

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
LABORATORY TEST PROCEDURE
FOR
FMVSS No. 226
EJECTION MITIGATION



ENFORCEMENT
Office of Vehicle Safety Compliance
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OVSC LABORATORY TEST PROCEDURE No. 226
TABLE OF CONTENTS

	PAGE
1 PURPOSE AND APPLICATION	1
2 GENERAL REQUIREMENTS.....	2
3 SECURITY	3
4 GOOD HOUSEKEEPING	3
5 TEST SCHEDULING AND MONITORING	3
6 TEST DATA DISPOSITION.....	4
7 GOVERNMENT FURNISHED PROPERTY	5
8 CALIBRATION OF TEST INSTRUMENTS.....	6
9 TEST EQUIPMENT	8
10 PHOTOGRAPHIC COVERAGE	12
11 DEFINITIONS.....	15
12 PRETEST REQUIREMENTS	17
13 COMPLIANCE TEST EXECUTION.....	19
14 POST TEST REQUIREMENTS.....	19
15 REPORTS	20
16 FORMS.....	28
17 DATA SHEETS.....	29
APPENDIX A HEADFORM SPECIFICATIONS	57
APPENDIX B IMPACTOR PERFORMANCE QUALIFICATION PROCEDURE	69

REVISION CONTROL LOG

FOR OVSC LABORATORY TEST PROCEDURES

TP 226 Ejection

TEST PROCEDURE		FMVSS 226		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00	3/1/2011	76 FR 3212 - 3305 Final Rule	3/1/2011	Original Release signed by O.D.
01				
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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 226 establishes requirements for ejection mitigation systems to reduce the likelihood of complete and partial ejections of vehicle occupants through side window during rollovers or side impact events. The standard applies to passenger cars, and to multipurpose passenger vehicles, trucks and buses with a GVWR of 4,536 kg or less, except walk-in vans, modified roof vehicles and convertibles. Also excluded from the standard are law enforcement vehicles, correctional institution vehicles, taxis and limousines, if they have a fixed security partition separating the 1st and 2nd or 2nd and 3rd rows and if they are produced by more than one manufacturer or are altered (within the meaning of 49 CFR 567.7)

Primary Phase-In Schedule (S8)

Phase-In Year (see Note)	Produced After August 31	Produced Before September 1	% of Manufacturer's Vehicles Certified to S4.2 Minimum Requirement
1	2013	2014	25
2	2014	2015	50
3	2015	2016	75
4	2016	2017	100

Note: Carry-forward credits allowed in Phase-in Year 4

Alternate Phase-In Schedule – Special Allowances (S4.1.3)

Small manufacturers, limited-line manufacturers and vehicles manufactured by an alterer (within the meaning of 49 CFR 567.7) or in multiple stages must be certified in accordance with the following schedule.

Production Date	% of Manufacturer's Vehicles Certified to S4.2
On or after September 1, 2018	100% for Small or Limited-line Manufacturers
On or after September 1, 2018	100% for Alterers and Multistage Vehicle Manufacturers

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 the metric units are required to use metric units in the test procedures, whereas standards using English 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 measurements 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 other Government Furnished Property (GFP) from unauthorized personnel during the entire compliance test 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 will be sent to the IPM (with copy to the COTR) within 48 hours.

The Contractor shall protect and segregate all information from compliance testing before and after each vehicle test. No information concerning the vehicle safety compliance test 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, 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, dummy calibration laboratory, 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 disposal of all vehicles. The status report form is 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 of the test completion.

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 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 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 and other transducers shall be calibrated every twelve months or after a vehicle fails to meet the FMVSS 226 performance requirements or after any indication from calibration checks that there may be a problem with the accelerometer or transducer whichever occurs sooner.

- 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/NCSL 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.

EJECTION MITIGATION IMPACTOR

The ejection impactor has a mass of $18 \text{ kg} \pm 0.05 \text{ kg}$ (S7.1). The base shaft is parallel to the y-axis of the headform. The headform is a featureless aluminum headform, 203.2 mm tall and 153.9 mm wide, covered with an 11.4 mm thick head skin (49 CFR 571.5). The headform must conform to the specifications contained in Appendix A.

