

TP-216a-00
May 6, 2009

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS No. 216a, ROOF CRUSH RESISTANCE



ENFORCEMENT
Office of Vehicle Safety Compliance
Mail Code: NVS-220
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Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 216a
TABLE OF CONTENTS

	PAGE
1. PURPOSE AND APPLICATION.....	1
2. GENERAL REQUIREMENTS	2
3. SECURITY	4
4. GOOD HOUSEKEEPING.....	5
5. TEST SCHEDULING AND MONITORING	5
6. TEST DATA DISPOSITION.....	5
7. GOVERNMENT FURNISHED PROPERTY (GFP)	7
8. CALIBRATION AND TEST INSTRUMENTATION	8
9. TEST EQUIPMENT	9
10. PHOTOGRAPHIC DOCUMENTATION	11
11. DEFINITIONS	13
12. PRETEST REQUIREMENTS	13
13. COMPLIANCE TEST EXECUTION	14
14. POST TEST REQUIREMENTS	18
15. REPORTS	20
16. FORMS.....	28
17. DATA SHEETS.....	30

REVISION CONTROL LOG
FOR OVSC LABORATORY
TEST PROCEDURES

TP-216a-00

TEST PROCEDURE		FMVSS 216a		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00	05/06/2009			Original release signed by O.D.
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1. PURPOSE AND APPLICATION

This document is provided by the National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) for the purpose of presenting procedures for uniform testing and providing suggestions for the use of specific equipment for contracted testing laboratories. It contains requirements based on the test procedures specified in the Federal Motor Vehicle Safety Standard(s) (FMVSS) and any applicable safety Regulations. 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 Contracting Officer's Technical Representative (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 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. In addition, the laboratory test procedures may specify test conditions that are less severe than the minimum requirements of the standard. 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. 216a requires that each side of the passenger compartment roof structure resist up to a maximum applied force equal to 3.0 times the unloaded weight of the vehicle in kilograms and multiplied by 9.8, for vehicles weighing less than 2,722 kg (6,000 lbs) and 1.5 times the unloaded vehicle weight for vehicles weighing between 2,722 kg (6,000 lbs) to 4,536 kg (10,000 lbs). The force must be applied separately to each side of the roof structure using a static loading device equipped with a rigid unyielding rectangular block (platen) measuring 762 millimeters by 1,829 millimeters.

The standard does not apply to school buses and convertibles or vehicles that conform to the dynamic rollover test requirements of FMVSS 208, "Occupant Crash Protection." It also does not apply to vehicles manufactured in two or more stages, other than chassis cabs, that conform to the roof crush requirements of FMVSS, "School Buses Occupant Protection."

Testing is performed with the test vehicle secured to a rigid horizontal surface. Both sides of the roof structure are tested. The lower surface of the test platen is aligned with its forward edge 254 mm forward of the forward most point of the roof while its longitudinal centerline is parallel with the vehicle's longitudinal centerline and centered with the initial point of contact with the roof or at the center of the roof contact area. The lower surface of the test platen is also orientated at a 5 degree pitch along its longitudinal axis and 25 degree roll along its traverse axis (see Figures 1 and 2).

The test vehicle meets the requirements of the standard if each side of the roof structure withstands the maximum applied force prior to:

- a) the lower surface of the test device moving more than 127 millimeters (5 inches),
and
- b) the interior of the roof structure contacting the head form specified in S5.2 of 49 CFR 571.201 when positioned at the location for a 50th percentile male occupant as specified in S7.2, and if contact occurs the load on the head form cannot be greater than 222 Newtons (50lbs).

2. GENERAL REQUIREMENTS...continued

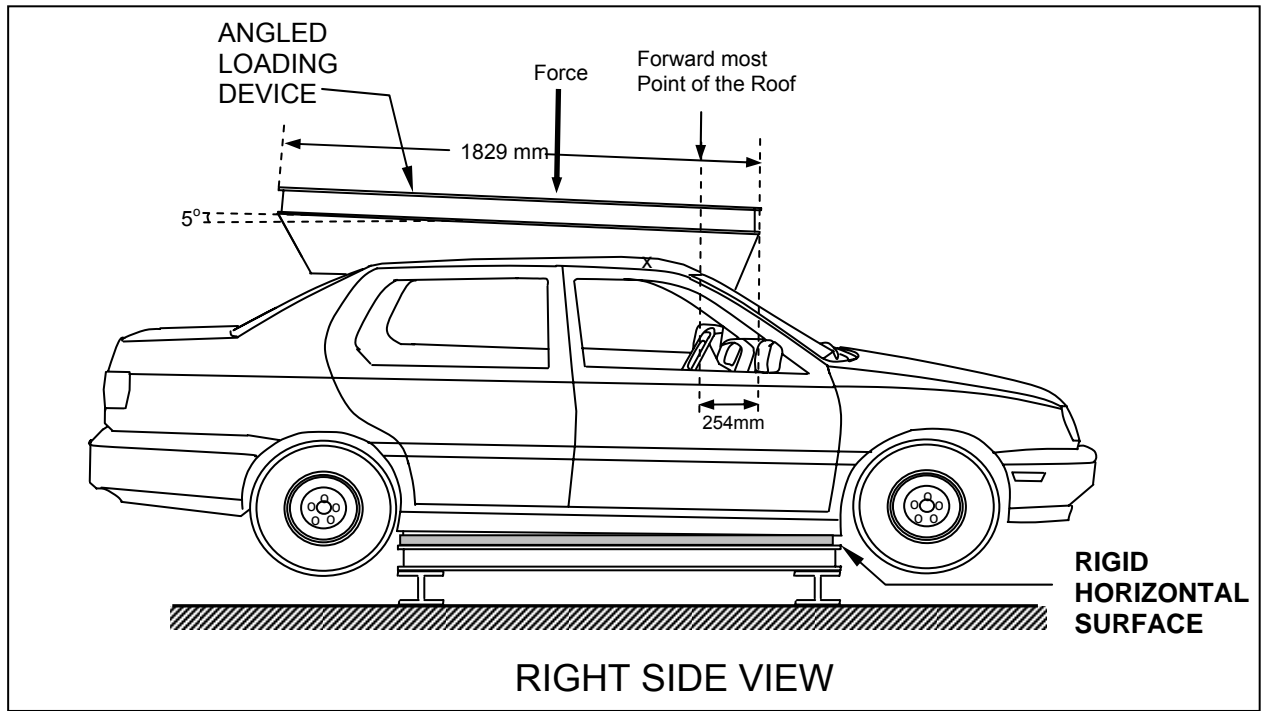


Figure 1

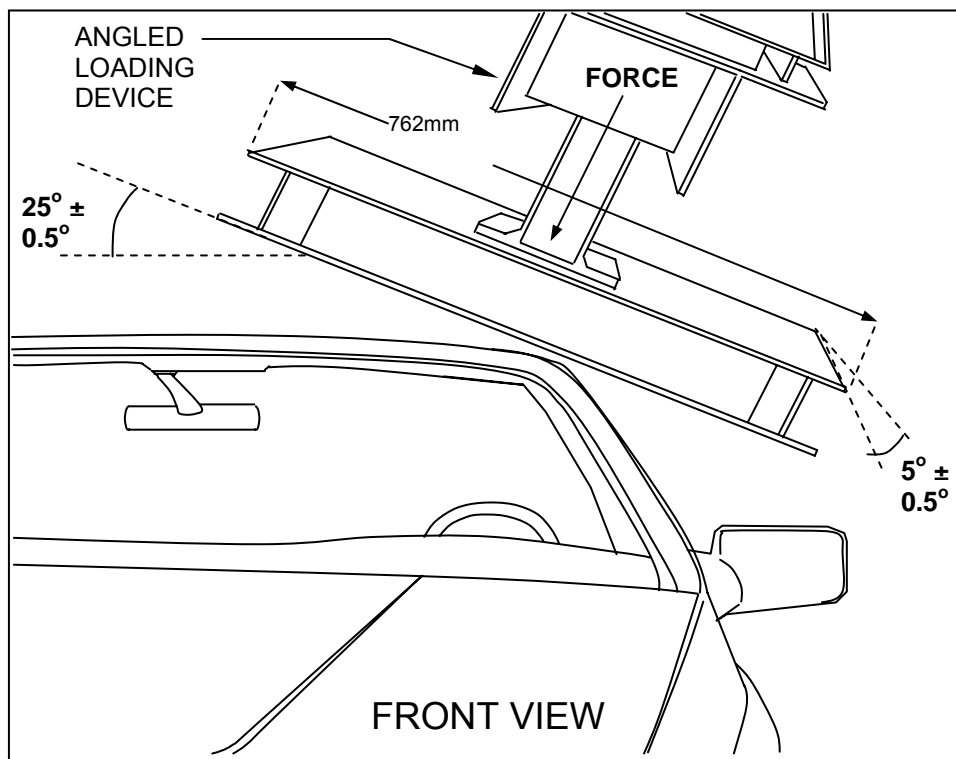


Figure 2

2. GENERAL REQUIREMENTS...continued

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.

