This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-06-C-00031. This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufactures' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: Vincent Paolini, Project Engineer

Approved By: David J. Travale, Program Manager
Transportation Sciences Center

Approval Date: Vincent M. Paolini

Final Report Acceptance By: Edward E. Chan

Accepted By: 

Acceptance Date:
Compliance tests were conducted on the subject 2010 Ford Fusion Hybrid 4-door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-305-00 for the determination of FMVSS 305 compliance. Test failures identified were as follows:

The test vehicle appeared to comply with all requirements of FMVSS 305 "Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection."
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PURPOSE AND TEST PROCEDURE</td>
</tr>
<tr>
<td>2</td>
<td>COMPLIANCE TEST RESULTS SUMMARY</td>
</tr>
<tr>
<td>3</td>
<td>SUMMARY OF TEST RESULTS</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 1 - Test Vehicle Specifications</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 2 – Pre-Test Data</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 3 - Moving Deformable Barrier (MDB) Data</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 4 - Pre-Impact Electrical Isolation Measurements &amp; Calculations</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 5 - High Speed Camera Locations and Data Summary</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 6 – Post-Test Data</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 7 – Post-Impact Electrical Isolation Measurements &amp; Calculations</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 8 – FMVSS 301 Rollover Data</td>
</tr>
<tr>
<td></td>
<td>Data Sheet 9 – FMVSS 305 Rollover Data</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>PHOTOGRAPHS</td>
</tr>
</tbody>
</table>
SECTION 1

PURPOSE AND TEST PROCEDURE

This rear impact test is part of the FMVSS 305 Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-06-C-00031. The purpose of this test was to determine if the subject vehicle, a 2010 Ford Fusion Hybrid 4-door Sedan, meets the performance requirements of FMVSS No. 305 “Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection.” The test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-305D-00, dated December 29, 2005).
SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1876 kg 2010 Ford Fusion Hybrid 4-door Sedan was impacted from the rear by an 1797 kg moving barrier at a velocity of 79.8 kph (49.6 mph). The test was performed by Calspan Corporation on June 29, 2009.

The test vehicle was equipped with a 66.2 liter fuel tank which was filled to 92 percent capacity with stoddard fluid prior to impact. Additional ballast (30 kg) was secured in the vehicle cargo area. Two ballast Part 572E 50th percentile male Anthropomorphic Test Device (ATD) were placed in the front occupant seating positions.

The crash event was recorded by three high-speed cameras and one real-time camera. High-speed camera locations and other pertinent camera information are found on page 3-8 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid or propulsion battery electrolyte spillage following the impact or during any portion of the static rollover test. The vehicle appeared to comply with all the requirements of FMVSS 305 "Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection."
SECTION 3

SUMMARY OF TEST RESULTS
### TEST VEHICLE SPECIFICATIONS

**TEST VEHICLE INFORMATION:**

<table>
<thead>
<tr>
<th>Year/Make/Model/Body Style</th>
<th>2010 Ford Fusion Hybrid 4-door Sedan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Body Color</td>
<td>Black</td>
</tr>
<tr>
<td>NHTSA Number</td>
<td>CA0200</td>
</tr>
</tbody>
</table>

**Engine Data:**

| Cylinders; CID; Liters; cc | 4; 2.5                                              |

**Transmission:**

- Manual; Automatic; Overdrive

**Final Drive:**

- Rear Wheel Drive; Front Wheel Drive; Four Wheel Drive

**MAJOR TEST VEHICLE OPTIONS:**

- AC; Pwr Steering; Power Brakes; Power Locks; Power Seats
- ABS; Tilt Wheel; Stab Control; Traction Control; Anti-Theft

**DEALER AND DELIVERY INFORMATION:**

- Date Received: 5/21/09
- Odometer Reading: 77 km
- Selling Dealer: West Herr Ford
- Dealer Address: 5025 Camp Rd, Hamburg, New York 14075

**DATA FROM VEHICLE'S CERTIFICATION LABEL:**

- Vehicle Manufacturer: Ford Motor Company
- Vehicle Build Date: 04/09
- VIN: 3FADP0L38AR132742
- GVWR: 2132 kg
- GAWR: FRONT: 1130 kg, REAR: 1002 kg

**DATA FROM VEHICLE'S TIRE LABEL AND SIDEWALL:**

- Location of Tire Placard: Rear Trunk
- Type of Spare Tire: Temporary

<table>
<thead>
<tr>
<th>Front</th>
<th>Rear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Pressure (sidewall - kPa)</td>
<td>300</td>
</tr>
<tr>
<td>Recommended Tire Size (tire placard)</td>
<td>P225/50R17</td>
</tr>
<tr>
<td>Vehicle Tire Size with load index &amp; speed symbol</td>
<td>P225/50R17 93V</td>
</tr>
<tr>
<td>Tire Manufacturer</td>
<td>Michelin</td>
</tr>
<tr>
<td>Tire Name</td>
<td>Energy</td>
</tr>
<tr>
<td>Treadwear, Traction, Temperature</td>
<td>440 A A</td>
</tr>
</tbody>
</table>