When mounted for testing with an appropriate support frame, the ejection impactor mechanism must:

- be capable of being positioned to strike targets in the side window areas on production vehicles, where the impact direction is interior to exterior and perpendicular to the longitudinal centerline of the vehicle. To achieve these impact locations, the vehicle must not be permanently damaged.
- have sufficient available stroke to allow the moving impactor mechanism to extend at least 400 mm beyond the zero position plane (S7.2).
- be constrained from freely rotating beyond the axis of travel within a tolerance of $\pm 1^\circ$.
- be capable of measuring the displacement of the moving impactor mechanism throughout the entire stroke, with an accuracy of ± 1 millimeter.
- be designed for use at peak speeds between 16 km/h and 20 km/h (± 0.5 km/h).
- be capable of measuring the velocity of the moving impactor mechanism with an accuracy of ± 0.25 km/h.

The ejection headform must not deflect downward more than 20 mm in the x-z plane when a $981 \text{ N} \pm 5 \text{ N}$ force is applied in a vertical longitudinal plane, through the y axis of the headform and no more than 5 mm rear of the posterior surface of the headform. The force must be applied once in each of the following headform axes: +z, -z, +x, -x. The static deflection measurement must be made with the ejection impactor extended 400 mm outboard of the theoretical point of impact with the countermeasure and attached to the ejection propulsion mechanism, including any support frame and anchorage (S7.2).

At each ejection impactor orientation of 0, 90, 180 and 270 degrees about the headform y axis, measure the force necessary to move the ejection impactor 200 mm rearward into the ejection propulsion mechanism at a rate of 50 ± 13 mm per second, starting at a point 400 mm outboard of the theoretical point of impact with the countermeasure. The measurement must be made with the $100 \text{ kg} \pm 0.5 \text{ kg}$ mass attached to the impactor with its center of gravity passing through the axis of motion and within 5 mm of the posterior surface of the headform. The measurement must exclude the force measured over the first 25 mm of travel, and recorded at a minimum frequency of 100 Hz. At each orientation, the force must be measured a total of five (5) consecutive times and averaged. The dynamic coefficient of friction (μ_k) for the maximum of the force average values must not exceed 0.25 where $\mu_k = F_{\text{max of force avg (N)}} / 9.81 \text{ m/sec}^2 (\text{Mass}_{\text{ejection impactor (kg)}} + \text{Mass}_{\text{attached (kg)}})$ (S7.3).

The performance qualifications for evaluating the ejection mitigation test device prior to commencing the compliance test program, after each test failure, and after every five (5) vehicles are tested is contained in Appendix B.

EJECTION MITIGATION PROPULSION MECHANISM

The propulsion system must:

- have the capacity to accelerate the ejection mitigation impactor to peak speeds between 16 km/h and 20 ± 0.5 km/h. NOTE: speeds must be achieved prior to the impactor making contact with deployed air curtains and after propulsion has ceased (S5.5).
- be able to deliver the ejection impactor targeting point when moving at the speed, delay time and conditions specified in S5.5 to within ± 10 mm of an axis normal to and passing through the target center, as the unobstructed impactor passes through a zone defined by vertical longitudinal planes 50 mm forward and rearward of “D” – where “D” is the distance along the axis of travel of the ejection impactor from its launch point to the theoretical point of impact with the countermeasure (See Figure 1) (S7.4).

