

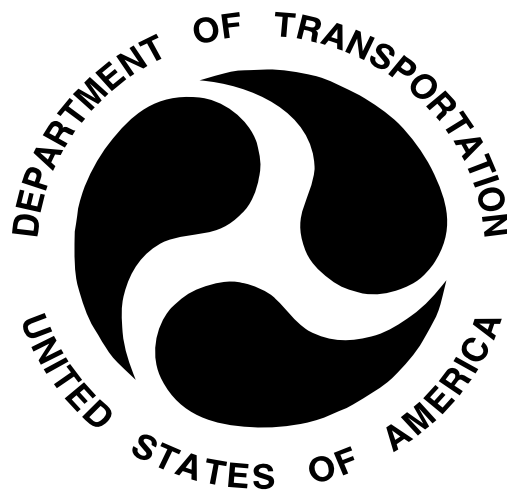
U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

**FMVSS 305, ELECTRIC POWERED VEHICLES: ELECTROLYTE
SPILLAGE AND ELECTRICAL SHOCK PROTECTION**



ENFORCEMENT
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Avenue, SE
Washington, DC 20590

REVISION CONTROL LOG
FOR OVSC LABORATORY
TEST PROCEDURES

TP-305

ELECTRIC POWERED VEHICLES: ELECTROLYTE SPILLAGE AND ELECTRICAL SHOCK
 PROTECTION

TEST PROCEDURE		FMVSS 305		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00	12/29/2005	65 FR 57988 66 FR 60160 69 FR 51399	12/01/2001	Final Rule and Amendments
01	09/11/2008			Added note for a zero voltage condition when calculating electrical isolation
02				
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1. PURPOSE AND APPLICATION

This document is a laboratory test procedure provided by the National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) for the purpose of presenting guidelines for a uniform testing data and information recording format, and providing suggestions for the use of specific equipment and procedures for contracted testing laboratories. The data correspond to specific requirements of the Federal Motor Vehicle Safety Standard(s) (FMVSS). The OVSC test procedures include requirements that are general in scope to provide flexibility for contracted laboratories to perform compliance testing and are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data. These test procedures do not constitute an endorsement or recommendation for use of any particular product or testing method.

Prior to conducting compliance testing, contracted laboratories are required to submit a detailed test procedure to the COTR to demonstrate concurrence with the OVSC laboratory test procedure and the applicable FMVSS. If any contractor views any part of an OVSC laboratory test procedure to be in conflict with a FMVSS or observes deficiencies in a laboratory test procedure, the contractor is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing or as soon as practicable. The contractor's test procedure must include a step-by-step description of the methodology and detailed check-off sheets. Detailed check-off sheets shall also be provided for the testing instrumentation including a complete listing of the test equipment with make and model numbers. The list of test equipment shall include instrument accuracy and calibration dates. All equipment shall be calibrated in accordance with the manufacturer's instructions. There shall be no contradictions between the laboratory test procedure and the contractor's in-house test procedure. Written approval of the in-house test procedures shall be obtained from the COTR before initiating the compliance test program.

NOTE: The OVSC Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct compliance tests for the OVSC, are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS. The laboratory test procedures are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC laboratory test procedures do not include all of the various FMVSS minimum performance requirements. Recognizing applicable test tolerances, the laboratory test procedures may specify test conditions that are less severe than the minimum requirements of the standard. In addition, the laboratory test procedures may be modified by the OVSC at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests are performed in a manner consistent with the standard itself and within the scope of the contract. Laboratory test procedures may not be relied upon to create any right or benefit in any person. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits its certification tests to those described in the OVSC laboratory test procedures.

2. GENERAL REQUIREMENTS

FMVSS No. 305 specifies performance requirements for limitation of electrolyte spillage, retention of propulsion batteries, and electrical isolation of the chassis from the high-voltage system during the crash event. This standard applies to vehicles that use electricity as propulsion power.

APPLICABILITY

The standard is applicable to passenger cars, multipurpose passenger vehicles, trucks and buses with a gross vehicle weight rating (GVWR) of 4536 kg or less, that use more than 48 nominal volts of electricity as propulsion power and whose speed, attainable in 1.6 km on a paved level surface, is more than 40 km/h.

STANDARD REQUIREMENTS

When tested to the procedures contained herein, each vehicle to which the standard applies shall not:

- Spill more than 5.0 liters of propulsion battery electrolyte outside the passenger compartment, and no visible trace of electrolyte shall spill into the passenger compartment. Spillage is measured from the time the vehicle ceases motion after a barrier impact test until 30 minutes thereafter, and throughout any static rollover after a barrier impact test.
- Have any propulsion battery system component located inside the passenger compartment move from the location in which they are installed
- Have any propulsion battery system component located outside the passenger compartment enter the passenger compartment
- Fail to maintain an electrical isolation of no less than 500 ohms/volt between the propulsion battery system and the vehicle's electricity-conducting structure

APPLICABLE BARRIER TESTS

Vehicles will be tested to the requirements of FMVSS 305 in conjunction with testing to FMVSS Nos. 208, 214 (dynamic side impact requirements), and/or FMVSS 301 (frontal or rear impact requirements). Table 1 indicates the governing barrier tests that are utilized when testing to other dynamic standards. The vehicle must be able to meet the requirements of this standard for any of the governing barrier tests. Also, the test facility must be adequate to conduct the governing barrier tests prescribed in dynamic test listed above. The facility must meet the minimum requirements regarding weighing capability, speed measurement systems, test surface, tow-road, abort system, barriers, and all other requirements.

2. GENERAL REQUIREMENTS....Continued

TABLE 1

Type of Test	Applicable FMVSS	Description	Requirement
Frontal Rigid Barrier	208	Any single rigid barrier crash at any speed up to and including 48 km/h, in a line of travel perpendicular to the barrier face or at any angle between +/- 30 degrees from the line of travel perpendicular to the barrier face	305 S5.1, S5.2, and S5.3
Side Moving Deformable Barrier	214Dynamic	Any single moving deformable barrier crash at any speed up to and including 54km/h, side impact	
Rear Rigid Barrier	301	Any single moving rigid barrier crash at any speed up to and including 48km/hr, rear impact (passenger car, MPV, truck, or bus under 4,536 kg GVWR (10,000 pounds))	
Rear Deformable Barrier	301 (Optional)	Any single moving deformable barrier crash at any speed up to and including 80km/hr, rear impact with 70% overlap toward either side of the vehicle (passenger car, MPV, truck, or bus under 4,536 kg GVWR (10,000 pounds))	

METRIC SYSTEM OF MEASUREMENT

Section 5164 of the Omnibus Trade and Competitiveness Act (Pub. L. 100-418) establishes that the metric system of measurement is the preferred system of weights and measures for trade and commerce in the United States. Executive order 12770 directs Federal agencies to comply with the Act by converting regulatory standards to the metric system after September 30, 1992. In a final rule published on March 15, 1990 (60 FR 13639), NHTSA completed the first phase of metrication, converting English measurements in several regulatory standards to the metric system. Since then, metrication has been applied to other regulatory standards (63 FR 28912).

Accordingly, the OVSC laboratory test procedures include revisions to comply with governmental directives in using the metric system. Regulatory standards converted to metric units are required to use metric measurements in the test procedures, whereas standards using English units are allowed to use English measurements or to use English measurements in combination with metric equivalents in parentheses. For any testing equipment that is not available for direct measurement in metric units, the test laboratory shall calculate the exact metric equivalent by means of a conversion factor carried out to at least five significant digits before rounding consistent with the specified metric requirement.

2. GENERAL REQUIREMENTS....Continued

All final compliance test reports are required to include metric measurements for standards using metrication.

NOTE: The methodology for rounding measurement in the test reports shall be made in accordance with ASTM E29-06b, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications."