**VEHICLE CAPACITY DATA:**

<table>
<thead>
<tr>
<th>Type of Front Seats</th>
<th>- Bench;</th>
<th>X Bucket;</th>
<th>- Split Bench</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Occupants</td>
<td>2 Front;</td>
<td>3 Rear;</td>
<td>5 Total</td>
</tr>
<tr>
<td>Vehicle Capacity Weight (VCW) =</td>
<td>385 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Occupants x 68.04 kg =</td>
<td>340 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Cargo/Luggage Weight (RCLW) =</td>
<td>45 kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ELECTRIC VEHICLE PROPULSION SYSTEM:**

- Electric Vehicle Type: Electric; Electric/Hybrid
- Propulsion Battery Type: NiMH Traction Battery
- Nominal Voltage: 230 V
- Location of Automatic Propulsion Battery Disconnect: Interior of Traction Battery System

**Auxiliary Battery Type:** N/A
DATA SHEET 2

PRE-TEST DATA

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids)= UDWH:

<table>
<thead>
<tr>
<th>Left Side (kg)</th>
<th>Right Side (kg)</th>
<th>Ratio (%)</th>
<th>Total (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>499</td>
<td>510</td>
<td>1009.0</td>
</tr>
<tr>
<td>Rear</td>
<td>362</td>
<td>321</td>
<td>683.0</td>
</tr>
</tbody>
</table>

Total Delivered Weight (UDW) = 1692.0 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Delivered Weight (UDW)</td>
<td>1692.0 kg</td>
</tr>
<tr>
<td>Rated Cargo/Luggage Weight (RCLW)</td>
<td>45 kg</td>
</tr>
<tr>
<td>Weight of 2 p.572E Dummies @ 78 each</td>
<td>156 kg</td>
</tr>
</tbody>
</table>

TARGET TEST WEIGHT = 1893.0 kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 28.0 KG OF CARGO WEIGHT:

<table>
<thead>
<tr>
<th>Left Side (kg)</th>
<th>Right Side (kg)</th>
<th>Ratio (%)</th>
<th>Total (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>558</td>
<td>559</td>
<td>1117.0</td>
</tr>
<tr>
<td>Rear</td>
<td>394</td>
<td>365</td>
<td>759.0</td>
</tr>
</tbody>
</table>

Total Vehicle Test Weight (ATW) = 1876.0 kg

Weight of Ballast Secured in Vehicle¹ = 30 kg Ballast Type: Lead Shot Bags

Method of securing Ballast: Compartment Placement

Components Removed for Weight Reduction: None

VEHICLE ATTITUDE (all dimension in millimeters):

<table>
<thead>
<tr>
<th></th>
<th>Left Front</th>
<th>Right Front</th>
<th>Left Rear</th>
<th>Right Rear</th>
<th>CG²</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS DELIVERED:</td>
<td>722</td>
<td>733</td>
<td>722</td>
<td>720</td>
<td>1101</td>
</tr>
<tr>
<td>AS TESTED:</td>
<td>703</td>
<td>713</td>
<td>709</td>
<td>712</td>
<td>1104</td>
</tr>
</tbody>
</table>

Vehicle's Wheel Base: 2729 mm

¹Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system
²Rearward of the front axle centerline.

VEHICLE PRE-TEST WIDTH AND IMPACT OFFSET MEASUREMENT:

Vehicle Width at Widest Point: 1822 mm Location: Rear Axle

Centerline offset for impact line: 1275 mm

Filler neck side (left/right): Left
Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan
NHTSA No. CA0200

Nominal Design Riding Position for adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.

Seat back angle for driver's seat: 10.8
Measurement instructions: Seat back was set to 10.8 degrees on head restraint post with sill level

Seat back angle for passenger's seat: 10.8
Measurement instructions: Seat back was set to 10.8 degrees on head restraint post with sill level

2. SEAT FORE AND AFT POSITIONING:
Positioning of the driver's seat: Full forward – Full rear = Travel 296 mm. Seat was positioned at 147 mm on face of the cushion while in full down.
Positioning of the passenger's seat: Full forward – Full rear = Travel 250 mm. Seat was positioned at 125 mm on face of the cushion while in full down.