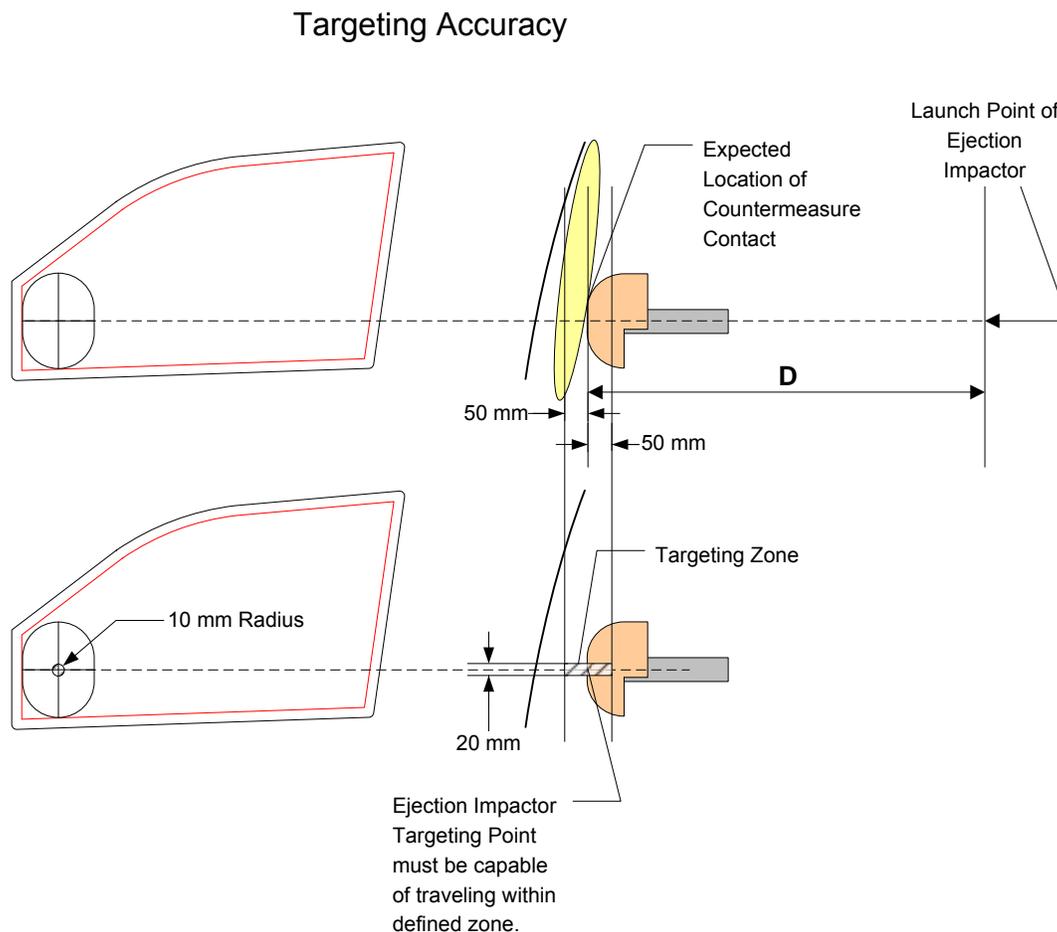


Figure 1

The control system must have the capability:

- for the operator to control the energizing of the propulsion system to achieve the required impact velocities.
- to send signals to deploy an air curtain, fire the impactor, and activate a data acquisition system, in the proper sequence, with one action by the operator (e.g. pushing one button).
- to fire the impactor at a pre-determined delay time such that it strikes the countermeasure while aligned with any target location (a) 1.5 ± 0.1 seconds after activation of the countermeasure and at a speed of 20 ± 0.5 km/h and (b) 6.0 ± 0.1 seconds after activation of the countermeasure and a speed of 16 ± 0.5 km/h.

TEMPERATURE CONTROLLED VEHICLE PREPERATION AND TEST AREA

The Contractor must have a temperature controlled building large enough to house and prepare the test vehicle along with the ejection impactor while allowing for government, vehicle manufacturer, and laboratory personnel to move around the test vehicle. The building must be climate controlled and able to maintain the ambient air temperature between 18 to 29°C at any relative humidity between 10 to 70 percent.