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test vehicles and Government Furnished Property (GFP) from unauthorized personnel during the entire compliance testing program. The contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of test vehicles and GFP. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Acquisition Management, within two working days after the incident. A letter containing specific details of the security problem shall be sent to the IPM (with copy to the COTR) within 48 hours.

The contractor shall protect and segregate the data that evolves from compliance testing before and after each vehicle test. No information concerning the vehicle safety compliance testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Division Chief.

NOTE: No individuals, other than contractor personnel directly involved in the compliance testing program or OVSC personnel, shall be allowed to witness any vehicle or equipment item compliance test or test dummy calibration unless specifically authorized by the COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle compliance testing area, fixtures and instrumentation in a neat, clean and painted condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a test schedule to the COTR prior to conducting the first compliance test. Tests shall be completed at intervals as required in the contract. If not specified, the first test shall be conducted within 6 weeks after receiving the first delivered unit. Subsequent tests shall be completed in no longer than 1 week intervals unless otherwise specified by the COTR.

Scheduling of tests shall be adjusted to permit vehicles (or equipment, whichever applies) to be tested to other FMVSSs as may be required by the OVSC. All compliance testing shall be coordinated with the COTR in order to allow monitoring by the COTR and/or other OVSC personnel if desired. The contractor shall submit a monthly test status report and a vehicle status report (if applicable) to the COTR. The vehicle status report shall be submitted until all vehicles are disposed of. The status report forms are provided in the forms section.

6. TEST DATA DISPOSITION

The Contractor shall make all preliminary compliance test data available to the COTR on location within 30 minutes after the test (or within four hours for equipment testing). Final test data, including digital printouts and computer generated plots (if applicable), shall be available to the COTR in accordance with the contract schedule or if not specified within two working days. Additionally, the Contractor shall analyze the preliminary test results as directed by the COTR.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc., shall be either sent to the COTR or destroyed at the conclusion of each delivery order, purchase order, etc.

The contractor shall protect and segregate the data that evolves from compliance testing before and after each test.

TEST DATA LOSS

A. INVALID TEST DESCRIPTION

An invalid compliance test is one, which does not conform precisely to all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test.

B. INVALID TEST NOTIFICATION

The Contractor shall notify NHTSA of any test not meeting all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test, by telephone, within 24 hours of the test and send written notice to the COTR within 48 hours of the test completion.

6. TEST DATA DISPOSITION....Continued

C. RETEST NOTIFICATION

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the Contractor that a retest is required. The retest shall be completed within 2 weeks after receipt of notification by the Contracting Officer that a retest is required.

D. WAIVER OF RETEST

NHTSA, in its sole discretion, reserves the right to waive the retest requirement. This provision shall not constitute a basis for dispute over the NHTSA's waiving or not waiving any requirement.

E. TEST VEHICLE (ONLY IF APPLICABLE)

NHTSA shall furnish only one vehicle for each test ordered. The Contractor shall furnish the test vehicle required for the retest. The retest vehicle shall be equipped as the original vehicle. The original vehicle used in the invalid test shall remain the property of NHTSA, and the retest vehicle shall remain the property of the Contractor. The Contractor shall retain the retest vehicle for a period not exceeding 180 days if it fails the test. If the retest vehicle passes the test, the Contractor may dispose of it upon notification from the COTR that the test report has been accepted.

F. TEST REPORT

No test report is required for any test that is determined to be invalid unless NHTSA specifically decides, in writing, to require the Contractor to submit such report. The test data from the invalid test must be safeguarded until the data from the retest has been accepted by the COTR. The report and other required deliverables for the retest vehicle are required to be submitted to the COTR within 3 weeks after completion of the retest.

G. DEFAULT

The Contractor is subject to the default and subsequent procurement costs for nondelivery of valid or conforming test (pursuant to the Termination For Default clause in the contract).

H. NHTSA'S RIGHTS

None of the requirements herein stated shall diminish or modify the rights of NHTSA to determine that any test submitted by the Contractor does not conform precisely to all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

GFP consist of test vehicles, test equipment and instrumentation. The GFP is authorized by contractual agreement. The contractor is responsible for the following.

A. ACCEPTANCE OF TEST VEHICLES

The contractor has the responsibility of accepting each GFP test vehicle whether delivered by a new vehicle dealership or another vehicle transporter. In both instances, the contractor acts on behalf of the OVSC when signing an acceptance of the GFP test vehicle delivery order. When a GFP vehicle is delivered, the contractor must verify:

1. All options listed on the "window sticker" are present on the test vehicle.
2. Tires and wheel rims are new and the same as listed.
3. There are no dents or other interior or exterior flaws in the vehicle body.
4. The vehicle has been properly prepared and is in running condition.
5. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
6. Proper fuel filler cap is supplied on the test vehicle.
7. Spare tire, jack, lug wrench and tool kit (if applicable) is located in the vehicle cargo area.
8. The VIN (vehicle identification number) on the vehicle condition report matches the VIN on the vehicle.
9. The vehicle is equipped as specified by the COTR.

A Vehicle Condition form will be supplied to the contractor by the COTR when the test vehicle is transferred from a new vehicle dealership or between test contracts. The upper half of the form is used to describe the vehicle as initially accepted. The lower half of the Vehicle Condition form provides space for a detailed description of the post-test condition. The contractor must complete a Vehicle Condition form for each vehicle and deliver it to the COTR with the Final Test Report or the report will NOT be accepted for payment.

If the test vehicle is delivered by a government contracted transporter, the contractor should check for damage which may have occurred during transit. GFP vehicle(s) shall not be driven by the contractor on public roadways unless authorized by the COTR.

7. GOVERNMENT FURNISHED PROPERTY (GFP)....Continued

B. TEST EQUIPMENT AND INSTRUMENTATION

The contractor has the responsibility of accepting GFP test equipment and instrumentation delivered to the contractor. The contractor acts on behalf of the OVSC when signing an acceptance of the GFP test equipment and instrumentation delivery order. When GFP test equipment and instrumentation is delivered, the contractor must:

1. Verify all partial and sub-component quantities as per the packaging document
2. Verify physical condition of all equipment and instrumentation (inspect for damage)
3. Verify functional condition of all equipment and instrumentation
4. Store in a clean, organized, secure, and environmentally controlled area

C. NOTIFICATION OF COTR

The COTR must be notified within 24 hours after a vehicle (and/or equipment item) has been delivered. In addition, if any discrepancy or damage is found at the time of delivery, a copy of the Vehicle Condition form shall be sent to the COTR immediately.

8. CALIBRATION OF TEST INSTRUMENTS

Before the Contractor initiates the vehicle safety compliance test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration practices. The calibration system shall include the following as a minimum:

- A. Standards for calibrating the measuring and test equipment shall be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the Contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding 12 months for instruments and 12 months for the calibration standards except for static types of measuring devices such as rulers, weights, etc., which shall be calibrated at periodic intervals not to exceed two years. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

Accelerometers shall be calibrated every twelve months or after a test failure or after any indication from calibration checks that there may be a problem with the accelerometer whichever occurs sooner.

8. CALIBRATION OF TEST INSTRUMENTS....Continued

- C. All measuring and test equipment and measuring standards shall be labeled with the following information:
1. Date of calibration
 2. Date of next scheduled calibration
 3. Name of the technician who calibrated the equipment
- D. A written calibration procedure shall be provided by the Contractor, which includes as a minimum the following information for all measurement and test equipment:
1. Type of equipment, manufacturer, model number, etc.
 2. Measurement range
 3. Accuracy
 4. Calibration interval
 5. Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident).
 6. The actual procedures and forms used to perform the calibrations.
- E. Records of calibration for all test instrumentation shall be kept by the Contractor in a manner that assures the maintenance of established calibration schedules.
- F. All such records shall be readily available for inspection when requested by the COTR. The calibration system shall need the acceptance of the COTR before vehicle safety compliance testing commences.
- G. Test equipment shall receive a system functional check out using a known test input immediately before and after the test. This check shall be recorded by the test technician(s) and submitted with the final report.
- H. The Contractor may be directed by NHTSA to evaluate its data acquisition system.