3. FUEL TANK CAPACITY DATA:
3.1 A. "Usable Capacity" of the standard equipment fuel tank is 66.2 liters
B. "Usable Capacity" of the optional equipment fuel tank is - liters
C. "Usable Capacity" of the vehicle(s) used for certification testing to requirements of FMVSS 301 = 60.9 to 62.2 liters
3.2 Actual Amount of Stoddard solvent added to vehicle for test = 61.6 liters
3.3 Is vehicle equipped with electric fuel pump? Yes- X ; No- -
If YES, explain the vehicle operating conditions under which the fuel pump will pump fuel.
With ignition turned “ON”

4. STEERING COLUMN ADJUSTMENTS:
Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. If the tested vehicle has any of these adjustments, does your company use any specific procedures to determine the geometric center.
Operational Instructions: Telescopic travel was 30 mm; centered at 15 mm. Tilt wheel was centered at
Center of loci: face of wheel was set at 22.7 degrees
Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan  
NHTSA No. CA0200

5. **SEAT BELT UPPER ANCHORAGE:**
   Nominal design riding position: 4 detents available – set at detent 1 with 0 as uppermost

6. **PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED):**
   - Electrolyte Fluid Type: Alkaline
   - Electrolyte Fluid Specific Gravity: 1.3 grams / cc
   - Electrolyte Fluid Kinematic Viscosity: 1.75 centistokes at 25ºC
   - Electrolyte Fluid Color: Clear Liquid
   - Propulsion Battery Coolant Type, Color and Specific Gravity: Air, N/A
   - Location of Battery Modules: X In Occupant Compartment, - Outside Occupant Compartment

7. **PROPULSION BATTERY STATE OF CHARGE**
   - Maximum State of Charge: 290 – 330 volts
   - Test Voltage (≥95% of maximum) -
   OR
   - Range of Normal Operating Voltage: -
   - Test Voltage (within range) -

8. **Details of Chassis Ground Points and Locations:**
   By removing the rear seat, located behind the seats trim panel located between the rear door opening and rear seat, a grounding weld nut is found.

9. **Details of Propulsion Battery Components:**
   The main battery is located behind the rear passenger seat. Propulsion unit located in engine compartment.

10. **Comments:**
    None
DATA SHEET 3

MOVING DEFORMABLE BARRIER (MDB) DATA

Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan

MDB FACE MANUFACTURER AND SERIAL NUMBER:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Block Numbers: 139B1008 124B0309</th>
<th>Unit Number: A0409029</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plascore</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MDB DETAILS:

- Overall Width of Framework Carriage = 1250 millimeters
- Overall Length of MDB (incl. honeycomb impact face) = 4120 millimeters
- Wheelbase of Framework Carriage = 2591 millimeters
- Tread of Framework Carriage (Front & Rear) = 1875 millimeters
- C.G. Location Rearward of Front Axle = 1139 millimeters

MDB WEIGHT:

- Left Front = 357.0 kg
- Left Rear = 323.0 kg
- Right Front = 404.0 kg
- Right Rear = 273.5 kg
- TOTAL FRONT = 761.0 kg
- TOTAL REAR = 596.5 kg
- TOTAL MDB WEIGHT = 1357.5 kg

Tires (Mfr, line, size): -

TIRE PRESSURE:

- Left Front = 207 kPa
- Left Rear = 207 kPa
- Right Front = 207 kPa
- Right Rear = 207 kPa

Brake Abort System? (Yes/No) Yes
Date of Last Calibration: 06/07
Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan

VOLTAMETER INFORMATION:

Make: Fluke
Model: 87
S/N: 65280327

Internal Resistance Value: 0.12 MΩ
Resolution: .001 V
Last Calibration Date: 4/10/2009

Propulsion Battery Voltage: (ready to drive position) $V_b = 260.5$ V
Propulsion Battery to Vehicle Chassis: $V_1 = 230$ V
Propulsion Battery to Vehicle Chassis: $V_2 = 230$ V
Propulsion Battery to Vehicle Chassis Across Known Resistor: $R_o = 120k$ Ω
Propulsion Battery to Vehicle Chassis with $R_o$ installed: $V_1' = 0.06$ V
Propulsion Battery to Vehicle Chassis: with $R_o$ installed: $V_2' = 0.05$ V

ELECTRICAL ISOLATION MEASUREMENTS:

$R_{i1}$: 919760 kΩ $R_{i1} = R_o*(1+V_2/V_1)*[(V_1-V_1')/V_1']$
$R_{i2}$: 1103760 kΩ $R_{i2} = R_o*(1+V_1/V_2)*[(V_2-V_2')/V_2']$
$R_i$ 919760 kΩ Lesser value of $R_{i1}$ and $R_{i2}$
$R_i/V_b$ 3530749 Ω/V Electrical Isolation Value