TEMPERATURE MONITORING EQUIPMENT

The ambient air temperature and humidity must be monitored and continuously recorded within 1 meter of the headform and test vehicle. The temperature sensors shall be accurate at least to within 0.1°C.

WEIGHING SCALES

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

CENTER PUNCH

Spring loaded automatic center punch with a punch tip of 5 ± 2 mm diameter (prior to coming to a point) and a spring adjustment to 150 ± 25 N of force to activate the punch (for example: Starrett 18B automatic center punch with adjustable stroke) (S5.4.1.2(a)).

PUNCH BLOCK

A 100 mm x 100 mm x 18 mm rigid material (i.e. plywood block) punch block used on the opposite side of the glazing as a reaction surface against the punch (S5.4.1.2(b)).

INCLINOMETER

An inclinometer with a measuring range from 0 to 360°, a resolution of 0.1° and a minimum accuracy of $\pm 0.1^\circ$ shall be used to measure vehicle attitude, seat back and headform angles.

MEASURING DEVICES

A Portable Coordinate Measurement Machine (CMM) used to locate targets and distances.

DATA ACQUISITION AND REDUCTION

The contractor shall provide the necessary equipment to record and display the data. The data acquisition system shall have a sufficient number of channels available for recording the necessary time histories of each test. Each channel will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211. A minimum of three (3) auxiliary inputs shall also be available to record additional data at the COTR's request.

A precision time system compatible with the test equipment shall be used to provide a time reference for all recorded data. A system that identifies the precise instant of ejection impactor firing will be incorporated with the time reference signal.

10. PHOTOGRAPHIC COVERAGE

DIGITAL PHOTOGRAPHS

The contractor shall take digital photographs of the pretest and post test procedures. Photographs shall be taken in color and contain clear images. A tag, label or placard identifying the test vehicle model as well as the ejection headform target location, NHTSA number 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. Left-side view of test vehicle
- b. Right-side view of test vehicle
- c. ¾ view from left-side of test vehicle
- d. ¾ view from right-side of test vehicle
- e. Vehicle's certification label
- f. Vehicle's tire information label
- g. Actual instrumentation as setup for each impact test(s)
- h. For each window, interior view of the pretest condition of the vehicle
- i. For each target, the test setup documenting the zero displacement plane determination
- j. For each target, the pretest view documenting the prebroken glazing, if applicable
- k. For each target, the pretest setup and orientation of the ejection impactor
- l. For each target, a post-test photograph(s) documenting the target location and impactor position
- m. For each window, the post test condition of the component window structure.

Digital High-Speed Video

Each impact test shall be documented on high-speed digital video at a minimum speed of 1,000 frames per second. High-speed digital video cameras shall operate at 1000 frames per second for at least 10 ms before the ejection impactor is fired and through the end of the event.

The minimum resolution for these cameras shall be 1536 CMOS sensors per every two rows of pixels, with 80% of the horizontal distance of the two rows covered by effective light sensors. There shall be a minimum of 1024 rows of sensors. Cameras that do not meet these specifications may be used if approved by the COTR.

A time zero impact mark must be registered in a frame to indicate when the ejection impactor is fired in a headform test. Each frame shall contain the camera speed and frame number beginning with the time zero frame labeled at "Frame 0." The frame numbers prior to time zero shall be negative numbers.

The Contractor shall report all camera locations along with camera speeds and focal length on the appropriate data sheets.

CAMERAS REQUIRED

Three (3) high-speed digital video cameras are required for each headform impact test:

- One camera as close to perpendicular as possible to the plane of motion capturing the impact event inside the vehicle.
- One camera as close to perpendicular as possible to the plane of motion capturing the impact event outside the vehicle.
- One camera oblique to the plane of motion capturing the impact event inside the vehicle.

LIGHTING SYSTEMS AND EVENT TRIGGER MARKER

An external light source(s) may be necessary to illuminate the test area and interior of the test vehicle to provide the proper exposure without producing excess glare so that views of the test are visible for film analysis. An event marker to indicate the start of the test shall be placed in the field of view for exterior and interior camera video coverage.