Further guidance is provided in the International Standard ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment" and American National Standard ANSI/NCSS Z540-1, "Calibration Laboratories and Measuring and Test Equipment General Requirements."

8. CALIBRATION OF TEST INSTRUMENTS....Continued

NOTE: In the event of a failure to meet the standard's minimum performance requirements additional calibration checks of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration will be at the COTR's discretion and shall be performed without additional cost.

9. SUGGESTED TEST EQUIPMENT

ELECTRICAL ISOLATION MEASUREMENT

Voltage Measurement Device and Interface

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

Voltage measurements throughout this test must be made quickly and safely. To ensure these requirements are met, the testing lab must devise, for COTR approval, a test interface port or other device to facilitate these voltage measurements. All voltage measurements shall be immediate upon connection to the interface port. This test interface port equipment shall be easily accessible from the exterior of the vehicle and connected to the appropriate propulsion system and battery components via laboratory installed wires. The external mounting of this test interface port shall be configured such that no movement, interference, or damage will result to it from a barrier crash test. The test interface port shall incorporate a fusible link and any other necessary safety device or usage procedure to protect the data measurement and recording equipment from damage, and the test technicians from electrical shock.

A terminal block or circuitboard is recommended as a means to providing an external interface.

The following is an example quoted from Transport Canada document, "Test Procedures, Frontal Impact 208-212-301F-305F, No. 03-002"

"This kit is composed of a PVC box compliant with the electrical code and containing insulated banana connectors that allow the measuring equipment to be connected for the verification of the standard. A warning light indicates the presence of voltage inside the box. A shielded cable with three conductors, 20 feet in length and capable of supporting 600 volts, connects the box to the vehicle's electrical system. This cable is covered with orange-coloured mechanical protection (similar to the Hybrid vehicle high-voltage identification code). The box is protected by a 0.5-amp fuse."

9. SUGGESTED TEST EQUIPMENT....Continued

STATIC ROLLOVER AND ELECTROLYTE COLLECTION

Static Rollover Machine

The rollover machine must be capable of rotating, and holding in place, the barrier impacted test vehicle up to 5443 kg about its longitudinal axis with the axis kept horizontal, to each successive increment of 90°, 180°, and 270° at a uniform rate, with 90° of rotation taking place in any time interval from 1 to 3 minutes. Leakage will be collected for the 5-minute period from the beginning of rotation plus any additional 1-minute collection periods that are required. Voltage measurements shall be able to be made continuously throughout the rollover test.

STODDARD AND ELECTROLYTE COLLECTION CONTAINERS

Containers for the collection of Stoddard solvent and propulsion battery electrolyte and a stopwatch for timing the fluid collection intervals are required. Containers for each fluid collected must be labeled before they are photographed. For containers containing both Stoddard and electrolyte, the fluids shall be allowed to separate by specific gravity then measured and photographed.

OTHER INSTRUMENTATION

The Contractor shall provide the necessary equipment to permanently record and display data. The data shall be included in the final test report and on the electronic data media.

TEST DUMMIES

As required by the governing barrier test procedure. No dummy instrumentation is necessary unless required by additional contract obligations.

10. PHOTOGRAPHIC DOCUMENTATION

DIGITAL PHOTOGRAPHS

The contractor shall take digital photographs of the test execution procedures. Photographs shall be taken in color and contain clear images. A tag, label or placard identifying the test item, NHTSA number (if applicable) and date shall appear in each photograph and must be legible. Each photograph shall be labeled as to the subject matter. The required resolution for digital photographs is a minimum of 1,600 x 1,200 pixels. Digital photographs are required to be created in color and in a JPG format. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs.

10. PHOTOGRAPHIC DOCUMENTATION....Continued

The test reports shall include enough photographs to describe the testing in detail and shall be organized in a logical succession of consecutive pictures. The digital photographs should be included in the test report as 203 mm x 254 mm or 215.9 mm x 279 mm (8 x 10 or 8½ x 11 inch) pictures (or for equipment testing -- 125 mm x 175 mm (5 x 7 inch) pictures). All photographs are required to be included in the test report in the event of a test failure. Any failure must be photographed at various angles to assure complete coverage. Upon request, the photographs should be sent to the COTR on a CD or DVD and saved in a "read only" format to ensure that the digital photographs are the exact pictures taken during testing and have not been altered from the original condition.

PHOTOGRAPHIC VIEWS

As a minimum the following test photographs shall be included in each vehicle final test report, submitted by the contractor:

- A. Propulsion battery module(s)
- B. High voltage interconnect(s)
- C. Propulsion battery venting system(s)
- D. Battery box(s) or container(s) which holds the individual battery modules
- E. Other visible electrical propulsion components.
- F. Pretest view of the propulsion battery, if any part of it is visible. DO NOT disassemble any parts other than carpet, seats, and other interior pieces to take these photographs.
- G. Pretest and post-test view of the electric propulsion drive. Take the best photographs possible without removing any parts. Use mirrors to view any hidden components where possible.
- H. Pretest view of the installed Test Interface Port and other test devices.
- I. Post-test propulsion battery electrolyte spillage location view, when leakage occurs.
- J. Post-test indication of battery module movement, or retention loss. Apply paint or other highly visible finish, such as machinist blue, to all attachment fasteners or means (welds), pretest, to indicate component movement or retention loss.
- K. Post-test battery component intrusion, when intrusion occurs. Disassembly and removal of parts may be necessary to take these photographs. DO NOT disassemble without OVSC representative present.
- L. Post-test views of test vehicle while vehicle is on static rollover machine at 90°, 180°, 270°, and 360°, highlighting propulsion battery location.
- M. Photographs of propulsion battery system mounting and/or intrusion failures.
- N. Pretest and post-test of the vehicle passenger compartment to show any vehicle areas at which intrusion/spillage may occur.
- O. Post-test view of the propulsion battery box(s) or container(s) that hold the individual battery modules. Disassembly and removal of parts may be necessary to take these photographs. DO NOT disassemble without OVSC representative present.
- P. Photographs of all labels on the vehicle related to the electrical propulsion system.
- Q. Other photographs requested by COTR.

10. PHOTOGRAPHIC DOCUMENTATION....Continued

CAMERA COVERAGE

1. High-speed photographic coverage:

All High-speed photographic coverage required by the governing barrier test procedure shall be included in this test.

2. Real-time photographic coverage:

The contractor shall use a "real time" color digital and/or color motion picture camera with at least 24 frames per second (fps) to record the condition of the passenger compartment interior area of the vehicle, and locations of propulsion battery components, pre- and post-test. All real-time photographic coverage required by the governing barrier test procedure shall be included in the final film submission.

A real-time camera shall be used to record any propulsion battery electrolyte spillage from, or into the interior compartment of, the test vehicle after the impact event or during the static rollover test.

The video footage shall be transferred to a compact disc (CD) or DVD as AVI or MPEG files with any standard or generally available "codec" compatible to Microsoft Windows. All video footage should be saved in a "read only" format before sending to the COTR to verify that the evidence has not been altered from its original condition. Video footage may only be saved using other types of file formats if approved by the COTR.

11. DEFINITIONS

PROPULSION BATTERY SYSTEM COMPONENT

Any part of a propulsion battery module, interconnect, venting system, battery restraint device, and battery box or container that holds the individual battery modules used for propulsion.

DUMMY

Use definitions for test dummies as specified in FMVSS Nos. 208, 214D, and/or 301.