Is the Electrical Isolation Value $\geq 500$ Ω/V? YES
If NO - Failure

Comments:
None
**Vehicle:** 2010 Ford Fusion Hybrid 4-door Sedan

**NHTSA No.:** CA0200

### Camera Locations and Data Summary

<table>
<thead>
<tr>
<th>Camera No.</th>
<th>View</th>
<th>Coordinates (millimeters)</th>
<th>Angle (deg.)</th>
<th>Lens (mm)</th>
<th>Film Speed (fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Left Side View</td>
<td>X: 7345; Y: 1195; Z: 1094</td>
<td>-3</td>
<td>24</td>
<td>1000</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Real-Time Camera</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Overhead View</td>
<td>X: 0; Y: 405; Z: 4880</td>
<td>-90</td>
<td>20</td>
<td>1000</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Right Side View</td>
<td>X: 7850; Y: 1345; Z: 959</td>
<td>-5</td>
<td>24</td>
<td>1000</td>
</tr>
</tbody>
</table>

*Reference (from point of impact); all measurements accurate to within ±6 mm.*

- **X** = (Impact Point) + Forward
- **Y** = (Impact Point) + To Right
- **Z** = (Ground Level) + Down
Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan  
NHTSA No. CA0200

REQUIRED IMPACT VELOCITY RANGE:: 78.5 to 80.1 km/h

ACTUAL IMPACT VELOCITY WITHIN 1.5 M OF IMPACT PLANE:

Trap No. 1 = 79.8 km/h  
Trap No. 2 = 79.8 km/h  
Average Impact Speed = 79.8 km/h

WELDING ROD IMPACT POINT:

-10 Vertical distance from target center (+ is above) Tolerance: ±40 mm

-30 Horizontal distance from target center (+ is right) Tolerance: ±50 mm

STODDARD SOLVENT SPILLAGE MEASUREMENT:

A. Front impact until vehicle motion ceases -
Actual = 0 g  Maximum Allowable = 28 g

B. For 5 minute period after vehicle motion ceases -
Actual = 0 g  Maximum Allowable = 28 g

C. For next 25 minutes -
Actual = 0 g/minute  Maximum Allowable = 28 g/minute

D. Provide Spillage Details:
None

ELECTROLYTE SPILLAGE MEASUREMENT:

Is propulsion battery electrolyte spillage visible in occupant compartment?  -  Yes (fail)  X  No

For 30 minutes until vehicle motion ceases -
Actual = 0 L  Maximum Allowable = 5 L

Provide Spillage Details:
None
Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan

POST TEST SEAT DATA

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SEAT MOVEMENT (mm)</th>
<th>SEAT BACK FAILURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 (Left Front)</td>
<td>46 rearward</td>
<td>None – Reclined during impact</td>
</tr>
<tr>
<td>P2 (Right Front)</td>
<td>0</td>
<td>None – Reclined during impact</td>
</tr>
</tbody>
</table>

POST TEST ATD CONTACT DATA

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>Position 1 (Driver)</th>
<th>Position 2 (Passenger)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>Rear of head to head restraint</td>
<td>Rear of head to head restraint</td>
</tr>
<tr>
<td>Chest</td>
<td>No Contact</td>
<td>No Contact</td>
</tr>
<tr>
<td>Abdomen</td>
<td>No Contact</td>
<td>No Contact</td>
</tr>
<tr>
<td>Left Knee</td>
<td>No Contact</td>
<td>No Contact</td>
</tr>
<tr>
<td>Right Knee</td>
<td>No Contact</td>
<td>No Contact</td>
</tr>
</tbody>
</table>

VEHICLE DIMENSIONS:

Vehicle length:

<table>
<thead>
<tr>
<th></th>
<th>Left Side</th>
<th>Centerline</th>
<th>Right Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>4715</td>
<td>4846</td>
<td>4715</td>
</tr>
<tr>
<td>Post-Test</td>
<td>4023</td>
<td>4125</td>
<td>4226</td>
</tr>
<tr>
<td>Crush</td>
<td>692</td>
<td>721</td>
<td>489</td>
</tr>
</tbody>
</table>

Vehicle Wheel Base:

<table>
<thead>
<tr>
<th></th>
<th>Left Side</th>
<th>Right Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>2725</td>
<td>2732</td>
</tr>
<tr>
<td>Post-Test</td>
<td>2622</td>
<td>2743</td>
</tr>
<tr>
<td>Crush</td>
<td>103</td>
<td>-11</td>
</tr>
</tbody>
</table>
Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan

VOLTMETER INFORMATION:
Make: Fluke  Model: 87  S/N: 65280327
Internal Impedance Value 0.12 MΩ
Normal Propulsion Battery Voltage (Vbh): 5.69 V

ELECTRICAL ISOLATION MEASUREMENTS

\[ V_1 = 3.0 \text{ V} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]
\[ V_2 = 3.5 \text{ V} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]
\[ V'_1 = 0.006 \text{ V} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]
\[ V'_2 = 0.001 \text{ V} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]

\[ R_{i1} = 129740 \text{ Ω} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]
\[ R_{i2} = 779777 \text{ Ω} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]
\[ R_i = 129740 \text{ Ω} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]
\[ R_i/V_b = 2761404 \text{ Ω} \quad \text{Impact} \quad \text{Time: 2 minutes 00 seconds} \]