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 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. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will 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 compliance test unless specifically authorized by the COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle compliance testing area, test 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. Final test data, including digital printouts and computer generated plots, 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 or the test completion.

6. TEST DATA DISPOSITION

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

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 re-procurement costs for non-delivery of valid or conforming tests (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 consists of test vehicles. The handling and disposition of GFP is governed 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.

B. 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 AND TEST INSTRUMENTATION

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.
- 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.

8. CALIBRATION AND TEST INSTRUMENTATION...continued

- 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.
- I. 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/NC SL Z540-1, "Calibration Laboratories and Measuring and Test Equipment General Requirements."

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. TEST EQUIPMENT

The following is a list of the minimum equipment needed to perform the test.

A. Static Loading Device

The static loading device consists of a rigid unyielding block (platen) with its lower surface formed as a flat rectangle measuring 762 millimeters by 1,829 millimeters. The loading device must have a minimum of one load actuating device (e.g. hydraulic ram). The static loading device will have the capability of applying the required load linearly while maintaining platen angles throughout the entire load application phase at a rate of not more than 13 millimeters per second. The static loading device will have the capability of traveling a minimum of 153 millimeters after initial contact with the roof.

B. Vehicle Tie-Down Fixture

The vehicle tie-down fixture consists of a rigid, horizontal ($\pm 0.25^\circ$) surface and must be capable of supporting the vehicle weight, the loads applied, and preventing movement of the vehicle during the test.

C. Load Measuring Device(s)

The single load measuring device or a series of load measuring devices must have a minimum total load capacity ranging up to 25,000 lbs and an accuracy of ± 0.25 percent. The device(s) shall be used for measuring the load being transmitted into the vehicle roof by the platen.

9. TEST EQUIPMENT...continued

D. Head Positioning Fixture (HPF)

The head positioning fixture consists of a head form meeting the specifications defined in S5.2 of FMVSS No. 201, "Occupant Protection in Interior Impact," mounted on a 3-axis load cell and attached to a fixture that is capable of being rigidly affixed to the test vehicle's floor pan area of the driver and front outboard passenger seat. To protect the load cell from damage, the fixture shall have the capability of collapsing after withstanding a minimum of 350 Newtons of compressive resultant force as measured on the head form. The fixture shall also be designed to adjust vertically or laterally to achieve the proper head form position.

E. Inclinator

An inclinometer with a measuring range from 0-360°, a resolution of 0.1 ° and a minimum accuracy of $\pm 0.1^\circ$ shall be used to verify vehicle attitude and initial platen angles.

F. Linear Deflection Measuring Device

The linear displacement potentiometer must be capable of measuring the displacement of the test platen to an accuracy of ± 1.5 millimeters. The measuring device must be fixed at one end on the test platen and the other end attached to a stationary rigid part on the static loading device. Alternate methods for measuring linear deflection of the loading device shall be discussed in advance with the COTR.

G. Weighing Scales

Weighing scales shall have a maximum accuracy of ± 18 kilograms for determining the weight of the test vehicle.

H. Data Acquisition System

The Data Acquisition System must have a minimum resolution of 100Hz and shall be used to record the vehicle roof structure load, platen displacement, time, the HPF's load cell (X, Y & Z directions) response, and the linear deflection input from potentiometers. A minimum of 5 auxiliary inputs shall also be available to record additional data at the COTR's request.

10. PHOTOGRAPHIC DOCUMENTATION

Digital Photographs

The contractor shall take digital photographs of the pretest, test execution and post test 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.

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 shall 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 shall 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

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

A. PRE TEST PHOTOGRAPHS

1. Full front exterior view of vehicle
2. Right side exterior view of vehicle
3. Left side exterior view of vehicle
4. Full rear exterior view of vehicle
5. ¾ front view of exterior driver's side of vehicle
6. ¾ front view of exterior passenger side of vehicle
7. Interior driver seat area prior removing seats
8. Interior passenger seat area prior removing seats
9. Head positioning fixture installed in the driver seat area after removing seats
10. Head positioning fixture installed in the passenger seat area after removing seats
11. Front view of test vehicle secured to vehicle tie-down fixture with the test platen aligned at the initial contact point (or area) on the roof and inclinometer on platen.*
12. Rear view of test vehicle secured to vehicle tie-down fixture with the test platen aligned at the initial contact point (or area) on the roof and inclinometer on platen.*
13. Top view of test vehicle secured to vehicle tie-down fixture with the test platen aligned at the initial contact point (or area) on the roof and inclinometer on platen.*
14. Opposite side view of test vehicle secured to vehicle tie-down fixture with the test platen aligned at the initial contact point (or area) on the roof and inclinometer on platen.*
15. Left side of vehicle's sill tied to vehicle tie-down fixture
16. Right side of vehicle's sill tied to vehicle tie-down fixture

10. PHOTOGRAPHIC DOCUMENTATION...continued

B. TEST EXECUTION PHOTOGRAPHS

1. Front view (side being crushed) at full load*
2. Rear view (side being crushed) at full load*

C. POSTTEST PHOTOGRAPHS (Platen Released) *

1. $\frac{3}{4}$ front view of exterior driver's side of vehicle
2. $\frac{3}{4}$ front view of exterior passenger side of vehicle
3. Full front exterior view of vehicle
4. Full rear exterior view of vehicle
5. Interior close-up of HPF on Tested Side
6. Interior photograph of untested side HPF movement indicator

*** These photographs shall also be taken for the second side test and included in the final test report.**

D. REAL TIME CAMERA

Two real time video cameras shall be used to record exterior views of the vehicle and platen interaction. Two additional cameras shall be used to record interior views of the HPF interaction with the interior of the test vehicle – see Figure 3. Videos shall be digital and in color, and operate at a minimum of 24 frames per second. A tag, label or placard identifying the test vehicle model, NHTSA number and date shall appear, at a minimum, at the beginning of each video and must be legible. The video shall be stored on a CD or DVD as AVI or MPEG files with standard or generally available “codec.”

LIGHTING SYSTEMS AND EVENT TRIGGER SWITCH

An external light source may be necessary to illuminate the test area and interior of the test vehicle to provide the proper exposure without producing excess glare. An event trigger switch to indicate the start of the test shall be placed in the field of view for exterior and interior camera video coverage.

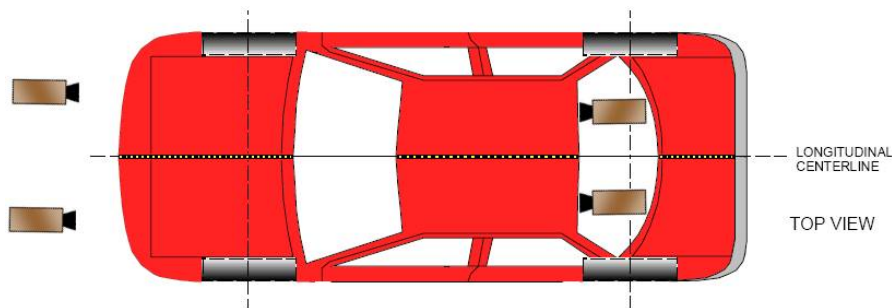


Figure 3

NOTE: DO NOT MOUNT CAMERAS TO THE VEHICLE'S PILLARS OR ROOF STRUCTURE.

11. DEFINITIONS

Convertible: a vehicle whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member (S3 of 49 CFR §571.201).

Head Restraint Measuring Device (HRMD): means the Society of Automotive Engineers (SAE) (July 1995) J826 three-dimensional manikin with a head form attached, representing the head position of a seated 50th percentile male, with sliding scale at the back of the head for the purpose of measuring backset. The head form is designed by and available from the ICBC, 151 West Esplanade, North Vancouver, BC V7M 3H9, Canada (www.icbc.com). (571.202a S3)

Platen: the portion of the static loading device that consists of a rigid, unyielding block with its lower surface formed as a flat rectangle 762 millimeters by 1,829 millimeters. (571.216a S6)

Longitudinal or longitudinally: Parallel to the longitudinal centerline of the vehicle. (571.3)

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)

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 216a,
- E. Review vehicle Owner's Manual (or equipment mfg. instructions), and

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.
- 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.

