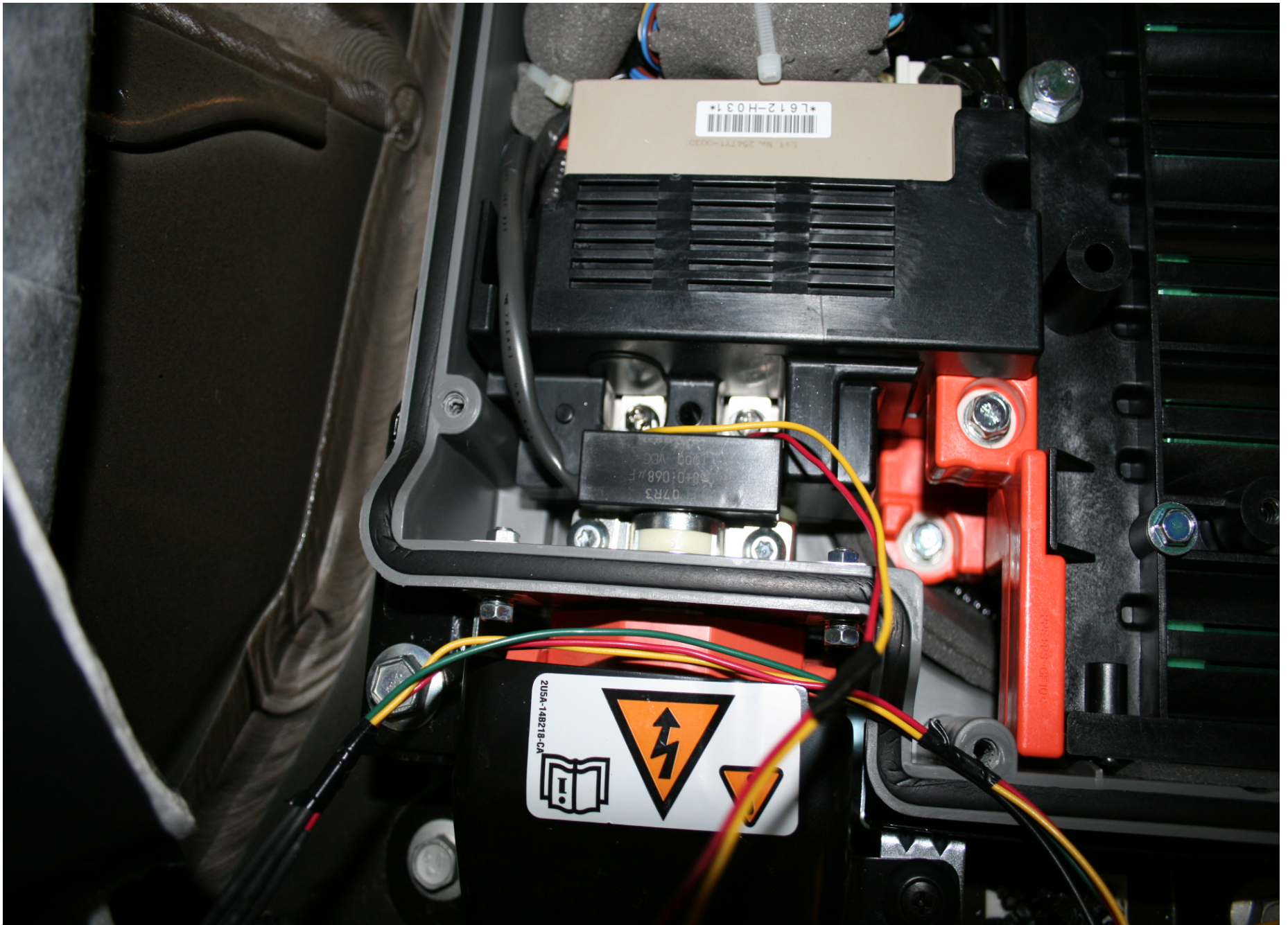
Pre-Test Propulsion Battery Module

B-42.



Pre-Test High Voltage Interconnect

B-43.



Pre-Test Installed Test Interface Port

B-44.



Pre-Test Vehicle Pass. Compartment Adjacent to Propulsion Battery

B-45.



Post-Test Vehicle Pass. Compartment Adjacent to Propulsion Battery

B-46.



Post-Test Vehicle Pass. Compartment Adjacent to Propulsion Battery



B-47.

Pre-Test Vehicle Chassis Ground Points Location



Pre-Test Service Switch Disconnect

B-49.



Pre-Test Inertia Cut Off Switch

B-50.



Pre-Test Propulsion Battery Tether

B-51.



Post-Test Propulsion Battery Module View 1

B-52.



Post-Test Propulsion Battery Module View 2