GOVERNING BARRIER TEST PROCEDURE

The OVSC Test Procedures for FMVSS Nos. 208, 214D or 301 per Table 1. Each of these is available on the agency website: www.NHTSA.dot.gov

ELECTROLYTE SPILLAGE

The fall, flow, or run of propulsion battery electrolyte in, on, or from the vehicle, including wetness resulting from capillary action.

GROSS VEHICLE WEIGHT RATING OR GVWR

The value specified by the manufacturer as the loaded weight of a single vehicle. (571.3)

LONGITUDINAL OR LONGITUDINALLY

Parallel to the longitudinal centerline of the vehicle. (571.3)

OUTBOARD DESIGNATED SEATING POSITION

A designated seating position where a longitudinal vertical plane tangent to the outboard side of the seat cushion is less than 12 inches from the innermost point on the inside surface of the vehicle at a height between the design H-point and the shoulder reference point (as shown in fig. 1 of Federal Motor Vehicle Safety Standard No. 210) and longitudinally between the front and rear edges of the seat cushion. (571.3)

RATED CARGO AND LUGGAGE CAPACITY WEIGHT (RCLW)

RCLW = vehicle capacity weight – (68 kg x designated seating capacity).

Maximum RCLW used in testing a truck, MPV, or bus is 136 kg.

RCLW for school buses will follow the calculation contained within the governing barrier test procedure.

11. DEFINITIONS....Continued

TELLTALE

A display that indicates the actuation of a device, a correct or defective functioning or condition, or a failure to function. (571.101, S4)

UNLOADED VEHICLE WEIGHT (UVW)

The weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but without cargo, occupants, or accessories that are ordinarily removed from the vehicle when they are not in use. (571.3)

VEHICLE CAPACITY WEIGHT (VCW)

The rated cargo and luggage load plus 68 kilograms times the vehicle's designated seating capacity (571.110, S3).

VCW for school buses will follow the calculation contained within the governing barrier test procedure.

12. PRETEST REQUIREMENTS

Prior to conducting a compliance test, the contractor shall:

- A. Verify COTR approval of Contractor's in-house test procedure,
- B. Verify the training of technicians for performance of this test,
- C. Verify the calibration status of test equipment,
- D. Review applicable revision of FMVSS 208,
- E. Review vehicle Owner's Manual (or equipment mfg. instructions), and
- F. Set cold tire pressures according to the vehicle manufacturer's recommendations (where applicable).

12.1 DETAILED TEST AND QUALITY CONTROL PROCEDURES REQUIRED

Prior to conducting any compliance test, Contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes:

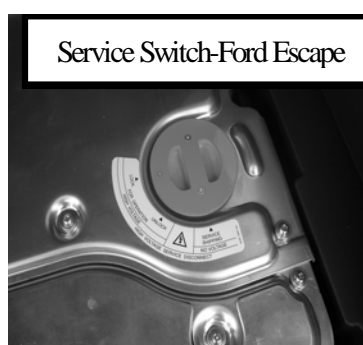
- A. A step-by-step description of the methodology to be used.

12. PRETEST REQUIREMENTS....Continued

- B. A written Quality Control (QC) Procedure which shall include calibrations, the data review process, report review, and the people assigned to perform QC on each task.
- C. A complete listing of test equipment with instrument accuracy and calibration dates.
- D. Detailed check off lists to be used during the test and during data review. These lists shall include all test procedure requirements and FMVSS requirements pertaining to the safety standard for which testing is being performed. Each separate check off sheet shall identify the lab, test date, vehicle and test technicians. These check sheets shall be used to document that all requirements and procedures have been complied with. These sheets shall be submitted with the test report.
- E. There shall be no contradiction between the OVSC Laboratory Test Procedure and the Contractor's in-house test procedure. The procedures shall cover all aspects of testing from vehicle receipt to submission of the final report. Written approval of the procedures must be obtained from the COTR before initiating the compliance test program.

12.2 DATA COLLECTION SET-UP

- A. Remove the key from the keylock and insure the vehicle is not powered.
- B. Remove barriers to access the propulsion battery module (e.g. seat backs, carpet, covers).
- C. Wear high-voltage protection gloves, nonconductive shoes, eye protection and any other safety equipment deemed necessary to safely prepare the vehicle and conduct the test.
- D. Set the propulsion battery module switch, service plug, or otherwise to the "OFF" or de-powered, position (See examples below). Follow any Manufacturer instructions provided by the COTR.



- A. Wait 5 Minutes.

12. PRETEST REQUIREMENTS....Continued

- E. Remove propulsion battery module service cover, or cover that closes the battery compartment.
- F. Measure the voltage across the propulsion battery at the appropriate terminals, and verify 0 volts.
- G. Measure the voltage between the positive terminal of the propulsion battery and the vehicle body, and verify 0 volts.
- H. Measure the voltage between the negative terminal of the propulsion battery and the vehicle body, and verify 0 volts.
- I. If any voltage measurements differ from 0 volts, **STOP**, quarantine vehicle, document incident and contact the COTR.
- J. Attach test leads from the propulsion battery, propulsion system, automatic propulsion battery disconnect, ground points, and any other points necessary on the vehicle such that immediate retrieval of data is possible after an impact event and at all times during the static rollover test.

NOTE: If vehicle is equipped with an automatic disconnect physically contained within the battery pack system, all voltage measurements **after impact** will be taken from the traction side of the automatic disconnect to the vehicle chassis.

If the vehicle utilizes an automatic disconnect that is not physically contained within the battery pack system, all post-impact voltage measurements are to be made from the battery side of the automatic disconnect. Automatic disconnect presence, location, and set-up instruction are vehicle specific and is available from the COTR.

- K. Re-Install the propulsion battery module service cover, or otherwise close the battery compartment. Take great care to preserve the integrity of the connection wiring and propulsion battery holddowns.

12.3 TEST VEHICLE PREPARATION

- A. Apply paint or other highly visible finish, such as machinist blue, to all *battery system component* attachment fasteners or attachment means (e.g., welds), to indicate component movement or separation, post-test.
- B. If the vehicle is equipped with a liquid cooling system, assure that the coolant is a different color than the Stoddard solvent in use as specified in FMVSS Nos. 208, 214D and 301.

12. PRETEST REQUIREMENTS....Continued

- C. Reset the propulsion battery module switch, service plug, or otherwise to the “ON”, or powered, position. Verify proper function of propulsion system.
- D. Charge the propulsion battery system to the level specified in (1), (2), or (3) below:
1. The voltage corresponding to the maximum state of charge recommended by the manufacturer, as stated in the vehicles owner’s manual or on a label that is permanently affixed to the vehicle;
- OR
2. If the manufacturer has made no recommendation, a voltage corresponding to a state of charge of not less than 95 percent of the maximum capacity of the battery system. Verify the charge level with the COTR.
- OR
3. If the batteries are rechargeable only by an energy source on the vehicle, upon approval from the COTR, operate the vehicle such that the maximum practicable state of charge within the normal operating range, as specified by the manufacturer, is reached as indicated by the vehicle’s instrumentation, if installed, or using other measurement methods as directed by the COTR.
- E. Complete [Data Sheet 1—Test Vehicle Specifications](#) and [Data Sheet 2– Pre-test Data](#).
- F. Prepare the test vehicle per the test procedure of the applicable governing barrier test (e.g. FMVSS 208).
- G. Document and photograph test vehicle per the FMVSS 305 test procedure, and record in [Data Sheet 6](#).

12.4 ELECTRICAL ISOLATION BASELINE MEASUREMENT

NOTE: The following measurements are to be made immediately prior to barrier impact test, and should be completed within 15 minutes.