12. PRETEST REQUIREMENTS...continued

- 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.

13. COMPLIANCE TEST EXECUTION

A. TEST VEHICLE PREPARATION

1. Wash and clean the vehicle. Inspect test vehicle per receiving inspection procedures (Section 7). Record and notify the COTR of any abnormal conditions that could influence the test results
2. Record vehicle data on Data Sheet No. 1 using the information listed on the certification label, tire sidewall and tire placard.
3. Inflate all tires to the manufacturer's specifications as listed on the vehicle's tire information label or placard.
4. Weigh the vehicle to determine its unloaded vehicle weight. Record UVW on Data Sheet No. 1.
5. Remove any roof racks or other non-structural components that may interfere with the platen during loading. Record the items removed on the Data Sheet No.1. (571.216a S7.1).

B. DETERMINE THE VEHICLE'S LONGITUDINAL CENTERLINE

1. Measure the vehicle body's maximum width at points above the front and rear wheel housings to determine its longitudinal centerline. Measure the width at these points and divide it by two. Place inch-wide checkered tape (or other marker) along the length of the vehicle body (i.e, hood, cowl, roof, rear deck, trunk or pickup bed) to mark the location of its centerline.
2. FOR PICKUP TRUCKS ONLY, draw a horizontal line at any height along the length of each side of the vehicle from the front to the rear – see Figure 4. Transverse both the cab and cargo bed as reference for realigning the cargo bed of the truck with the cab once the vehicle is no longer resting on its suspension components.

13. COMPLIANCE TEST EXECUTION....Continued



Figure 4

- C. DETERMINE THE SEATS' POSITIONS USING CHECK SHEET IN APPENDIX A
- D. DETERMINE THE LOCATION OF THE CENTER OF THE HEAD OF THE HPFS USING CHECK SHEET IN APPENDIX B
- E. BUILD THE I-BEAM STRUCTURES

If the rocker panel pinch weld flanges are vertical or approximately vertical with respect to the ground, build **I-Beam structures** to support each pinch weld flange as described below. Each I-beam structure will consist of, as a minimum, a 4-inch high steel I-beam with steel box tubes welded to the top of the I-beam (see Figures 9 & 10). For angled pinch weld flanges, weld a flat metal plate to the inner box tube to support the pinch weld (see Figure 11).

13. COMPLIANCE TEST EXECUTION....Continued

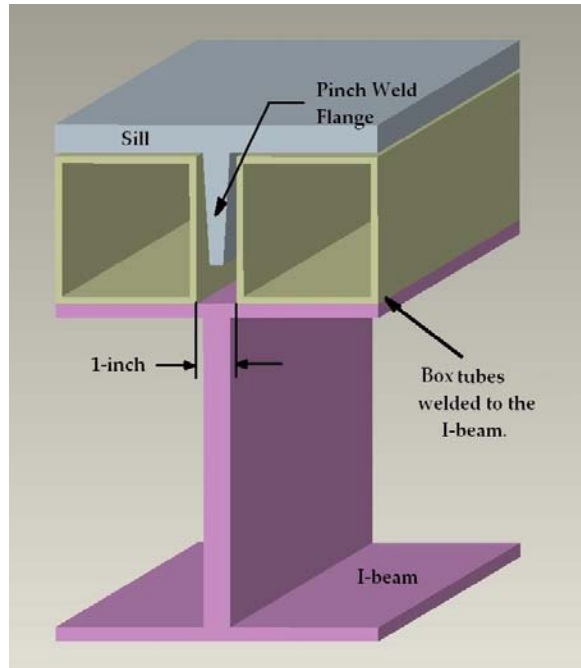


Figure 5



Figure 6

13. COMPLIANCE TEST EXECUTION...continued

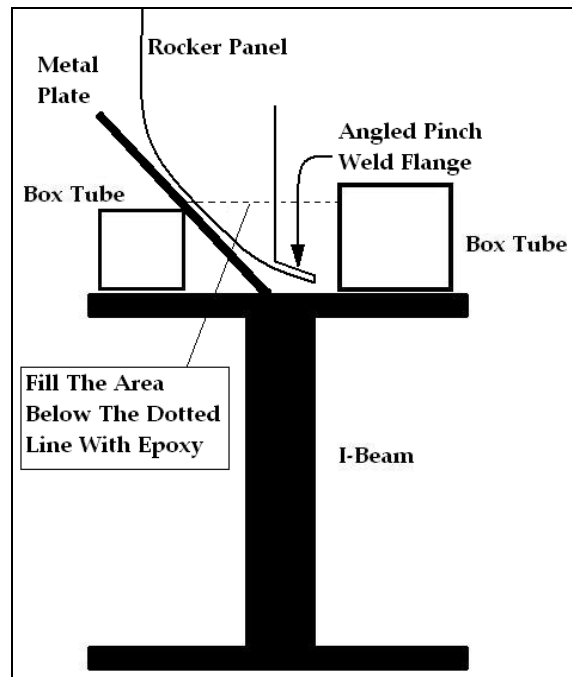


Figure 7

NOTE: The I-beam structure should extend the entire length of the sill located on each side of the test vehicle. If the pinch weld flange on the sill is not straight or does not allow for support by a single I-beam structure, provide separate smaller I-beam structures to cover the entire length of the flange. The I-beam structure dimensions stipulated above are provided simply as an example; depending on vehicle specific parameters, the size of the tubing and length of I-beams may vary. Variation in I-beam structure design may be required based on vehicle sill geometry.

- F. GLUE I-BEAM STRUCTURES TO THE TEST VEHICLE USING CHECK SHEET IN APPENDIX C
- G. SECURE THE TEST VEHICLE ON THE TIE-DOWN FIXTURE USING CHECK SHEET IN APPENDIX D
- H. POSITION THE HPFs IN THE TEST VEHICLE USING CHECK SHEET IN APPENDIX E
- I. INITIAL PLATEN CONTACT WITH ROOF OF TEST VEHICLE USING CHECK SHEET IN APPENDIX F
- J. TAKE THE REQUIRED PRETEST PHOTOGRAPHS AS SPECIFIED IN SECTION 10.
- K. CALCULATE THE MAXIMUM APPLIED FORCE AS FOLLOWS AND RECORD IN DATA SHEETS No. 4 & 5:
 1. = $UVW \text{ (kg)} \times 9.8 \times 3.0$ - For vehicles with GVWR less than 2722 kg.
 2. = $UVW \text{ (kg)} \times 9.8 \times 1.5$ - For vehicles with GVWR of 2722 kg or greater

13. COMPLIANCE TEST EXECUTION...continued

- L. CHECK FOR DATA ACQUISITION SYSTEM READINESS. TRIGGER THE OPERATION OF THE INTERIOR AND EXTERIOR CAMERAS
- M. WITH THE PLATEN AT ITS PROPER POSITION, BEGIN APPLYING THE LOAD TO THE FORWARD EDGE OF THE VEHICLE'S ROOF AT A RATE NOT TO EXCEED 13 MILLIMETERS PER SECOND.
- N. GUIDE THE PLATEN TO PREVENT IT FROM BEING ROTATED OR DISPLACED.
- O. STOP APPLYING LOAD WHEN EITHER OF THE FOLLOWING CONDITIONS EXISTS;
 - 1. the force being exerted through the platen to the side of the roof reaches the Maximum Applied Force (+0 N, -250N),
 - 2. the 201 head form sustains a resultant load greater than 222 Newtons (50 pounds)
 - 3. the platen travels more than 127 millimeters (-0, + 5 mm)
- P. TAKE THE NECESSARY PHOTOGRAPHS (DURING LOAD AND POSTTEST) AS SPECIFIED IN SECTION 10.

