REPORT NUMBER: 305-CAL-07-05

SAFETY COMPLIANCE TESTING FOR FMVSS 305
ELECTRIC POWERED VEHICLES: ELECTROLYTE SPILLAGE
AND ELECTRICAL SHOCK PROTECTION

HONDA MOTOR COMPANY
2007 HONDA ACCORD
4-DOOR SEDAN

NHTSA NUMBER: C75304

CALSPAN
TRANSPORTATION SCIENCES CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225

October 9, 2007

FINAL REPORT

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance (NVS-224)
1200 New Jersey Avenue, SE
Washington, DC  20590
This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-02-D-01114. 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.

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Approved By: Vince Paolini, Program Manager
Transportation Sciences Center

APPROVED
By James.Czarnecki at 1:10 pm, 11/2/07

FINAL REPORT ACCEPTANCE BY:

Edward E. Chan

Accepted By: Edward E. Chan

Acceptance Date: 11/16/07

Digitally signed by Edward E. Chan
Compliance tests were conducted on the subject 2007 Honda Accord 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."
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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. DTNH22-02-D-01114. The purpose of this test was to determine if the subject vehicle, a 2007 Honda Accord 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 1822.5 kg 2007 Honda Accord 4-door Sedan was impacted from the rear by an 1797 kg moving barrier at a velocity of 47.5 kph (29.5 mph). The test was performed by Calspan Corporation on October 9, 2007.

The test vehicle was equipped with a 64.7 liter fuel tank which was filled to 92 percent capacity with stoddard fluid prior to impact. Additional ballast (42 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 spillage following the impact or during any portion of the static rollover test. The average vehicle longitudinal crush was 331 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 305 "Electrical Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection."
DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:
Year/Make/Model/Body Style: 2007 Honda Accord 4-door Sedan
Vehicle Body Color: Red
NHTSA Number: C75304

DEALER AND DELIVERY INFORMATION:
Date Received: 7/27/07
Odometer Reading: 253 km
Selling Dealer: Wilde Honda
Dealer Address: 1710 HWY. 164 Waukesha, WI 53186

DATA FROM VEHICLE'S CERTIFICATION LABEL:
Vehicle Manufacturer: Honda Motor Company
Vehicle Build Date: 09/06
VIN: JHMCN36457C001081
GVWR: 2070 kg; GAWR: 1120 kg FRONT; 970 kg REAR

DATA FROM VEHICLE'S TIRE LABEL AND SIDEWALL:
Location of Tire Placard: Door A-pillar side sill
Type of Spare Tire: Temporary

<table>
<thead>
<tr>
<th></th>
<th>Front</th>
<th>Rear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Tire Pressure (sidewall - kPa)</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Cold Pressure (tire placard - kPa) – test pressure</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>Recommended Tire Size (tire placard)</td>
<td>P215/60R16</td>
<td>P215/60R16</td>
</tr>
<tr>
<td>Vehicle Tire Size with load index &amp; speed symbol</td>
<td>P215/60R16 94V</td>
<td>P215/60R16 94V</td>
</tr>
<tr>
<td>Tire Manufacturer</td>
<td>Michelin</td>
<td>Michelin</td>
</tr>
<tr>
<td>Tire Name</td>
<td>Energy MXV4</td>
<td>Energy MXV4</td>
</tr>
</tbody>
</table>

ELECTRIC VEHICLE PROPULSION SYSTEM:
Electric Vehicle Type: - Electric; x Electric/Hybrid
Propulsion Battery Type: 7.2 V NiMH
Nominal Voltage: 144 V
Location of Automatic Propulsion Battery Disconnect: N/A

Auxiliary Battery Type: N/A
PRE-TEST DATA

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

<table>
<thead>
<tr>
<th></th>
<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>494</td>
<td>317</td>
<td>49.5</td>
<td>811.0</td>
</tr>
<tr>
<td>Rear</td>
<td>499</td>
<td>327</td>
<td>50.5</td>
<td>826.0</td>
</tr>
</tbody>
</table>

Total Delivered Weight (UDW) = 1637.0 kg

CALCULATION OF VEHICLE’S TARGET TEST WEIGHT:

\[
\text{Total Delivered Weight (UDW)} = 1637.0 \text{ kg} \\
\text{Rated Cargo/Luggage Weight (RCLW)} = 44.8 \text{ kg} \\
\text{Weight of 2 p.572E Dummies @ 78 each} = 148.8 \text{ kg} \\
\text{TARGET TEST WEIGHT} = 1830.6 \text{ kg}
\]

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 36.7 KG OF CARGO WEIGHT:

<table>
<thead>
<tr>
<th></th>
<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>547.5</td>
<td>356.5</td>
<td>49.6</td>
<td>904.0</td>
</tr>
<tr>
<td>Rear</td>
<td>552.0</td>
<td>366.5</td>
<td>50.4</td>
<td>918.5</td>
</tr>
</tbody>
</table>