Is the measured Electrical Isolation Value \( \geq 500 \text{ Ω/V} \)?  
\[ \text{X} \quad \text{Yes} \quad \text{-} \quad \text{No (Fail)} \]

PROPULSION BATTERY SYSTEM COMPONENTS

Describe Propulsion Battery Module movement within occupant compartment:
None

Has the Propulsion Battery Module moved within the occupant compartment?  
\[ \text{-} \quad \text{Yes(Fail)} \quad \text{X} \quad \text{No} \]

Describe intrusion of an outside Propulsion Battery Component into the occupant compartment:
None

Has an outside Propulsion Battery Component intruded into the occupant compartment?  
\[ \text{-} \quad \text{Yes(Fail)} \quad \text{X} \quad \text{No} \]

Is Propulsion Battery electrolyte spillage visible in the occupant compartment?  
\[ \text{-} \quad \text{Yes(Fail)} \quad \text{X} \quad \text{No} \]
DATA SHEET 8

FMVSS 301 ROLLOVER DATA

Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan  
NHTSA No.: CA0200

I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>Rotation Time (spec. 1-3 min)</th>
<th>FMVSS 301 Hold Time</th>
<th>Total Time</th>
<th>Next Whole Minute Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>0º - 90º</td>
<td>1 minutes 08 seconds</td>
<td>5 minutes</td>
<td>6 minutes</td>
<td>8 seconds</td>
</tr>
<tr>
<td>90º - 180º</td>
<td>1 minutes 03 seconds</td>
<td>5 minutes</td>
<td>6 minutes</td>
<td>3 seconds</td>
</tr>
<tr>
<td>180º - 270º</td>
<td>1 minutes 04 seconds</td>
<td>5 minutes</td>
<td>6 minutes</td>
<td>4 seconds</td>
</tr>
<tr>
<td>270º - 360º</td>
<td>1 minutes 09 seconds</td>
<td>5 minutes</td>
<td>6 minutes</td>
<td>9 seconds</td>
</tr>
</tbody>
</table>

II. FMVSS 301 REQUIREMENTS: (Maximum allowable solvent spillage):

<table>
<thead>
<tr>
<th>First 5 minutes from onset of rotation (g)</th>
<th>6th min. (g)</th>
<th>7th min. (g)</th>
<th>8th min. (if required) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>142 g</td>
<td>28 g</td>
<td>28 g</td>
<td>28 g</td>
</tr>
</tbody>
</table>

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>First 5 minutes from onset of rotation (g)</th>
<th>6th min. (g)</th>
<th>7th min. (g)</th>
<th>8th min. (if required) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0º - 90º</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>90º - 180º</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>180º - 270º</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>270º - 360º</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>Spillage Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>0º - 90º</td>
<td>None</td>
</tr>
<tr>
<td>90º - 180º</td>
<td>None</td>
</tr>
<tr>
<td>180º - 270º</td>
<td>None</td>
</tr>
<tr>
<td>270º - 360º</td>
<td>None</td>
</tr>
</tbody>
</table>
**DATA SHEET 9**

**FMVSS 305 ROLLOVER DATA**

Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan  
NHTSA No.: CA0200

### I. DETERMINATION OF PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD:

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>Rotation Time (spec. 1 - 3 min)</th>
<th>FMVSS 301 Hold Time</th>
<th>Total Time</th>
<th>Next Whole Minute Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>0º - 90º</td>
<td>1 minute 08 seconds</td>
<td>5 minutes</td>
<td>6 minutes 8 seconds</td>
<td>7 minutes</td>
</tr>
<tr>
<td>90º - 180º</td>
<td>1 minute 03 seconds</td>
<td>5 minutes</td>
<td>6 minutes 3 seconds</td>
<td>7 minutes</td>
</tr>
<tr>
<td>180º-270º</td>
<td>1 minute 04 seconds</td>
<td>5 minutes</td>
<td>6 minutes 4 seconds</td>
<td>7 minutes</td>
</tr>
<tr>
<td>270º-360º</td>
<td>1 minute 09 seconds</td>
<td>5 minutes</td>
<td>6 minutes 9 seconds</td>
<td>7 minutes</td>
</tr>
</tbody>
</table>

### II. ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE:

<table>
<thead>
<tr>
<th>Rollover Stage</th>
<th>Propulsion Battery Electrolyte Spillage (L)</th>
<th>Spillage Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-90º</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>90-180º</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>180-270º</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>270-360º</td>
<td>0</td>
<td>None</td>
</tr>
</tbody>
</table>

Total Spillage: **0** L  
**FMVSS 305 permits 5 L maximum**

Is the total spillage of Propulsion Battery electrolyte greater than 5.0 liters?  
- YES (Fail)  x NO