14. POST TEST REQUIREMENTS

VISUAL OBSERVATIONS

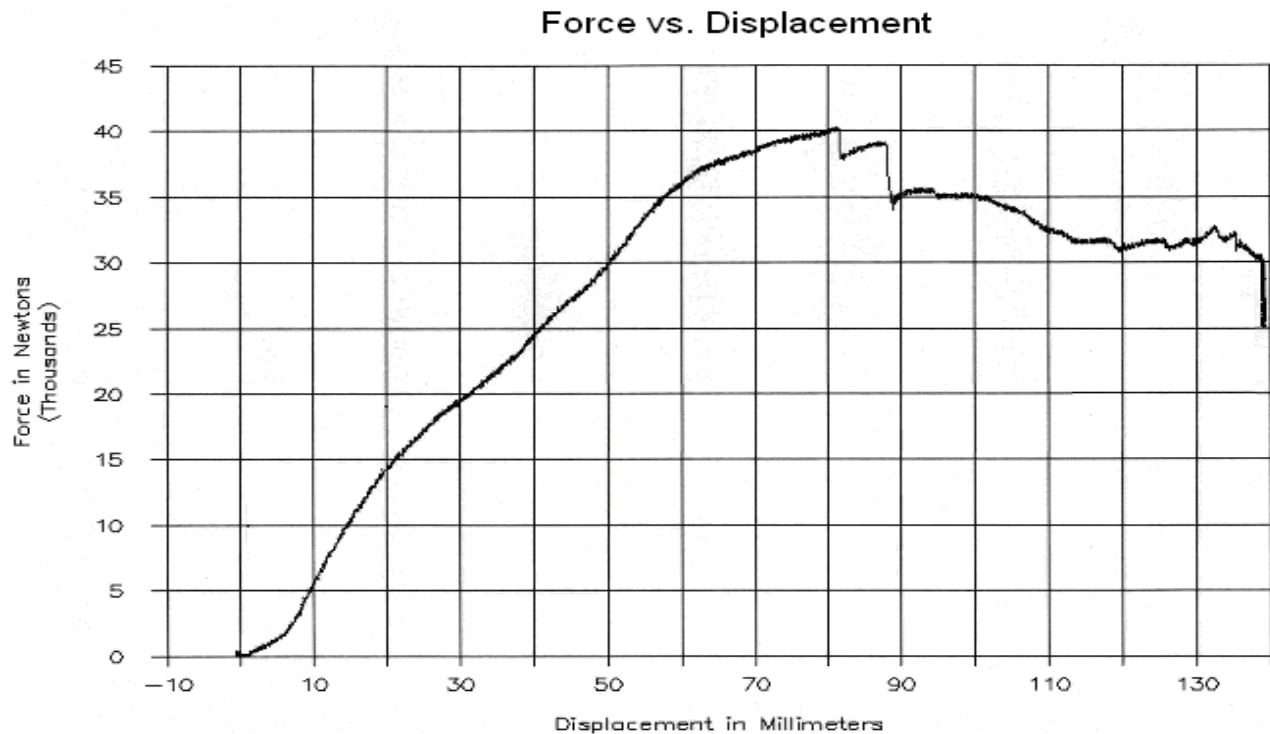
Describe the damage and deformation to the roof, pillars, sills, interior headliners, etc. Also, briefly describe abnormalities or excessive buckling or collapse of vehicle structures, if any. Verify whether the windshield and sun roof panels (if applicable) shattered during the test. Record on Data Sheet No. 4 or 5.

DATA PLOTS

Plot **Force (N)** vs. **Displacement (mm)** as shown in Figure 18. Overlay a plot of the force imparted on the HPF 201 head form, if any. Determine the maximum load achieved and corresponding platen travel. Verify whether the maximum load achieved reached the maximum applied force (0,-250N) prior to the HPF 201 head form sustaining a resultant load greater than 222N and the platen exceeding 127 mm of travel. Record on Data Sheet No. 4 or 5. If head contact occurs, determine the maximum resultant force sustained by the head form and corresponding platen travel. Verify whether the maximum resultant force sustained by the head form exceeded 222N. If so, determine the corresponding platen travel. Record on Data Sheet No. 4 or 5.

Plot **Displacement (mm)** vs. **Time (ms)** to obtain the nominal load rate. Verify that the nominal load rate remained below 13 mm/s. Record on Data Sheet No. 4 or 5.

14. POST TEST REQUIREMENTS...continued



Copies of data plots shall be included in the report (see Section 15).

COMPUTER DATA DISK

Figure 8

The Contractor shall deliver to NHTSA a disk (CDROM) with all of the test data formatted as specified in the NHTSA Test Reference Guide -Volume I: Vehicle Tests.

Data entry software (ENTRÉE) may also be downloaded from the website and used to generate the specification data files as defined in the guides.

The guide and Entrée for windows may be found at:

<http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.8027fe7cfb6e727568d07a30343c44cc/>

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 NOTICE OF TEST FAILURE

Any indication of an apparent 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 Apparent Test Failure, shown in this section, with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) shall be included.

In the event of an apparent test failure, a posttest 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 REPORT

15.3.1 COPIES

In the case of an apparent test failure, two 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 this section.

Where there has been no indication of an apparent test failure, one paper copy 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. REPORTS....continued

15.3.2 REQUIREMENTS

The Final Test Report with the associated documentation (including photographs) is 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 below for the purpose of standardization.

15. REPORTS...Continued

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:

The information required on the cover page is as follows:

- (1) Final Report Number such as 216a-ABC-XX-001, where —

- 216a 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, 002 for the 2nd test, 003 for the 3rd test, etc.)

- (2) Final Report Title and Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS 216a
 Roof Crush Resistance
 * * * * *
 World Motors Corporation
 20XX XYZ 4-door sedan
 NHTSA No. CX0401

- (3) Contractor's Name and Address, for example

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

The following DOT SYMBOL SHALL BE PLACED BETWEEN ITEMS (3) AND (4)



15. REPORTS...Continued

- (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, W43-481
 1200 New Jersey Ave., SE
 Washington, DC 20590

FIRST PAGE AFTER COVER PAGE

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: _____

15. REPORTS...Continued

SECOND PAGE AFTER COVER Page

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

216a-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 216a Compliance Testing
of a 20XX World XYZ Deluxe 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

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070-1234

15. REPORTS...Continued

Block 10 — WORK UNIT NUMBER

Leave blank

Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-XX-D-12345

Block 12 — SPONSORING AGENCY NAME AND ADDRESS

U.S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Ave., 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

Block 16 — ABSTRACT

Compliance tests were conducted on the subject 20XX World XYZ 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP216a-XX for the determination of FMVSS 216a 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 216a
15. REPORTS...Continued

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

Block 22 — PRICE

Leave blank

15.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include as a minimum the following:

Section 1 —	Purpose of Compliance Test
Section 2 —	Summary of Compliance Test Data
Section 3 —	Test Data and Results
Section 4 —	Test Equipment List and Calibration Information
Section 5 —	Photographs
Section 6 —	Laboratory Notice of Test Failure (if applicable)

15. REPORTS...Continued

a) SECTION 1 – PURPOSE OF COMPLIANCE TEST

This section briefly outlines the purpose for conducting the roof crush test and states the appropriate test procedure followed during the test. The following is provided as an example;

This roof crush compliance test is part of a program conducted for the National Highway Traffic Safety Administration by [insert company name] under contract [insert contract number]. The purpose of the test was to determine whether the subject vehicle, [insert model year, make, model], meets certain performance requirements of FMVSS 216a, "Roof Crush Resistance". The compliance test was conducted in accordance with OVSC Laboratory Test Procedure No. TP216a-XX dated _____, 20XX.

Note: This section shall be double-spaced on a single page.

b) SECTION 2 – SUMMARY OF COMPLIANCE TEST DATA

This section includes a written summary of the roof crush event. The following is an example paragraph;

The roof of a 20XX Ace Super 4-door sedan was required to sustain a maximum load of _____ N (_____ x UVW) on both the right and left sides of the vehicle with platen displacement of 127mm or less. The left side sustained a maximum load of _____ N at ___ mm of platen travel. The right side sustained a load of _____ N at ___ mm of platen travel. No head contact was observed.