- A. Check that the battery system is connected to the vehicle’s propulsion system, and the vehicle is in the “ready-to-drive” (propulsion motor(s) activated) position. Start [Data Sheet 3 – Pre-Impact Electrical Isolation Measurements & Calculations](#).
- B. Measure the voltage of the propulsion battery as shown in Figure 1 below. Before any vehicle impact test, verify that V_b is equal to or greater than the nominal operating voltage as specified by the vehicle manufacturer, or as supplied by the COTR. If V_b is not equal to

12. PRETEST REQUIREMENTS....Continued

or greater than the nominal operating voltage as specified by the vehicle manufacturer, or as supplied by the COTR, repeat the propulsion battery charging step of Test Vehicle

Preparation and promptly call COTR for guidance. The voltmeter used in this test measures direct current values and has an internal impedance of at least $10\text{M}\Omega$. Record the voltage measurement as V_b in [Data Sheet 3](#). Make certain all voltages are DC. If there is AC voltage on the traction side connection, consult the COTR for additional guidance.

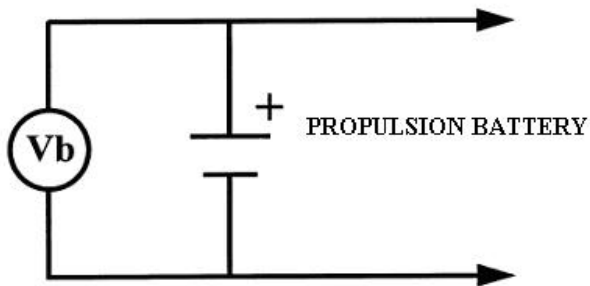


FIGURE 1

- C. Measure the voltage (V_1) from the negative side of the propulsion battery to the vehicle chassis point(s) as shown in Figure 2 below. Record the voltage measurement as V_1 in [Data Sheet 3](#).

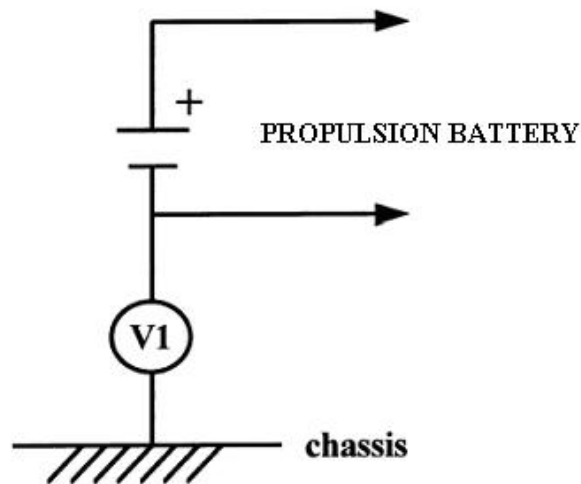


FIGURE 2

- D. Measure the voltage (V_2) from the positive side of the propulsion battery to the vehicle chassis point(s) as shown in Figure 3 below. Record the voltage measurement as V_2 in [Data Sheet 3](#).

12. PRETEST REQUIREMENTS....Continued

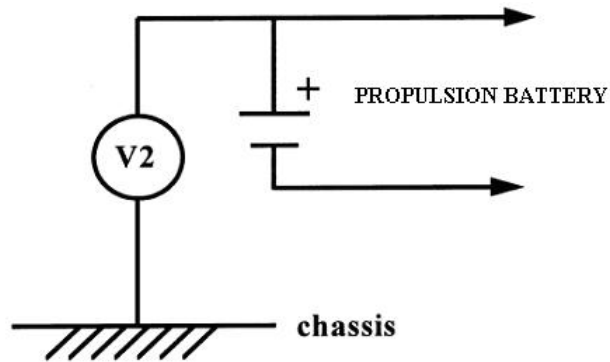


FIGURE 3

- E. Insert a resistor (R_o) of a known resistance (in ohms) approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766, between the negative side of the propulsion battery and the vehicle chassis. With R_o installed, measure and record the voltage (V_1') as shown in Figure 4 between the negative side of the propulsion battery and the vehicle chassis point(s). Calculate the electrical isolation value (in ohms) as shown in Figure 4 below. Record electrical isolation value as R_{i1} in [Data Sheet 3](#).

NOTE-- R_o is not required to be precisely this value since the equations are valid for any R_o ; however, an R_o value in this range should provide good resolution for the voltage measurements.¹

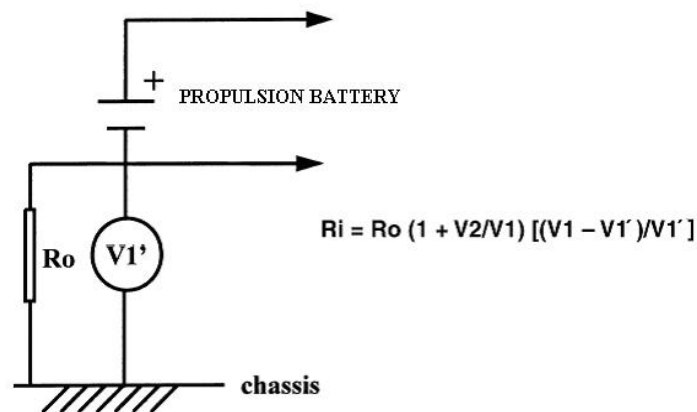


FIGURE 4

- F. With R_o installed, measure and record the voltage (V_2') as shown in Figure 5 between the positive side of the propulsion battery and the vehicle chassis point(s). Calculate the electrical isolation value (in ohms) as shown in Figure 5 below.

¹ SAE J1766-rev. June 1998- recommended practice for electric and hybrid electric vehicle battery systems crash integrity testing

12. PRETEST REQUIREMENTS....Continued

NOTE: If measured voltage is zero and results in a division by zero in the electrical isolation calculation, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.

Record electrical isolation value as R_{i2} in [Data Sheet 3](#).

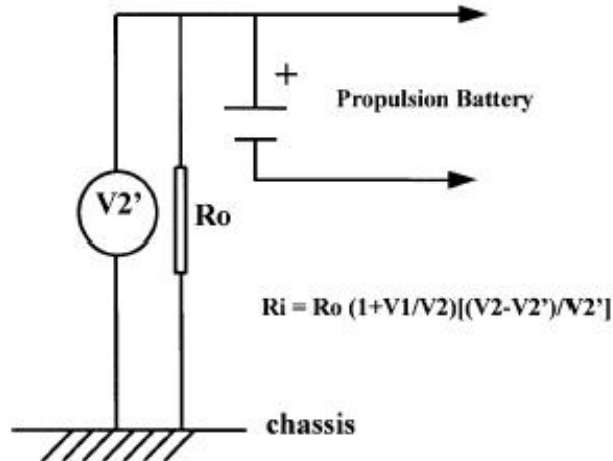


Figure 5

NOTE: Exact location of measurement will vary depending on the location of the disconnect(s) for the system.

- G. If R_{i1} is less than R_{i2} then, divide R_{i1} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 4. **Note: If measured voltage is zero and results in a division by zero, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.** Record this value as R_i / V_b , in [Data Sheet 3](#). This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- H. If R_{i2} is less than R_{i1} then, divide R_{i2} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 4. **Note: If measured voltage is zero and results in a division by zero record “Zero Volts.” This “zero voltage” condition is considered as being compliant.** Record this value as R_i / V_b , in [Data Sheet 3](#). This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- I. Recheck that the battery system is connected to the vehicle’s propulsion system, and the vehicle in the “ready-to-drive” (propulsion motor(s) activated) position.
- J. Verify that the parking brake and transmission are set in accordance with the governing barrier test procedure.

13. COMPLIANCE TEST EXECUTION

13.1 GOVERNING BARRIER TEST

Perform applicable governing barrier test (e.g. FMVSS 208).

NOTE: If vehicle is equipped with an automatic disconnect physically contained within the battery pack system, all voltage measurements after impact will be taken from the traction side of the automatic disconnect to the vehicle chassis.