Total Vehicle Test Weight (ATW) = 1822.5 kg

Weight of Ballast Secured in Vehicle = 42 kg  
Ballast Type: Lead shot bags  
Method of securing Ballast: Compartment placement

Components Removed for Weight Reduction: None

¹Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

²Rearward of the front axle centerline.
Vehicle: 2007 Honda Accord 4-door Sedan

PRE-TEST DATA

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED):

Electrolyte Fluid Type: KOH
Electrolyte Fluid Specific Gravity: 1.29
Electrolyte Fluid Kinematic Viscosity: 2.07
Electrolyte Fluid Color: Clear
Propulsion Battery Coolant Type, Color and Specific Gravity: Fan (Air cool), N/A
Location of Battery Modules: - In Occupant Compartment  x  Outside Occupant Compartment

PROPULSION BATTERY STATE OF CHARGE

Maximum State of Charge: -
Test Voltage (≥95% of maximum): -
OR
Range of Normal Operating Voltage: 4 or 5 segments if IMA battery level gauge
Test Voltage (within range): 157

Details of Chassis Ground Points and Locations:
Left side of floor under rear seating cushion

Details of Propulsion Battery Components:
Battery propulsion components are located behind rear seat back.

Comments:
None
Vehicle: 2007 Honda Accord 4-door Sedan  
NHTSA No. C75304

VOLTMETER INFORMATION:

Make: Fluke  
Model: 8022A  
S/N: 2180445

Internal Resistance Value: 250k Ω
Resolution: - V
Last Calibration Date: -

Propulsion Battery Voltage : (ready to drive position) $V_b = 157.1$ V
Propulsion Battery to Vehicle Chassis: $V_1 = 74$ V
Propulsion Battery to Vehicle Chassis: $V_2 = 68$ V
Propulsion Battery to Vehicle Chassis Across Known Resistor: $R_o = 118.5$ Ω
Propulsion Battery to Vehicle Chassis with $R_o$ installed: $V_1' = .003$ V
Propulsion Battery to Vehicle Chassis: with $R_o$ installed: $V_2' = .008$ V

ELECTRICAL ISOLATION MEASUREMENTS:

$R_{i1}: 5.6K \Omega \quad R_{i1} = R_o \times (1 + V_2/V_1) \times [(V_1-V_1'/V_1')]

R_{i2}: 2.3K \Omega \quad R_{i2} = R_o \times (1 + V_1/V_2) \times [(V_2-V_2'/V_2')]

R_i 2.3K Ω  
Lesser value of $R_{i1}$ and $R_{i2}$

$R/V_b = 14568$ V  
Electrical Isolation Value

Is the Electrical Isolation Value $\geq 500 \Omega/V$?  
Yes/No  
Yes

If NO - Failure

Comments:  
None
Vehicle: 2007 Honda Accord 4-door Sedan  
NHTSA No. C75304

ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

VOLTMETER INFORMATION:
Make: FLUKE  
Model: 8022A  
S/N: 2180445

Internal Impedance Value 250K MΩ
Normal Propulsion Battery Voltage (V_b): 156.3 V

ELECTRICAL ISOLATION MEASUREMENTS

\[ V_1 = 69.1 \text{ V Impact} \quad \text{Time: 5 minutes 05 seconds} \]
\[ V_2 = 74.4 \text{ V Impact} \quad \text{Time: 5 minutes 10 seconds} \]
\[ V_1' = 0.06 \text{ V Impact} \quad \text{Time: 5 minutes 15 seconds} \]
\[ V_2' = 0.06 \text{ V Impact} \quad \text{Time: 5 minutes 20 seconds} \]
\[ R_{i1} = \frac{156.3}{\text{Ω Impact}} \quad \text{Time: 5 minutes 25 seconds} \]
\[ R_{i2} = \frac{263679}{\text{Ω Impact}} \quad \text{Time: 5 minutes 25 seconds} \]
\[ R_i = \frac{156.3}{\text{Ω Impact}} \quad \text{Lesser value of } R_{i1} \text{ and } R_{i2} \quad \text{Time: 5 minutes 25 seconds} \]
\[ R_i/V_b = \frac{1687}{\text{Ω Impact}} \quad \text{Time: 5 minutes 25 seconds} \]

Is the measured Electrical Isolation Value \( \geq 500 \, \Omega/V? \)  
\( \checkmark \) Yes  
\( \quad \) 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?  
\( \checkmark \) Yes(Fail)  
\( \quad \) 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?  
\( \checkmark \) Yes(Fail)  
\( \quad \) No

Is Propulsion Battery electrolyte spillage visible in the occupant compartment?  
\( \checkmark \) Yes(Fail)  
\( \quad \) No
DATA SHEET 5