The test vehicle's unloaded weight was 1365 kg. The test was conducted at ABC Test Laboratories located in Detroit, MI on October 1, 2000.

c) SECTION 3 – TEST DATA AND RESULTS

This section requires the reporting of all of information found in the following Data Sheets;

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

Data Sheet No. 2 – Driver Seat HRMD Location Data

Data Sheet No. 3 – Front Passenger Seat HRMD Location Data

Data Sheet No. 4 – Test Information – Driver Side Test

Data Sheet No. 5 – Test Information – Front Outboard Passenger Side Test

16. FORMS

MONTHLY STATUS REPORT
FMVSS 216a
DATE OF REPORT _____

Test Program: _____ Contract Number: _____ Fiscal Year: _____ Laboratory: _____
Report Date: _____

NHTSA No.	Date Of Delivery	Initial Odometer Reading	Test Date	Pass Or Fail	Date of Final Report	Vehicle Condition Report Date	Invoice No.	Invoice Date	Final Odometer Reading	Date Vehicle Is Disposed

16. FORMS...Continued

LABORATORY NOTICE OF APPARENT TEST FAILURE TO OVSC

FMVSS NO. 216a TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: _____ DELIV. ORDER NO.: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

TEST SPECIMEN DESCRIPTION: _____

VEHICLE NHTSA NO.: _____ VIN: _____

MFR: _____

APPARENT TEST FAILURE DESCRIPTION: _____

FMVSS REQUIREMENT, PARAGRAPH S___ :

NOTIFICATION TO NHTSA (COTR): _____

DATE: _____ BY: _____

REMARKS:

17. DATA SHEETS

DATA SHEET No. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

TEST VEHICLE INFORMATION:

Year/Make/Model/BodyStyle: _____

Body Color _____ VIN: _____

Build Date: _____ ODOMETER READING: _____ miles

ENGINE DATA: _____ cylinders _____ CID _____ Liter _____ cc

Engine Placement : _____ longitudinal; or _____ lateral

TRANSMISSION: _____ speed _____ manual _____ automatic _____ overdrive

FINAL DRIVE: _____ rear wheel drive _____ front wheel drive _____ 4 WD

SAFETY RESTRAINTS: _____

DATA FROM TIRE SIDEWALL;

Size of the tires on test vehicle: _____ Manufacturer _____

Tire Pressure for Max. Load Carrying Capacity: _____ kPa Front; _____ kPa Rear

Treadwear: _____; Traction: _____; Temperature: _____;

DATA RECORDED FROM VEHICLE PLACARD OR TIRE LABEL:

Recommended Tire Size: _____

Recommended Cold Tire Pressure: _____ kPa Front; _____ kPa Rear

VEHICLE CAPACITY DATA:

Number of Occupants: _____ front _____ rear _____ Total

Type of Front Seat(s): _____ buckets _____ bench _____ split bench

Type of Front Seat Back: _____ fixed _____ adjustable with _____ lever or _____ knob

List of Components Removed: _____

UNLOADED VEHICLE WEIGHT:

Right Front = _____ kg. Right Rear = _____ kg.

Left Front = _____ kg. Left Rear = _____ kg.

Total Front = _____ kg. Total Rear = _____ kg.

TOTAL WEIGHT= _____ kg. % of Total weight in Front = _____ % of Total weight in Rear = _____

TEST VEHICLE ATTITUDE:

Pitch Attitude: (Nose Down (ND), Nose Up (NU))

INITIAL: Right Door Sill Angle _____ Left Door Sill Angle _____

FINAL: Right Door Sill Angle _____ Left Door Sill Angle _____

Roll Attitude:

INITIAL: Left-side _____ mm Right-side _____ mm

FINAL: Left-side _____ mm Right-side _____ mm

Technician Signature

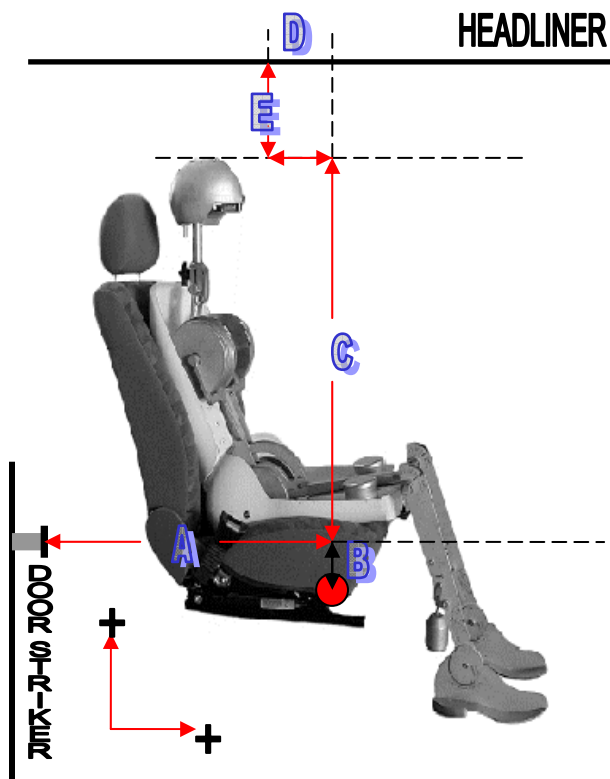
Date

17. DATA SHEETS...continued

DATA SHEET No. 2
Driver Seat HRMD Location Data

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____



H-Point Data (mm)

HRMD	H-Point Data (mm)	
	J826 Only	After HRMD Installed
Torso Angle		
X(=A) – fore/aft of striker		
Z(=B) – Above/below striker below		

Positioning Data (mm)

C	
D	
E	

- A – Horizontally from the door striker to the H-point
- B – Vertically from the H-point to the door striker
- C – Vertically from the door striker to the top of the head
- D – Horizontally from the center of the head to the H point
- E – Vertically from the center of the head to the headliner

Technician Signature

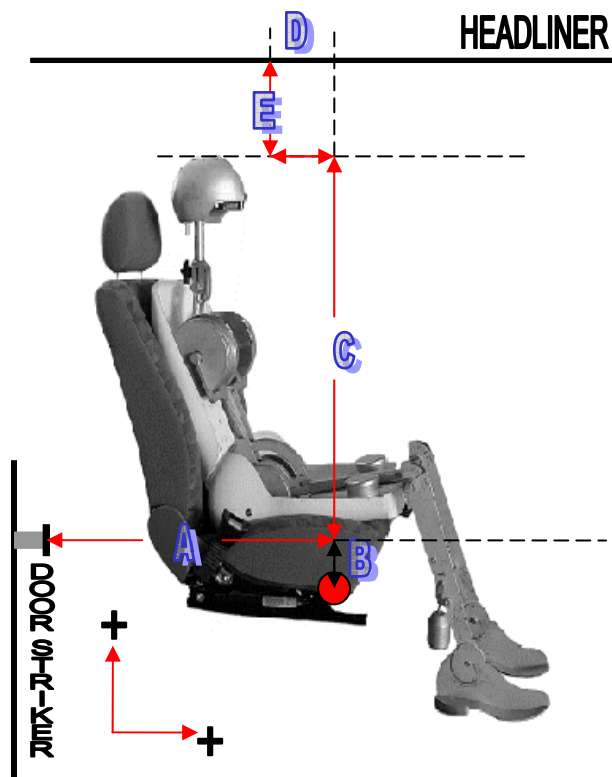
Date

17. DATA SHEETS...Continued

DATA SHEET No. 3
Front Passenger Seat HRMD Location Data

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____



H-Point Data (mm)

HRMD

	J826 Only	After HRMD Installed
Torso Angle		
X(=A) – fore/aft of striker		
Z(=B) – Above/below striker below		

Positioning Data (mm)

C	
D	
E	

- A – Horizontally from the door striker to the H-point
- B – Vertically from the H-point to the door striker
- C – Vertically from the door striker to the top of the head
- D – Horizontally from the center of the head to the H point
- E – Vertically from the center of the head to the headliner

Technician Signature

Date

17. DATA SHEETS...continued

DATA SHEET No. 4
 Test Information – First Tested Side

NHTSA No. _____ Test Date: _____ Side Tested: _____
 Laboratory: _____ Test Technician(s): _____

A. Driver Side Pre-Test Data

Levelness of the Tie-Down Surface/Platform (0 +/- 0.5 °) _____

Platen Angles: Pitch Angle _____ Roll Angle _____

Platen Alignment at Vehicle Longitudinal Centerline _____

Max. Applied Force for Vehicles w/GVWR ≤ 2722 kg = UVW _____ x 9.8 x **3.0** = _____ N

Max. Applied Force for Vehicles w/GVWR > 2722 kg = UVW _____ x 9.8 x **1.5** = _____ N

1. Any convertible top, movable or removable roof structure in their closed positions: Yes/No
 2. Close all windows, close and lock all doors: No___ Yes ___
 3. The test device will initially contact the roof at _____mm aft of windshield
 4. HRMD Top Center of Head Position (Driver): X___, Y___, Z___
 5. HPF 201 Head form Top Center of Head Position (Driver): X___, Y___, Z___
- HPF device properly aligned: Yes/No

B. Post Test Data

Maximum load achieved = _____N at _____ mm of displacement

Did the maximum load achieved reach the maximum applied force (0, -250N)?

No___ – FAIL; Yes___ – PASS

Did head contact occur? No___ ; Yes___ at _____ mm of displacement

Was a 222 N head resultant force attained? No___ – PASS; Yes___ – FAIL at _____ mm of displacement.