If the vehicle utilizes an automatic disconnect that is not physically contained within the battery pack system, all post-impact voltage measurements are to be made from the battery side of the automatic disconnect. Automatic disconnect presence, location, and set-up instruction are vehicle specific and must be obtained from the COTR.

13.2 ELECTRICAL ISOLATION COMPLIANCE MEASUREMENT

NOTE: All voltage measurements shall be recorded immediately after the barrier impact test, and at the start of each increment of 90°, 180°, 270°, and 360° of the FMVSS 301 static rollover test.

NOTE: If measured voltage is zero and results in a division by zero, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.

- A. Immediately following the barrier impact test, measure V_1 , V_2 , V_1' , and V_2' voltages per Figures 2-5 with R_o installed and record the values in [Data Sheet 4, Post-Impact Data](#).
- B. Calculate the electrical isolation value (in ohms) as shown in Figure 4. Record electrical isolation value as R_{i1} in [Data Sheet 4](#).
- C. Calculate the electrical isolation value (in ohms) as shown in Figure 5. Record electrical isolation value as R_{i2} in [Data Sheet 4](#).
- D. If R_{i1} is less than R_{i2} then, divide R_{i1} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 4. Record this value as R_i / V_b in [Data Sheet 4](#). This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- E. If R_{i2} is less than R_{i1} then, divide R_{i2} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 4. Record this value as R_i / V_b in [Data Sheet 4](#). This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.

F. COMPLIANCE TEST EXECUTION....Continued

- G. Visually inspect for electrolyte leakage in the passenger compartment and record and photograph findings in [Data Sheet 4](#) & [Data Sheet 6](#).
- H. Visually inspect for external battery component entry into the occupant compartment and record and photograph findings in [Data Sheet 4](#) & [Data Sheet 6](#).
- I. Visually inspect for internal battery component movement in the occupant compartment and record and photograph findings in [Data Sheet 4](#) & [Data Sheet 6](#).
- J. Document and photograph test vehicle per prescribed governing barrier test procedure and FMVSS 305 test procedure deliverables and record findings in [Data Sheet 6](#).
- K. Prepare the vehicle for the Static Rollover Test using the FMVSS 301 Compliance Test Procedure.

13.3 STATIC ROLLOVER TEST

NOTE: When the test vehicle is rotated in a fixture on its longitudinal axis to each successive increment of 90°, following an impact crash, propulsion battery electrolyte shall not exceed 5 liters, and electrical isolation shall not be less than 500 ohms/volt throughout the complete barrier impact test and at each 90° increment of the static rollover test.

The passenger compartment must be visually checked directly after a barrier impact for evidence of electrolyte leakage, battery system component intrusion, and retention of interior mounted battery modules. Photographs of the propulsion battery system components should be taken before the vehicle is placed in the static rollover machine.

Do not proceed to the static rollover if there are apparent test failures of the governing barrier test. The Contractor must conduct a static rollover test within 45 minutes after the vehicle impact only after the "quick look" data provides assurance that the vehicle has met the performance requirements of FMVSS No. 208, 214D, and/or 301, and 305. The Contractor must keep the test vehicle under constant observation for propulsion battery electrolyte leakage during the transition between impact and static rollover testing.

After the vehicle impact, propulsion battery electrolyte leakage will be collected by hand and documented with a real time (24 fps) digital motion picture camera. The "tea cup method" has been used in the past and involves simply placing a collection vessel(s) beneath the leakage source(s). The collected propulsion battery electrolyte samples can subsequently be measured and spillage volume calculated. Contractors are invited to suggest alternative methods for fluid collection. If the "tea cup method" is used, the test personnel must be in position to scramble to observation points around the test vehicle at the instant the vehicle comes to rest after the impact event. If possible, segregate the collections of Stoddard solvent, propulsion battery electrolyte, or any other fluid if leakage of fluid is evident. If it is not possible to collect leakage samples

13. COMPLIANCE TEST EXECUTION....Continued

separately, provide a collection vessel adequately sized to collect the leakage mixture and separate by suitable means, post-test. Take adequate safeguards when collecting leakage, as it may be hazardous.

- A. Reference Static Rollover preparation and procedure from the most current FMVSS 301 Test Procedure.
- B. Mount the test vehicle on the static rollover fixture and position at 0° (wheels down)
- C. Immediately following the rollover transition of each successive increment of 90° (e.g. at 90° , 180° , 270° , 360°), perform the following:

Note: If measured voltage is zero and results in a division by zero, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.

1. Measure V_1 , V_2 , V_1' , and V_2' voltages per Figures 2-5 with R_o installed, and record the values in [Data Sheet 5--Static Rollover Test Data](#).
 2. Calculate the electrical isolation value (in ohms) as shown in Figure 4. Record electrical isolation value as R_{i1} in [Data Sheet 5](#).
 3. Calculate the electrical isolation value (in ohms) as shown in Figure 5. Record electrical isolation value as R_{i2} in [Data Sheet 5](#).
 4. If R_{i1} is less than R_{i2} then, divide R_{i1} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 4. Record this value as R_i / V_b , in [Data Sheet 5](#). This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
 5. If R_{i2} is less than R_{i1} then, divide R_{i2} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 4. Record this value as R_i / V_b , in [Data Sheet 5](#). This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- D. Repeat Step 3 for increments of 180° , 270° and 360°

NOTE: If there is an indication of a test failure during an impact test, the static rollover test WILL NOT BE CONDUCTED!

14. POST TEST REQUIREMENTS

After the required tests are completed, the contractor shall:

- A. Verify all data sheets complete and photographs taken,
- B. Complete the Vehicle Condition report form including a word description of its post test condition,
- C. Copy applicable pages of the vehicle Owner's Manual for attachment to the final test report,
- D. Remove all instrumentation from vehicle. Return vehicle to its pretest condition.
- E. Move the test vehicle to a secure area,
- F. Place all original records in a secure and organized file awaiting test data disposition.

15. REPORTS

15.1. MONTHLY STATUS REPORTS

The contractor shall submit a monthly Test Status Report and a Vehicle Status Report to the COTR. The Vehicle Status report shall be submitted until all vehicles are disposed of. Samples of the required reports are found in the report forms section.

15.2. APPARENT NONCOMPLIANCE

Any indication of a test failure shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturdays and Sundays excluded). A Notice of Test Failure (see report forms section) with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) shall be included. In the event of a test failure, a post test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

15.3 FINAL TEST REPORTS

15.3.1 COPIES

In the case of an apparent test failure, seven paper copies and electronic copies in both Word and pdf formats of the Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. The Final Test Report format to be used by all contractors can be found in the "Report Section".

15. REPORTS....Continued

Where there has been no indication of an apparent noncompliance, three paper copies and electronic copies in both Word and pdf formats of each Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. No payment of contractor's invoices for conducting compliance tests will be made prior to the Final Test Report acceptance by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided with copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in draft form within one week after the compliance test is conducted. The contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the compliance test program.

Contractors are required to PROOF READ all Final Test Reports before submittal to the COTR. The OVSC will not act as a report quality control office for contractors. Reports containing a significant number of errors will be returned to the contractor for correction, and a "hold" will be placed on invoice payment for the particular test.

15.3.2 REQUIREMENTS

The Final Test Report and associated documentation (including photographs) are relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR.

For these reasons, each final report must be a complete document capable of standing by itself. The contractor should use DETAILED descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much DETAIL as possible in the report. Instructions for the preparation of the first three pages of the final test report are provided for standardization.

15.3.3 FIRST THREE PAGES

A. FRONT COVER

A heavy paperback cover (or transparency) shall be provided for the protection of the final report. The information required on the cover is as follows:

(1) Final Report Number such as 305-ABC-XX-001, where –

305	is the FMVSS tested
ABC	are the initials for the laboratory
XX	is the last two numbers of the Fiscal Year of the test program
001	is the Group Number (001 for the 1st test,

15. REPORTS ...Continued

002 for the 2nd test, etc.)