STATIC ROLLOVER TEST DATA

Vehicle: 2007 Honda Accord 4-door Sedan
NHTSA No.: C75304

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>0° - 90°</td>
<td>1 minutes 06 seconds</td>
<td>5 minutes</td>
<td>6 minutes 6 seconds</td>
<td>7 minutes</td>
</tr>
<tr>
<td>90° - 180°</td>
<td>0 minutes 59 seconds</td>
<td>5 minutes</td>
<td>5 minutes 59 seconds</td>
<td>6 minutes</td>
</tr>
<tr>
<td>180°-270°</td>
<td>0 minutes 59 seconds</td>
<td>5 minutes</td>
<td>5 minutes 59 seconds</td>
<td>6 minutes</td>
</tr>
<tr>
<td>270°-360°</td>
<td>1 minutes 02 seconds</td>
<td>5 minutes</td>
<td>6 minutes 2 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>0-90°</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>90-180°</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>180-270°</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>270-360°</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) _ NO

Is Propulsion Battery electrolyte spillage visible in the occupant compartment? _YES (Fail) _ NO
III. ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS:

**VOLTMETER INFORMATION:**

<table>
<thead>
<tr>
<th>Make</th>
<th>Fluke</th>
<th>Model</th>
<th>S/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>8022A</td>
<td>2180445</td>
</tr>
</tbody>
</table>

- **Internal Resistance Value (R₀):** 118.5 Ω
- **Normal Propulsion Battery Voltage (Vₖ):** 156.8 V

\[
R_{i1} = R_0 \ast \left(1 + \frac{V_2}{V_1}\right) \ast \left(\frac{V_1 - V_{1'}}{V_1}\right) \\
R_{i2} = R_0 \ast \left(1 + \frac{V_1}{V_2}\right) \ast \left(\frac{V_2 - V_{2'}}{V_2}\right)
\]

<table>
<thead>
<tr>
<th>Isolation Measurement (Volts)</th>
<th>Stage</th>
<th>( R_{i1} )</th>
<th>( R_{i2} )</th>
<th>( R_i )</th>
<th>( R_i/V_b )</th>
<th>Time (min)</th>
<th>Time (s)</th>
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<tbody>
<tr>
<td>( V_1 ) = 74</td>
<td>90°</td>
<td>280222</td>
<td>304848</td>
<td>280222</td>
<td>1944.8</td>
<td>1</td>
<td>06</td>
</tr>
<tr>
<td>( V_2 ) = 68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{1'} ) = 0.06</td>
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<tr>
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</tr>
<tr>
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<td></td>
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<tr>
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<td>( V_{2'} ) = 0.06</td>
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<td></td>
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</tr>
<tr>
<td>( V_1 ) = 74</td>
<td>360°</td>
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<td>304848</td>
<td>280222</td>
<td>1944.8</td>
<td>1</td>
<td>02</td>
</tr>
<tr>
<td>( V_2 ) = 68</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>( V_{1'} ) = 0.06</td>
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</tr>
</tbody>
</table>

Is the measured Electrical Isolation Value \( \geq 500 \, \Omega/V \)?  
\( \times \) YES  
\( \_ \) NO (Fail)

**COMMENTS:**
None
APPENDIX A

PHOTOGRAPHS
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<th>Photograph Title</th>
<th>Page</th>
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<td>A- 3</td>
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<td>TIRE PLACARD</td>
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<td>PRE-TEST TEST PORT INTERFACE PORT INSTALLATION VIEW</td>
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<td>PRE-TEST TEST DEVICE INSTALLATION VIEWS</td>
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<td>PRE-TEST CHASSIS GROUND POINT VIEWS</td>
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<td>PRE-TEST BATTERY PROPULSION MODULE(S) VIEW</td>
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<td>A- 23</td>
<td>POST-TEST PROPULSION BATTERY ELECTROLYTE SPILLAGE LOCATION VIEW</td>
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<td>A-15</td>
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<td>ROLLOVER 180 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
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<td>ROLLOVER 270 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
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<td>A- 27</td>
<td>ROLLOVER 360 VIEW HIGHLIGHTING PROPULSION BATTERY LOCATION</td>
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Figure A-1: Vehicle Certification Placard

Figure A-2: Vehicle Tire Placard
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Figure A-6: Pre-Test Chassis Ground Point View
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Figure A-8: Post-Test Battery Propulsion Module(S) View
Figure A-9: Pre-Test Propulsion Battery View

Photo Not Available

Figure A-10: Post-Test Propulsion Battery View
Figure A-11: Pre-Test High Voltage Interconnect View

Photo Not Available

Figure A-12: Post-Test High Voltage Interconnect View
Figure A-13: Pre-Test Battery Compartment View

Photo not available: due to trunk not being able to opened

Figure A-14: Post-Test Battery Compartment View
Figure A-15: Pre-Test Battery Venting System View

Photo not available: due to trunk not being able to opened

Figure A-16: Post-Test Battery Venting System View
None

Figure A-23: Post-Test Propulsion Battery Electrolyte Spillage Location View
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Figure A-25: Rollover View - 180° Highlighting Propulsion Battery Location
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Figure A-27: Rollover View - 360° Highlighting Propulsion Battery Location