Note: Do not mount light sources or cameras to the vehicle's pillars or roof structure.

INFORMATIONAL PLACARDS

Vehicle identification Placard(s) shall be positioned so that the placard will be visible in the camera's field of view. The following information will be shown:

- a. Vehicle's NHTSA Number
- b. The words "FMVSS 226"
- c. Target Identification
- d. Test Date
- e. Name of contract laboratory
- f. Vehicle model year, make and model

Each digital high speed camera view shall be stored as a separate digital file. Video footage shall begin at least 10 ms before test starts and ends after the ejection mitigation impactor stops traveling. The video shall be stored on a CD or DVD as AVI or MPEG files with standard or generally available "codec." Other types of files may be used if approved by the COTR.

11. DEFINITIONS

- 11.1 **Ejection Impactor** means a device specified in S7.1 of this standard that is a component of the ejection mitigation test device and is the moving mass that strikes the ejection mitigation countermeasure (S3).
- 11.2 **Ejection Impactor Targeting Point** means the intersection of the y-axis of the ejection headform and the outer surface of the ejection headform (S3).
- 11.3 **Ejection Mitigation Countermeasure** means a device or devices, except for seat belts, integrated into the vehicle that reduce the likelihood of occupant ejection, through a side window opening, and that requires no action by the occupant for activation (S3).
- 11.4 **Ejection Propulsion Mechanism** means a device that is a component of the ejection mitigation test device consisting of a mechanism capable of propelling the ejection impactor and constraining it to move along its axis or shaft (S3).
- 11.5 **Limited-Line Manufacturer** means a manufacturer that sells three or fewer carlines, as that term is defined in 49 CFR 583.4, in the United States during a production year (S3).
- 11.6 **Modified roof** means the replacement roof on a motor vehicle whose original roof has been removed in part or in total (S3).
- 11.7 **Row** means a set of one or more seats whose seat outlines do not overlap with the seat outline of any other seats, when all seats are adjusted to their rearmost normal riding or driving position, when viewed from the side (S3).
- 11.8 **Seat Outline** means the outer limits of a seat projected laterally onto a vertical longitudinal vehicle plane (S3).
- 11.9 **Side Daylight Opening** means, other than a door opening, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal plane, is tangent to the periphery of the opening. The periphery includes surfaces 100 mm inboard of the inside surface of the window glazing and 25 mm outboard of the outside surface of the side glazing. The periphery excludes the following: any flexible gasket material or weather stripping used to create a waterproof seal between the glazing or door and the vehicle interior; grab handles used to facilitate occupant egress and ingress; and any part of a seat (S3).
- 11.10 **Small Manufacturer** means an original vehicle manufacturer that produces or assembles fewer than 5,000 vehicles annually for sale in the United States (S3).
- 11.11 **Target** means the x-z plane projection of the ejection headform face as shown in Figure 2 (S3).