- (2) Final Report Title and Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS 305
Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection

ABC Motor Company
20XX Saferider 4-door sedan
NHTSA No. CX0401

- (3) Contractor's Name and Address such as

COMPLIANCE TESTING LABORATORIES, INC.
4335 West Dearborn Street
Detroit, Michigan 48090-1234

NOTE: DOT SYMBOL SHALL BE PLACED BETWEEN ITEMS (3) AND (4)

- (4) Date of Final Report completion
- (5) The words "FINAL REPORT"
- (6) The sponsoring agency's name and address as follows

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Avenue, SE
Washington, DC 20590

15. REPORTS ...Continued

B. FIRST PAGE AFTER FRONT COVER

When a contract test laboratory is reporting, a disclaimer statement and an acceptance signature block for the COTR shall be provided as follows:

This publication is distributed by the National Highway Traffic Safety Administration in the interest of information exchange. 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 manufacturers' 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.

Prepared By: _____

Approved By: _____ *

Approval Date: _____ *

FINAL REPORT ACCEPTANCE BY OVSC:*

Accepted By: _____

Acceptance Date: _____

* These lines not required when OVSC staff writes the Test Report

15. REPORTS....Continued**C. SECOND PAGE AFTER FRONT COVER**

A completed Technical Report Documentation Page (Form DOT F1700.7) shall be completed for those items that are applicable with the other spaces left blank. Sample data for the applicable block numbers of the title page follows.

Block 1 — REPORT NUMBER

305-ABC-XX-001

Block 2 — GOVERNMENT ACCESSION NUMBER

Leave blank

Block 3 — RECIPIENT'S CATALOG NUMBER

Leave blank

Block 4 — TITLE AND SUBTITLE

Final Report of FMVSS 305 Compliance Testing of 20XX Saferider 4-door sedan,
NHTSA No. CX0401

Block 5 — REPORT DATE

Month Day, 20XX

Block 6 — PERFORMING ORGANIZATION CODE

ABC

Block 7 — AUTHOR(S)

John Smith, Project Manager
Bill Doe, Project Engineer

Block 8 — PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

15. REPORTS....Continued

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070-1234

Block 10 — WORK UNIT NUMBER

Leave blank

Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-XX-D-12345

Block 12 — SPONSORING AGENCY NAME AND ADDRESS

United States Department of Transportation
National Highway Traffic Safety Administration
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Avenue, SE
Washington, DC 20590

Block 13 — TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Month Day to Month Day, 20XX

Block 14 — SPONSORING AGENCY CODE

NVS-220

Block 15 — SUPPLEMENTARY NOTES

Leave blank

15. REPORTS....Continued

Block 16 — ABSTRACT

Compliance tests were conducted on the subject 200X Saferider 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-305-0X for the determination of FMVSS 305 compliance. Test failures identified were as follows:

None

NOTE: Above wording must be shown with appropriate changes made for a particular compliance test. Any questions should be resolved with the COTR.

Block 17 — KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 305

Block 18 — DISTRIBUTION STATEMENT

Copies of this report are available from —

National Highway Traffic Safety Administration
Technical Information Services Division, NPO-411
1200 New Jersey Avenue SE (Room E12-100)
Washington DC 20590

e-mail: tis@nhtsa.dot.gov
FAX: 202-493-2833

Block 19 — SECURITY CLASSIFICATION OF REPORT

Unclassified

Block 20 — SECURITY CLASSIFICATION OF PAGE

Unclassified

Block 21 — NUMBER OF PAGES

Add appropriate number

15. REPORTS....Continued

Block 22 — PRICE

Leave blank

15.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

Section 1 — Purpose of Compliance Test

Section 2 — Test Procedure and Discussion of Results

Section 3 — Test Data

Section 4 — Test Equipment List and Calibration Information

Section 5 — Photographs

Section 6 — Other Documentation

Section 7 — Notice of Test Failure (if applicable)

16. DATA SHEETS

Data Sheet No. 1
Test Vehicle Specifications

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style _____
 NHTSA No.: _____; Color: _____; Date Received: _____
 Odometer Reading: _____ miles
 Selling Dealer: _____

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: _____
 Date of Manufacture: _____
 VIN: _____
 GVWR: _____ kg. ; GAWR-Front: _____ kg. ; GAWR-Rear: _____ kg.

DATA FROM VEHICLE'S TIRE PLACARD & SIDEWALL:

Location of Placard on Vehicle: _____
 Recommended Tire Size: _____
 Recommended Cold Tire Pressure: Front: _____ kPa; Rear: _____ kPa
 Size of Tires on Test Vehicle: _____
 Type of Spare Tire: _____

VEHICLE CAPACITY DATA:

Type of Front Seat(s): _____
 Number of Occupants: Front = _____; Rear = _____; Total = _____
 A. VEHICLE CAPACITY WEIGHT (VCW) = _____ kg.
 B. Number of Occupants x 68 kg. = _____ kg.
 RATED CARGO AND LUGGAGE WEIGHT (RCLW) [A-B]: _____ kg
 Maximum RCLW used in testing a truck, MPV, or bus is 136 kg.
 RCLW-School Bus (If Applicable)= _____ kg

ELECTRIC VEHICLE PROPULSION SYSTEM

Type of Electric Vehicle (Electric/Hybrid): _____
 Propulsion Battery Type: _____
 Nominal Voltage: _____ V;
 Physical Location of Automatic Propulsion Battery Disconnect:

 Auxiliary Battery Type: _____

RECORDED BY: _____ DATE: _____
 APPROVED BY: _____ DATE: _____

16. DATA SHEETS....Continued

Data Sheet No. 2
Pre-Test Data

Vehicle: _____ NHTSA No.: _____

CALCULATION OF TARGET TEST WEIGHT (TTW)

1. Unloaded Vehicle Weight (UVW) = _____ kg.
 2. Rated Cargo & Luggage Weight (RCLW) = _____ kg.
 3. Weight of _____ Part 572 Dummies = _____ kg.
 TARGET TEST WEIGHT = 1 + 2 + 3 = _____ kg.

NOTE: The target weight is calculated including tolerances as specified in each vehicle crash test procedure.

As Tested

Test Weight of Vehicle, _____ Dummies and _____ kg of Cargo Weight

TOTAL TEST WEIGHT = _____ kg

Measured Cold Tire Pressure @ Total Test Weight:

Front: _____ kPa; Rear: _____ kPa

**PROPULSION BATTERY SYSTEM DATA:
(COTR supplied data)**

Electrolyte Fluid Type: _____

Electrolyte Fluid Specific Gravity: _____

Electrolyte Fluid Kinematic Viscosity: _____ centistokes

Electrolyte Fluid Color: _____

Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable): _____

Location of Battery Modules:

 Inside Passenger Compartment: _____ Outside Passenger Compartment: _____

Measure and Record Battery State of Charge (see page 18): _____

(Note: Check which condition applies and specify the manufacturer's value for the:) Maximum State of Charge recommended by manufacturer: _____**OR** Test Voltage ($\geq 95\%$ of Maximum State of Charge): _____ Test Voltage (Within Normal Operating Voltage Range): _____

16. DATA SHEETS....Continued

Data Sheet No. 3
Pre-Impact Electrical Isolation Measurements & Calculations

Vehicle: _____ NHTSA No.: _____

VOLTMETER INFORMATION:

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10M Ω
- NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles

Make: _____; Model: _____; S/N: _____

Internal Impedance Value: _____M Ω

Resolution: _____V Last Calibration Date: _____

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
- Normal operating voltage range specified by the manufacturer = _____