Did the platen travel exceed 127 mm? No _____ – PASS Yes_____ – FAIL

Did the windshield break? No___; Yes___ at ___ mm of displacement

Did the sun roof panel(s) break? No___ Yes _____ N/A _____

Description of damage and deformation that occurred during the test:

17. DATA SHEETS...continued

Did the second HPF shift from its original position? No ___ Yes ___ Distance _____ mm

Indicate in the picture below where the second HPF center is located versus the original position (center). **NOTE:** The distance between each concentric circle is _____ mm.



17. DATA SHEETS...continued

DATA SHEET No. 5
 Test Information – Second Tested Side

NHTSA No. _____ Test Date: _____ Side Tested: _____
 Laboratory: _____ Test Technician(s): _____

A. Front Outboard Passenger Side Pre-Test Data

Levelness of the Tie-Down Surface/Platform (0 +/- 0.5 °) _____

Platen Angles: Pitch Angle__ Roll Angle__

Platen Alignment at Vehicle Longitudinal Centerline_____

Max. Applied Force for Vehicles w/GVWR ≤ 2722 kg = UVW _____ x 9.8 x **3.0** = _____ N

Max. Applied Force for Vehicles w/GVWR > 2722 kg = UVW _____ x 9.8 x **1.5** = _____ N

1. Any convertible top, movable or removable roof structure in their closed positions: Yes/No
2. Close all windows, close and lock all doors: No__ Yes __
3. The test device will initially contact the roof at _____mm aft of windshield
4. HRMD Top Center of Head Position (Driver): X____, Y____, Z____
5. HPF 201 Head form Top Center of Head Position (Passenger): X____, Y____, Z____
 HPF device properly aligned: Yes/No

B. Post Test Data

Maximum load achieved = _____N at _____ mm of displacement

Did the maximum load achieved reach the maximum applied force (0, -250N)?

No__ – FAIL; Yes__ – PASS

Did head contact occur? No__ ; Yes__ at _____ mm of displacement

Was a 222 N head resultant force attained? No__ – PASS; Yes__ – FAIL at _____ mm of displacement.

Did the platen travel exceed 127 mm? No _____ – PASS Yes____ – FAIL

Did the windshield break? No__ ; Yes__ at __ mm of displacement

Did the sun roof panel(s) break? No__ Yes ____ N/A ____

Description of damage and deformation that occurred during the test:

18. TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

ITEM	MFR	MODEL	S/N	CALIB. PERIOD	DATE OF LAST CALIB.	ACCURACY

REMARKS:

I certify that I have read and performed each instruction.

Date

APPENDIX A
Seat Adjustment Reference Marks Check Sheet

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

Adjust the seats in accordance with S8.3 of 49 CFR 571.214. (S7.2 of 49CFR 571.216a)

Prior to placing the H-point machine in the driver or right front outboard seating position, mark for reference the seat adjustment as follows:

- ___ 1.1. Position the seat's adjustable lumbar supports in the lowest, retracted or deflated adjustment positions. (S8.3.1.1 of 49CFR 571.214)
- ___ 1.2. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or non-deployed (most open) adjustment position. (S8.3.1.2 of 49CFR 571.214)
- ___ 1.3. **Mark** a point (seat cushion reference point - **SCR**P) on the side of the seat cushion that is between 150 mm and 250 mm from the front outermost edge of the seat cushion.
- ___ 1.4. Draw a line (seat cushion reference line - **SCR**L) through the seat cushion reference point.
- ___ 1.5. Using only the controls that primarily move the seat in the fore-aft direction, move the **SCR**P to the rearmost position. (S8.3.1.3.1 of 49CFR 571.214)
 If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the **SCR**P to the rearmost position.
- ___ 1.6. Using any part of any control, other than the parts just used for fore-aft positioning, determine and record the range of angles of the **SCR**L and set the **SCR**L at the mid-angle. (S8.3.1.3.1 of 49CFR 571.214)
 If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the **SCR**P in its lowest position while maintaining the **SCR**L line angle at the mid-angle.
- ___ 1.7. Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.
- ___ 1.8. Using only the controls that primarily move the seat in the fore-aft direction, **mark** for future reference the fore-aft seat positions. **Mark** each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and **mark** each detent. For power seats, **mark** only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost.
- ___ 1.9. Using only the controls that primarily move the seat and/or seat cushion in the fore-aft direction, place the seat **SCR**P in the mid-fore-aft position. (S8.3.1.3.2 of 49CFR 571.214)
- ___ 1.10. Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually **mark** the maximum, minimum, and middle height of the **SCR**P with the **SCR**L at the mid-angle determined in 1.6.

- ___ 1.10.1. Set the height of the **SCR**P to the minimum height, with the SCRL set to the mid-angle determined in 1.6.
- ___ 1.10.2. Set the seat back to the manufacturer’s nominal design riding position in the manner specified by the manufacturer. If not specified, set at the first detent rearward of 25° from the vertical. (S8.3.1.2 of 49CFR 571.214)

Manufacturer’s seat back angle _____
 Tested seat back angle _____

___ 1.11. **Seat Cushion Reference Marks**

___ 1.11.1. **Bucket seats**

Locate and **mark** the longitudinal centerline of the seat cushion. The intersection of the vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface determines the longitudinal centerline of a bucket seat cushion. (**Note:** the longitudinal centerline of the seat back may also be marked as a leveling reference for the H-point machine)

___ 1.11.2. **Bench Seats**

Driver Seat - Locate and **mark** the longitudinal line on the seat cushion that marks the intersection of the vertical longitudinal plane through the centerline of the steering wheel and the seat cushion upper surface.

Passenger Seat - Locate and **mark** for future reference the longitudinal centerline of the passenger seat cushion. The longitudinal centerline is the same distance from the longitudinal centerline of the vehicle as the center of the steering wheel

 I certify that I have read and performed each instruction.

 Date

APPENDIX B
CHECK SHEET FOR LOCATING THE CENTER OF THE HEAD OF THE HPFs

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

Position the three dimensional manikin specified in Society of Automotive Engineers (SAE) Surface Vehicle Standard J826, revised July 1995, "Devices for Use in Defining and Measuring Vehicle Seating Accommodation," (incorporated by reference, see paragraph S3.2), in accordance to the seating procedure specified in that document, except that the length of the lower leg and thigh segments of the H-point machine are adjusted to 414 and 401 millimeters, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826 (July 1995). (571.216a S7.2 (a))

With the seat in position, as described in Appendix A:

- ___ 1. Place a 910 mm² piece of muslin cotton cloth over the seat area. (The muslin cloth shall be comparable to 48 threads/in² and density of 2.85 lb/yd.) Tuck the muslin cloth in a sufficient amount to prevent hammocking of the material.
- ___ 2. Install the lower leg, and foot segments.
- ___ 3. Place the seat and back assembly of the H-Point machine at the centerline of the seat.
- ___ 4. Set the length of the lower leg segment at 414 mm and the length of the thigh bar at 401 mm.
- ___ 5. Leg and foot placement
 - ___ 5.1. Driver Designated Seating Position.
 - ___ 5.1.1. If the H-Point machine is equipped with a foot angle pin, insert it so that the foot angle is never less than 87 degrees.
 - ___ 5.1.2. Place the right foot on the undepressed accelerator pedal with the sole of the foot on the pedal and the heel as far forward as allowable. Do not place the heel on the toe board.
 - ___ 5.1.3. Adjust the left leg to be the same distance from H-point machine centerline as the right leg.
 - ___ 5.1.4. Level the T-bar. Place the left foot on the toe board with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toe board and the floor pan and not on the wheel well projection. If the foot cannot be positioned on the toe board, set it on the floor pan.
 - ___ Foot on toe board
 - ___ Foot on floor pan
 - ___ 5.2. Passenger Designated Seating Position
 - ___ 5.2.1. If the H-Point machine is equipped with a foot angle pin, insert it so that the foot angle is never less than 87 degrees.
 - ___ 5.2.2. Space the lower legs 269 mm apart, equally spaced about the centerline of the H-point machine – see Figure B1.



Figure B1

- ___ 5.2.3. Level the T-bar. Place the left foot on the toe board with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toe board and the floor pan and not on the wheel well projection. If the foot cannot be positioned on the toe board, set it on the floor pan.
- ___ Foot on toe board
 ___ Foot on floor pan
- ___ 6. Apply the lower leg weights.
- ___ 7. Apply the thigh weights.
- ___ 8. Tilt the back pan forward against the forward stop and draw the H-point machine away from the seatback using the T-bar.
- ___ 9. Repositioning the back pan
- ___ 9.1. Allow the H-point machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required due to the seat pan contacting the seat back.
- ___ The seat pan does not slide rearward. Go to 9.2
- ___ 9.2. Slide the H-point machine rearward by a horizontal rearward load applied at the T-bar until the seat pan contacts the seat back.
- ___ 10. Apply a 10 kg load TWICE at the intersection of the hip angle quadrant and the T-bar housing along a line from the above intersection to a point just above the thigh bar housing.
- ___ 11. Carefully return the back pan to the seat back.
- ___ 12. Install the right and left buttock weights.
- ___ 13. Install the eight torso weights alternating the installation between right and left – see Figure B2.