Is Propulsion Battery electrolyte spillage visible in the occupant compartment?  
- YES (Fail)  x NO
### DATA SHEET 9

**FMVSS 305 ROLLOVER DATA (CONTINUED)**

Vehicle: 2010 Ford Fusion Hybrid 4-door Sedan  
NHTSA No.: CA0200

### III. ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS:

#### VOLTMETER INFORMATION:

<table>
<thead>
<tr>
<th>Make</th>
<th>Fluke</th>
<th>Model</th>
<th>87</th>
<th>S/N: 65280327</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Resistance Value ((R_o))</td>
<td>0.12 MΩ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Propulsion Battery Voltage ((V_b))</td>
<td>3.66 V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
x = R_o \times (1 + \frac{V_2}{V_1}) \times \left(\frac{V_1 - V_1'}{V_1'}\right)
\]

\[
y = R_o \times (1 + \frac{V_1}{V_2}) \times \left(\frac{V_2 - V_2'}{V_2'}\right)
\]

Lesser value of \(x\) and \(y\)

<table>
<thead>
<tr>
<th>Isolation Measurement (Volts)</th>
<th>Stage</th>
<th>(R_{i1}) Ω</th>
<th>(R_{i2}) Ω</th>
<th>(R_i) Ω</th>
<th>(R_{i}/V_b) Ω/V</th>
<th>Time (min)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_1) = 4</td>
<td>90°</td>
<td>479760</td>
<td>959760</td>
<td>479760</td>
<td>31081967</td>
<td>1</td>
<td>08</td>
</tr>
<tr>
<td>(V_1') = 0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2) = 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2') = 0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_1) = 0.7</td>
<td>180°</td>
<td>227349</td>
<td>455853</td>
<td>227349</td>
<td>62117096</td>
<td>1</td>
<td>03</td>
</tr>
<tr>
<td>(V_1') = 0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2) = 3.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2') = 0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_1) = 1.16</td>
<td>270°</td>
<td>255159</td>
<td>511035</td>
<td>255159</td>
<td>69715659</td>
<td>1</td>
<td>04</td>
</tr>
<tr>
<td>(V_1') = 0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2) = 3.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2') = 0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_1) = 1.2</td>
<td>360°</td>
<td>234808</td>
<td>470227</td>
<td>234808</td>
<td>64155191</td>
<td>1</td>
<td>09</td>
</tr>
<tr>
<td>(V_1') = 0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2) = 2.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_2') = 0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Is the measured Electrical Isolation Value \(\geq 500\) Ω/V?  
\(\times\) YES  - NO (Fail)