$V_b =$ _____ V

PROPULSION BATTERY TO VEHICLE CHASSIS

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

$V_1 =$ _____ V

$V_2 =$ _____ V

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

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

$R_o =$ _____ Ω

16. DATA SHEETS....Continued

Electrical Isolation Measurement

Note: If measured voltage is zero and results in a division by zero, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.

$$V1' = \frac{\quad}{\quad} V$$
$$Ri1 = R_o (1 + V2/V1) [(V1-V1')/V1']$$
$$Ri1 = \frac{\quad}{\quad} \Omega$$

$$V2' = \frac{\quad}{\quad} V$$
$$Ri2 = R_o (1 + V1/V2) [(V2-V2')/V2']$$
$$Ri2 = \frac{\quad}{\quad} \Omega$$

Ri = The lesser of Ri1 and Ri2

Ri = $\frac{\quad}{\quad}$ Ω Pre-test

Ri/Vb = $\frac{\quad}{\quad}$ Ω/V (Electrical Isolation Value)
Minimum Electrical Isolation Value is 500 Ω/V

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

Comments: _____

RECORDED BY: _____ DATE: _____
APPROVED BY: _____ DATE: _____

16. DATA SHEETS....Continued

Data Sheet No. 4
Post-Impact Data

Vehicle: _____ NHTSA No.: _____

ELECTICAL 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: _____; Model: _____; S/N: _____

Internal Impedance Value: _____ MΩ

Nominal Propulsion Battery Voltage (Vb): _____ V

- Record V1, V2, V1', V2' voltage measurements immediately after the impacted vehicle **comes to rest.**

V1 = _____ V Impact Time: _____ minutes _____ s

V2 = _____ V Impact Time: _____ minutes _____ s

V1' = _____ V Impact Time: _____ minutes _____ s

V2' = _____ V Impact Time: _____ minutes _____ s

- Attach complete data acquisition to final test report

Electrical Isolation Measurement

Note: If measured voltage is zero and results in a division by zero, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.

$$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$$

R_{i1} = _____ Ω Impact Time: _____ minutes _____ s

$$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$$

R_{i2} = _____ Ω Impact Time: _____ minutes _____ s

R_i = The lesser of R_{i1} and R_{i2}

R_i = _____ Ω Impact Time: _____ minutes _____ s

R_i/V_b = Electrical Isolation Value/ Nominal Battery Voltage

Minimum Electrical Isolation Value is 500 Ω/ V

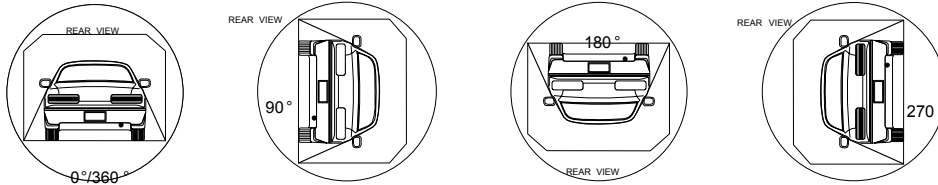
R_i/V_b = _____ Ω/V Impact Time: _____ minutes _____ s

16. DATA SHEETS....Continued

Data Sheet No. 5
STATIC ROLLOVER TEST DATA

Vehicle: _____

NHTSA No.: _____



I. 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	minutes	seconds	minutes	seconds
0°-90°								
90°-180°								
180°-270°								
270°-360°								

II. ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE:

FMVSS 305 Requirements: Maximum allowable propulsion battery electrolyte spillage is **5.0 Liters**

Rollover Stage	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0°-90°		
90°-180°		
180°-270°		
270°-360°		

Total Spillage: _____ L

- 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

16. DATA SHEETS....Continued

III. ELECTICAL ISOLATION MEASUREMENTS & CALCULATIONS

VOLTMETER INFORMATION:

- The voltmeter used in this test shall measure DC values and have an internal resistance of at least 10MΩ
- NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles

Make: _____; Model: _____; S/N: _____
 Internal Resistance Value (Ro): _____ MΩ
 Nominal Propulsion Battery Voltage (Vb): _____ V

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. The increment of rotation for each turn shall be completed within a maximum of 3 minutes.

Electrical Isolation Measurement

V1 = _____ V 0° Time: _____ minutes _____ s

V1 = _____ V 90° Time: _____ minutes _____ s

V1 = _____ V 180° Time: _____ minutes _____ s

V1 = _____ V 270° Time: _____ minutes _____ s

V2 = _____ V 0° Time: _____ minutes _____ s

V2 = _____ V 90° Time: _____ minutes _____ s

V2 = _____ V 180° Time: _____ minutes _____ s

V2 = _____ V 270° Time: _____ minutes _____ s

V1' = _____ V 0° Time: _____ minutes _____ s

V1' = _____ V 90° Time: _____ minutes _____ s

V1' = _____ V 180° Time: _____ minutes _____ s

V1' = _____ V 270° Time: _____ minutes _____ s

V2' = _____ V 0° Time: _____ minutes _____ s

V2' = _____ V 90° Time: _____ minutes _____ s

V2' = _____ V 180° Time: _____ minutes _____ s

V2' = _____ V 270° Time: _____ minutes _____ s

- Attach complete data acquisition to final test report of governing barrier test

16. DATA SHEETS....Continued

Electrical Isolation Calculation

Note: If measured voltage is zero and results in a division by zero, record “Zero Volts.” This “zero voltage” condition is considered as being compliant.

$$Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']$$

Ri1 = _____ Ω 90° Time: _____ minutes _____ s
 Ri1 = _____ Ω 180° Time: _____ minutes _____ s
 Ri1 = _____ Ω 270° Time: _____ minutes _____ s
 Ri1 = _____ Ω 360° Time: _____ minutes _____ s

$$Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']$$

Ri2 = _____ Ω 90° Time: _____ minutes _____ s
 Ri2 = _____ Ω 180° Time: _____ minutes _____ s
 Ri2 = _____ Ω 270° Time: _____ minutes _____ s
 Ri2 = _____ Ω 360° Time: _____ minutes _____ s

Ri = The lesser of Ri1 and Ri2

Ri = _____ Ω 90° Time: _____ minutes _____ s
 Ri = _____ Ω 180° Time: _____ minutes _____ s
 Ri = _____ Ω 270° Time: _____ minutes _____ s
 Ri = _____ Ω 360° Time: _____ minutes _____ s

Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage
 Minimum Electrical Isolation Value is 500 Ω/ V

Ri/Vb = _____ Ω/V 90° Time: _____ minutes _____ s
 Ri/Vb = _____ Ω/V 180° Time: _____ minutes _____ s
 Ri/Vb = _____ Ω/V 270° Time: _____ minutes _____ s
 Ri/Vb = _____ Ω/V 360° Time: _____ minutes _____ s

- Is the measured Electrical Isolation Value ≥500 Ω/ V?

YES NO (Fail)

COMMENTS:

RECORDED BY: _____ DATE: _____
 APPROVED BY: _____ DATE: _____

16. DATA SHEETS....Continued

Data Sheet No. 6
 Photograph Data Sheet

Vehicle: _____

NHTSA No.: _____

PHOTOGRAPH CHECKLIST

Pre-test Post-test

- A. View of the propulsion battery if any part of it is visible. Do NOT disassemble any parts other than carpet, seats and overlay to take these photographs
- B. View of the electric propulsion drive. Take the best photograph possible without removing any parts.
- C. View of the vehicle passenger compartment adjacent to propulsion battery.
- D. Post-test battery module movement, or retention loss, if applicable.
- E. Post-test battery component intrusion.
- F. Post-test view of test vehicle while vehicle is on static rollover machine.
- G. Photographs of propulsion battery system mounting and/or intrusion failures.
- H. Post-test propulsion battery electrolyte spillage location view.
- I. Labels and markings related to propulsion battery system.
- J. Other photographs requested by COTR.

COMMENTS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____