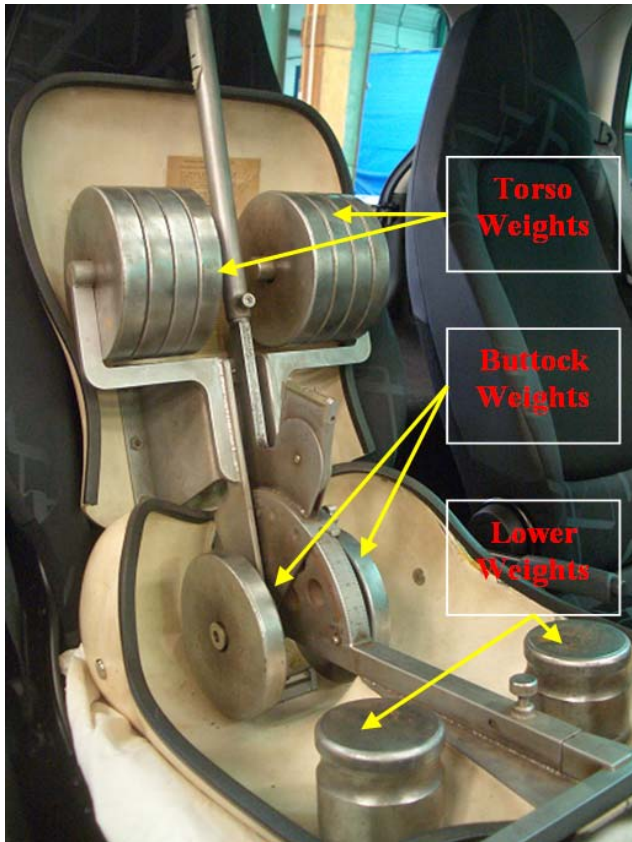


Figure B2

- __14. Tilt the back pan forward until the stop is contacted.
- __15. Rock the H-point from side to side over a 10 degree arc (5 degrees to each side of the vertical centerline) for three complete cycles. Restrain the T-bar during rocking so that the seat pan does not change position. Minimize any inadvertent exterior loads applied in a vertical or fore-aft direction. The feet are free to move during this rocking motion.
- __16. Without applying a forward or lateral load, lift the right foot off the floor the minimum amount necessary until no additional forward foot movement is obtained.
- __17. Lower the right foot until the heel is in contact with the floor pan and the ball of the foot is in contact with the floor, toe board, or undepressed accelerator pedal.
- __18. Without applying a forward or lateral load, lift the left foot off the floor the minimum amount necessary until no additional forward foot movement is obtained.
- __19. Lower the left foot until the heel is in contact with the floor pan and the ball of the foot is in contact with the floor or toe board.
- __20. Is the seat pan level?
 - __Yes. Go to 23
 - __No. Go to 22
- __21. Apply a sufficient lateral load to the top of the seatback pan to level the H-point machine seat pan on the seat.
- __22. Holding the T-bar to prevent the H-point machine seat pan from sliding forward on the seat cushion, return the seatback pan to the seatback.
- __23. Holding the T-bar to prevent the H-point machine seat pan from sliding forward on the seat cushion, apply sufficient rearward force perpendicular to the back angle bar just above the torso weights to increase the hip angle 3 degrees or a maximum of 66 N (15 lb). Minimize the exterior downward or side forces applied to the H-point machine. Release the force. Repeat

this step until the hip angle readout is identical – see Figure B3.



Figure B3

Complete as many force applications as necessary and record the results in the following table:

Force Application	Hip Angle
1	
2	
3	
4	
5	

- __24. Is the H-point machine level?
 __ Yes, go to 26.
 __ No, relevel. Go back to item 15 and repeat using a new data sheet.
- __25. Record the H-point location on DATA Sheet No. 2.
- __26. Remove **FOUR** SAE J826 three-dimensional manikin’s torso weights, two from the left side and two from the right side.(571.216aS7.2(b))
- __27. Place the two larger HRMD torso weights, flat side down on the hangers.
- __28. Carefully, attach the HRMD head form to the H-point machine – see Figure B4.



Figure B4

- __29. Level the head form by loosening the rear knob and repositioning the head. Retighten the knob by hand once the head is leveled.
- __30. Verify the H-point location. Record any changes on Data Sheets No. 2 or 3.
- __31. Record the final seating position of the HRMD on Data Sheets No. 2 or 3.
- __32. Determine the location of the top of the HRMD head form at its center in 3-D space. Record the coordinates on Data Sheets No. 2 or 3. (571.216aS7.2(c))
- __33. Remove the HRMD from vehicle.
- __34. Remove the seats, carpet and padding on floor directly below where the HPF will be mounted.
- __35. Repeat above procedure for the other front outboard seat location using a separate check sheet.

I certify that I have read and performed each instruction.

Date

APPENDIX C
CHECK SHEET FOR GLUING THE I-BEAM STRUCTURES TO THE TEST VEHICLE

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

- ___ 1. Remove any detachable components of the vehicle, including the vehicle's wheels, which may interfere or prevent the vehicle's sills from being supported on the tie-down fixture.
- ___ 2. Prepare the surface of the rocker panel pinch weld flanges by removing any type undercoating, cleaning and roughening the paint to ensure good adhesion for epoxy.
- ___ 3. Cap the ends of the trough created by the box tubes with putty. Fill the trough with epoxy (ChockFast Gray or similar epoxy with comparable chemical properties) and place the rocker panel pinch weld flange inside the trough so that the pinch weld is sufficiently imbedded in the epoxy. Allow the epoxy time to harden (see epoxy cure time characteristics).

 I certify that I have read and performed each instruction.

 Date

APPENDIX D
CHECK SHEET FOR SECURING THE TEST VEHICLE ON THE TIE-DOWN FIXTURE

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

___ 1. Use an inclinometer (or other measuring device) to measure the levelness of the rigid horizontal tie down fixture (0 ± 0.25 degrees). If the tie-down fixture consists of a number of crossbeams, measure the levelness of each crossbeam – see Figure D1. Record on Data Sheet No. 4.

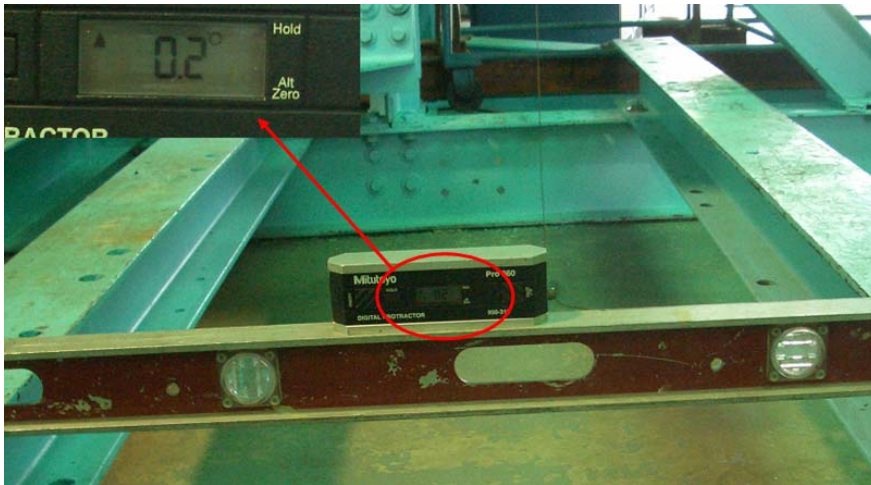


Figure D19

___ 2. With the epoxy on the I-beam structures fully cured, place the test vehicle on the tie down fixture and measure the vehicle's pitch and roll attitudes as follows;

___ 2.1. **Pitch (Longitudinal) Attitude**

___ 2.1.1. Use an inclinometer (or other measuring device) to measure the pitch attitude at points located on the driver and passenger sills adjacent to the front outboard seats – see Figure D2. Mark and identify on the vehicle the location where the pitch measurement is taken from.