**COMMENTS:**

None
<table>
<thead>
<tr>
<th>Figure</th>
<th>Photograph Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure A- 1</td>
<td>VEHICLE PLACARD</td>
<td>A- 4</td>
</tr>
<tr>
<td>Figure A- 2</td>
<td>TIRE PLACARD</td>
<td>A- 4</td>
</tr>
<tr>
<td>Figure A- 3</td>
<td>LABELS RELATED TO ELECTRIC PROPULSION SYSTEM</td>
<td>A- 5</td>
</tr>
<tr>
<td>Figure A- 4</td>
<td>PRE-TEST TEST PORT INTERFACE PORT INSTALLATION VIEW</td>
<td>A- 5</td>
</tr>
<tr>
<td>Figure A- 5</td>
<td>PRE-TEST TEST DEVICE INSTALLATION VIEWS</td>
<td>A- 6</td>
</tr>
<tr>
<td>Figure A- 6</td>
<td>PRE-TEST CHASSIS GROUND POINT VIEWS</td>
<td>A- 6</td>
</tr>
<tr>
<td>Figure A- 7</td>
<td>PRE-TEST FRONT VIEW</td>
<td>A- 7</td>
</tr>
<tr>
<td>Figure A- 8</td>
<td>POST-TEST FRONT VIEW</td>
<td>A- 7</td>
</tr>
<tr>
<td>Figure A- 9</td>
<td>PRE-TEST LEFT SIDE VIEW</td>
<td>A- 8</td>
</tr>
<tr>
<td>Figure A-10</td>
<td>POST-TEST LEFT SIDE VIEW</td>
<td>A- 8</td>
</tr>
<tr>
<td>Figure A-11</td>
<td>PRE-TEST RIGHT SIDE VIEW</td>
<td>A- 9</td>
</tr>
<tr>
<td>Figure A-12</td>
<td>POST-TEST RIGHT SIDE VIEW</td>
<td>A- 9</td>
</tr>
<tr>
<td>Figure A-13</td>
<td>PRE-TEST LEFT FRONT THREE-QUARTER VIEW</td>
<td>A-10</td>
</tr>
<tr>
<td>Figure A-14</td>
<td>POST-TEST LEFT FRONT THREE-QUARTER VIEW</td>
<td>A-10</td>
</tr>
<tr>
<td>Figure A-15</td>
<td>PRE-TEST RIGHT FRONT THREE-QUARTER VIEW</td>
<td>A-11</td>
</tr>
<tr>
<td>Figure A-16</td>
<td>POST-TEST RIGHT FRONT THREE-QUARTER VIEW</td>
<td>A-11</td>
</tr>
<tr>
<td>Figure A-17</td>
<td>PRE-TEST LEFT REAR THREE-QUARTER VIEW</td>
<td>A-12</td>
</tr>
<tr>
<td>Figure A-18</td>
<td>POST-TEST LEFT REAR THREE-QUARTER VIEW</td>
<td>A-12</td>
</tr>
<tr>
<td>Figure A-19</td>
<td>PRE-TEST RIGHT REAR THREE-QUARTER VIEW</td>
<td>A-13</td>
</tr>
<tr>
<td>Figure A-20</td>
<td>POST-TEST RIGHT REAR THREE-QUARTER VIEW</td>
<td>A-13</td>
</tr>
<tr>
<td>Figure A-21</td>
<td>PRE-TEST REAR VIEW</td>
<td>A-14</td>
</tr>
<tr>
<td>Figure A-22</td>
<td>POST-TEST REAR VIEW</td>
<td>A-14</td>
</tr>
<tr>
<td>Figure A-23</td>
<td>PRE-TEST MDB FRONT VIEW</td>
<td>A-15</td>
</tr>
<tr>
<td>Figure A-24</td>
<td>POST-TEST MDB FRONT VIEW</td>
<td>A-15</td>
</tr>
<tr>
<td>Figure A-25</td>
<td>PRE-TEST MDB LEFT SIDE VIEW</td>
<td>A-16</td>
</tr>
<tr>
<td>Figure A-26</td>
<td>POST-TEST MDB LEFT SIDE VIEW</td>
<td>A-16</td>
</tr>
<tr>
<td>Figure A-27</td>
<td>PRE-TEST MDB RIGHT SIDE VIEW</td>
<td>A-17</td>
</tr>
<tr>
<td>Figure A-28</td>
<td>POST-TEST MDB RIGHT SIDE VIEW</td>
<td>A-17</td>
</tr>
<tr>
<td>Figure A-29</td>
<td>PRE-TEST MDB TOP VIEW</td>
<td>A-18</td>
</tr>
<tr>
<td>Figure A-30</td>
<td>POST-TEST MDB TOP VIEW</td>
<td>A-18</td>
</tr>
<tr>
<td>Figure A-31</td>
<td>PRE-TEST OVERHEAD VEHICLE AND MDB VIEW</td>
<td>A-19</td>
</tr>
<tr>
<td>Figure A-32</td>
<td>POST-TEST IMPACT TARGET VIEW</td>
<td>A-19</td>
</tr>
<tr>
<td>Figure A-33</td>
<td>PRE-TEST BATTERY PROPULSION MODULE(S) VIEW</td>
<td>A-20</td>
</tr>
<tr>
<td>Figure A-34</td>
<td>POST-TEST BATTERY PROPULSION MODULE(S) VIEW</td>
<td>A-20</td>
</tr>
<tr>
<td>Figure A-35</td>
<td>PRE-TEST PROPULSION BATTERY VIEW</td>
<td>A-21</td>
</tr>
<tr>
<td>Figure A-36</td>
<td>POST-TEST PROPULSION BATTERY VIEW</td>
<td>A-21</td>
</tr>
<tr>
<td>Figure A-37</td>
<td>PRE-TEST HIGH VOLTAGE INTERCONNECT VIEW</td>
<td>A-22</td>
</tr>
<tr>
<td>Figure A-38</td>
<td>POST-TEST HIGH VOLTAGE INTERCONNECT VIEW</td>
<td>A-22</td>
</tr>
<tr>
<td>Figure A-39</td>
<td>PRE-TEST BATTERY COMPARTMENT VIEW</td>
<td>A-23</td>
</tr>
<tr>
<td>Figure A-40</td>
<td>POST-TEST BATTERY COMPARTMENT VIEW</td>
<td>A-23</td>
</tr>
<tr>
<td>Figure A-41</td>
<td>PRE-TEST BATTERY VENTING SYSTEM VIEW</td>
<td>A-24</td>
</tr>
<tr>
<td>Figure A-42</td>
<td>POST-TEST BATTERY VENTING SYSTEM VIEW</td>
<td>A-24</td>
</tr>
<tr>
<td>Figure A-43</td>
<td>PRE-TEST ELECTRIC PROPULSION COMPONENT(S) VIEW</td>
<td>A-25</td>
</tr>
<tr>
<td>Figure A-44</td>
<td>POST-TEST ELECTRIC PROPULSION COMPONENT(S) VIEW</td>
<td>A-25</td>
</tr>
<tr>
<td>Figure A-45</td>
<td>PRE-TEST ELECTRIC PROPULSION DRIVE VIEW</td>
<td>A-26</td>
</tr>
<tr>
<td>Figure A-46</td>
<td>POST-TEST ELECTRIC PROPULSION DRIVE VIEW</td>
<td>A-26</td>
</tr>
<tr>
<td>Figure A-47</td>
<td>PRE-TEST VEHICLE PASSENGER COMPARTMENT VIEW</td>
<td>A-27</td>
</tr>
<tr>
<td>Figure A-48</td>
<td>POST-TEST VEHICLE PASSENGER COMPARTMENT VIEW</td>
<td>A-27</td>
</tr>
<tr>
<td>Figure</td>
<td>Photograph Title</td>
<td>Page</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Figure A- 49</td>
<td>POST-TEST PROPULSION BATTERY ELECTROLYTE SPILLAGE LOCATION VIEW</td>
<td>A- 28</td>
</tr>
<tr>
<td>Figure A- 50</td>
<td>PRE-TEST FRONT UNDERBODY VIEW</td>
<td>A- 29</td>
</tr>
<tr>
<td>Figure A- 51</td>
<td>POST-TEST FRONT UNDERBODY VIEW</td>
<td>A- 29</td>
</tr>
<tr>
<td>Figure A- 52</td>
<td>PRE-TEST MID UNDERBODY VIEW</td>
<td>A- 30</td>
</tr>
<tr>
<td>Figure A- 53</td>
<td>POST-TEST MID UNDERBODY VIEW</td>
<td>A- 30</td>
</tr>
<tr>
<td>Figure A- 54</td>
<td>PRE-TEST REAR UNDERBODY VIEW</td>
<td>A- 31</td>
</tr>
<tr>
<td>Figure A- 55</td>
<td>POST-TEST REAR UNDERBODY VIEW</td>
<td>A- 31</td>
</tr>
<tr>
<td>Figure A- 56</td>
<td>PRE-TEST FUEL FILLER CAP VIEW</td>
<td>A- 32</td>
</tr>
<tr>
<td>Figure A- 57</td>
<td>POST-TEST FUEL FILLER CAP VIEW</td>
<td>A- 32</td>
</tr>
<tr>
<td>Figure A- 58</td>
<td>IMPACT VIEW</td>
<td>A- 33</td>
</tr>
<tr>
<td>Figure A- 59</td>
<td>ROLLOVER 90 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
<td>A- 34</td>
</tr>
<tr>
<td>Figure A- 60</td>
<td>ROLLOVER 180 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
<td>A- 34</td>
</tr>
<tr>
<td>Figure A- 61</td>
<td>ROLLOVER 270 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
<td>A- 35</td>
</tr>
<tr>
<td>Figure A- 62</td>
<td>ROLLOVER 360 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
<td>A- 35</td>
</tr>
</tbody>
</table>
Figure A-1: Vehicle Certification Placard