Figure D2

- ___2.1.2. Verify that the pitch attitude measured at each sill is within 0 ± 0.5 degrees. Record on Data Sheet No. 1. (571.216a S7.1)

___2.2. Roll (Lateral) Attitude

- ___2.2.1. Measure the vertical distance between the horizontal surface of the tie-down fixture and bottom (lowest point) of the driver and passenger side sills at points adjacent to the front outboard seats – see Figure D3. If crossbeams are used, measure vertically from the nearest crossbeam to the bottom of the sills. Mark and identify on the vehicle the location where the roll measurement is taken from.



Figure D3

- ___2.2.2. Verify that the difference between the vertical distances measured is not more than ± 10 mm. Record on Data Sheet No. 1. (571.216a S7.1)

NOTE: - If the vehicle attitudes measured at either sill do not fall within the stated tolerances, make adjustments as necessary to bring the vehicle into proper attitude. **Consult with the COTR, if necessary, prior to conducting major modifications that may compromise the ability of the tie-down to keep the vehicle stationary during the test.**

- ___3. With the test vehicle at proper pitch and roll attitudes, secure it to the tie-down fixture via the I-beam structures (see Figure D4)
- ___4. After securing the test vehicle to the tie-down fixture, check for proper vehicle attitude. Record any change to the attitude measurements on Data Sheet No.1.



Figure D4

___ 5. Additional procedures for Pick-Up trucks

- ___ 5.1. If the line previously drawn on the side of the truck is no longer co-linear between the bed and cab (or b-pillar with door), jack-up the frame under the cargo bed of the truck to bring the line on the cargo bed co-linear with the line on the cab of the truck to a best possible position.
- ___ 5.2. Ensure doors of the pick-up truck open and close normally without any additional force.

I certify that I have read and performed each instruction.

Date

APPENDIX E
CHECK SHEET FOR POSITIONING THE HPFs IN THE VEHICLE

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

- ___ 1. Using the coordinates determined in Section C (Appendix B), place an HPF at each front outboard seating position (see Figure E1) such that the top of the 201 headform at its center is aligned vertically (0, -3mm), laterally (0, -3mm inboard) and fore/aft (+/- 3mm) at the top of HRMD headform position. Record on Data Sheet No. 4 or No. 5. (571.216a S7.2)



Figure E1

- ___ 2. Install onboard cameras and any other instrumentation or equipment necessary to perform the test.

NOTE: The position of the HPF for the second side test must be checked for any movement that may have occurred as a result of the first side test.

 I certify that I have read and performed each instruction.

 Date

APPENDIX F
CHECK SHEET FOR INITIAL CONTACT WITH ROOF OF TEST VEHICLE

NHTSA No. _____ Test Date: _____ Side Tested: _____

Laboratory: _____ Test Technician(s): _____

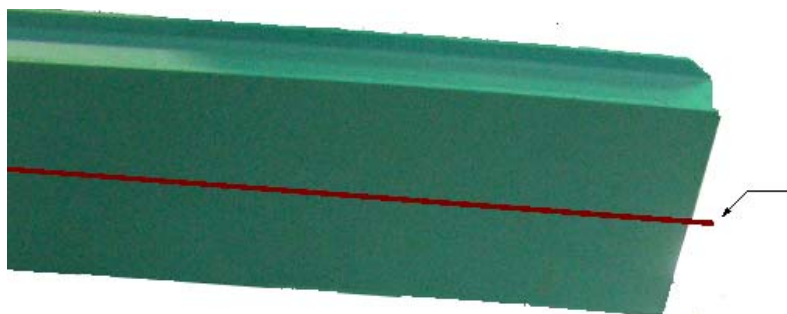
- ___ 1. Position the test vehicle and tie-down fixture in the static loading device such that the longitudinal centerline of the platen is parallel to the vertical plane through the vehicle's longitudinal centerline $0 \pm 0.5^\circ$. Take measurements at the front and rear edges of the platen as shown in Figure F1. Record on Data Sheet No. 4. (571.216a S7.3 (a))



Figure F1

- ___ 2. Position the platen so that its lower surface is tangent to the surface of the vehicle's roof and;

- ___ 2.1. The longitudinal centerline on its lower surface (see Figure F2) is within 10 mm of the initial point of contact, or on the center of the initial contact area, with the roof (571.216a S7.4 (b)(1))



The longitudinal centerline is within 10mm of initial point of contact or center of the initial contact area

Figure F2

- ___2.2. The midpoint of the forward edge of the lower surface of the test device is within 10 mm of the transverse vertical plane 254 mm forward of the forwardmost point on the exterior surface of the roof, including windshield trim, which lies in the longitudinal vertical plane passing through the vehicle's longitudinal centerline. (571.216a S7.4 (b)(2))
- ___2.3. **Raised or Altered Roof Vehicles** - If the vehicle being tested is a multipurpose passenger vehicle, truck, or bus that has a raised roof or altered roof, and the initial contact point of the platen is on the raised roof or altered roof to the rear of the roof over the front seat area, the platen is positioned so that the midpoint of the rearward edge of the lower surface of the static loading device is within 10 mm of the transverse vertical plane located at the rear of the roof over the front seat area – See Figure F3. **NOTE:** Contact the COTR prior to performing the test to ensure proper placement of the platen.
 ___ N/A

Transverse vertical plane at the rear of the roof over the front seat area

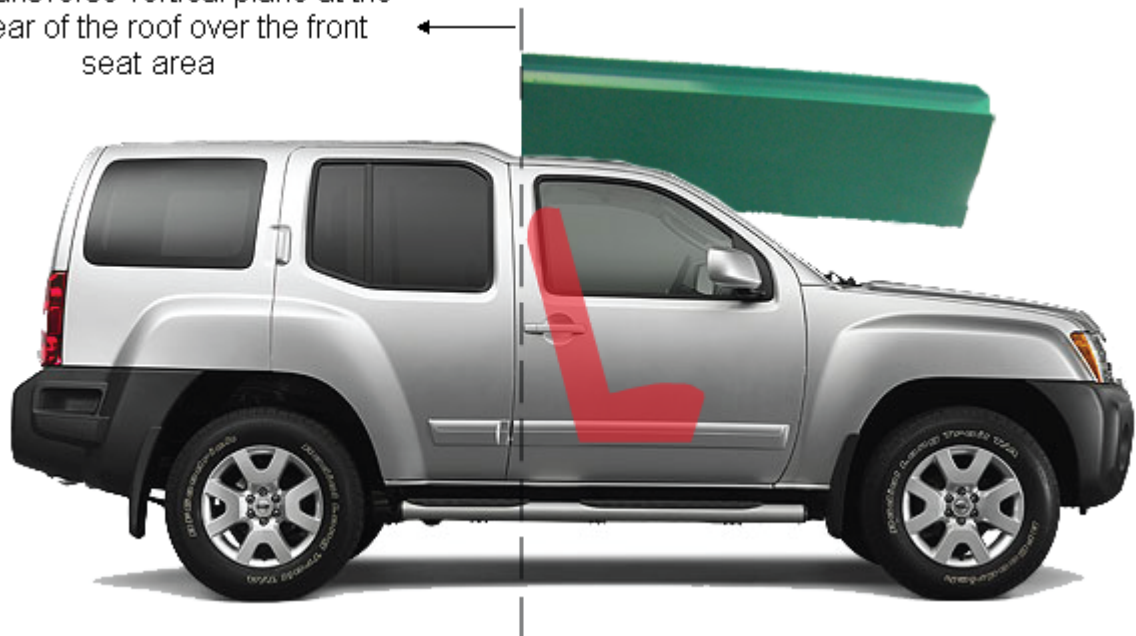


Figure F3

- ___2.4. **Chassis Cab incomplete vehicles** - If the vehicle being tested is built on a chassis cab incomplete vehicle that has a cargo body/box or other structure higher than the occupant compartment which could interfere with the placement of the 216a test device, such structure must be removed prior to the test. The weight of the cargo body/box is NOT deducted from the vehicle's UVW when calculating the minimum roof crush resistance.
- ___3. Verify the platen is at proper position and within specified tolerances as follows;
 - ___3.1. Its longitudinal axis is at a forward (i.e., pitch) angle in the side view projection of $5^\circ \pm 0.5^\circ$ below the horizontal (571.216a S7.3 (a))

- ___3.2. Its transverse axis is at an outboard (i.e, roll) angle, in the front view projection, of $25^\circ \pm 0.5^\circ$ below the horizontal (571.216a S7.3 (b))
- ___3.3. Record platen angles on Data Sheet No.4.
- ___4. Close all windows and close and lock all doors. Any moveable roof panel, moveable shade, or removable roof structure over the occupant compartment shall be closed and secured in place.

I certify that I have read and performed each instruction.

Date