Figure A-2: Vehicle Tire Placard
Figure A-3: Vehicle Electric Propulsion System Label

Figure A-4: Pre-Test Test Port Interface Port Installation View
Figure A-5: Pre-Test Test Device Installation Views

Figure A-6: Pre-Test Chassis Ground Point View
Figure A-13: Pre-Test Left Front Three-Quarter View

Figure A-14: Post-Test Left Front Three-Quarter View
Figure A-19: Pre-Test Right Rear Three-Quarter View

Figure A-20: Post-Test Right Rear Three-Quarter View
Figure A-25: Pre-Test MDB Left Side View

Figure A-26: Post-Test MDB Left Side View
Figure A-27: Pre-Test MDB Right Side View

Figure A-28: Post-Test MDB Right Side View
Figure A-29: Pre-Test MDB Top View

Figure A-30: Post-Test MDB Top View
Figure A-31: Pre-Test Overhead Vehicle and MDB View

Figure A-32: Post-Test Impact Target View
Figure A-35: Pre-Test Propulsion Battery View

Photo Not Available

Figure A-36: Post-Test Propulsion Battery View
Figure A-41: Pre-Test Battery Venting System View

Figure A-42: Post-Test Battery Venting System View
Figure A-43: Pre-Test Electric Propulsion Component(S) View

Figure A-44: Post-Test Electric Propulsion Component(S) View
No Photograph Necessary

Figure A-49: Post-Test Propulsion Battery Electrolyte Spillage Location View
Figure A-54: Pre-Test Rear Underbody View

Figure A-55: Post-Test Rear Underbody View
Figure A-56: Pre-Test Fuel Filler Cap View

Figure A-57: Post-Test Fuel Filler Cap View
Figure A-58: Impact View
No Photograph Necessary

Figure A-59: Post-Test Passenger Contact to Airbag

Figure A-60: Rollover View - 90°