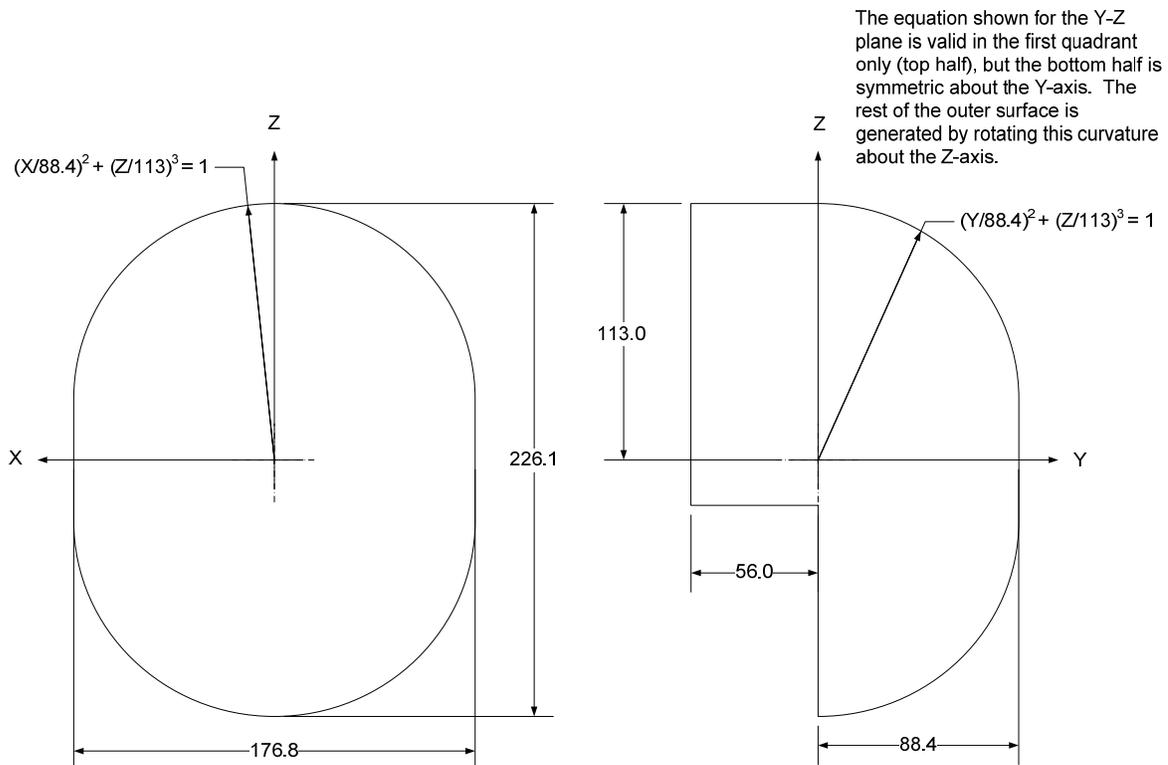


Figure 2 – Front and side view of headform outer surface (right) with dimensions in millimeters

- 11.13 **Unloaded vehicle weight (UVW)** means 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. (49 CFR 571.3)
- 11.14 **Walk-In Van** means a special cargo/mail delivery vehicle that has only has a driver designated seating position. The vehicle has a sliding (or folding) side door and a roof clearance that enables a person of medium stature to enter the passenger compartment area in an up-right position (S3).
- 11.15 **Zero Displacement Plane** means, a vertical plane parallel to the vehicle longitudinal centerline and tangent to the most outboard surface of the ejection headform when the headform is aligned with an impact target location and just touching the inside surface of a window covering the side daylight opening (S3).

12. PRETEST REQUIREMENTS

Prior to conducting any 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(s) of FMVSS 226,
- E. Review vehicle Owner's Manual (or equipment mfg. instructions), and

12.1 DETAILED TEST AND QUALITY CONTROL PROCEDURES REQUIRED

Submit a detailed in-house compliance test procedure to the COTR that includes:

1. A step-by-step description of the methodology to be used.
2. A written Quality Control (QC) Procedure that shall include calibrations, the data review process, report review, and the people assigned to perform on each task.
3. A complete listing of test equipment that shall include instrument accuracy and calibration dates.
4. Detailed check-off lists to be used during the test and during the 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.

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 test report. Written approval of the procedures shall be obtained from the COTR before initiating the compliance test program. After testing commences, written approval shall also be obtained from the COTR prior to any changes in the procedures.

12.2 EJECTION MITIGATION TEST DEVICE

The Contractor shall provide the ejection mitigation test device that consists of an ejection impactor (ejection headform attached to a shaft with a mass of 18 kg \pm 0.05 kg) and ejection propulsion mechanism meeting the specifications of S7.

The ejection mitigation test device shall be able to launch the ejection impactor such that the countermeasures are evaluated as installed inside the test vehicle.

12.3 TEST TEMPERATURE AND HUMIDITY CONDITIONS

The Contractor must verify that the ejection headform is in the specified temperature range of 18°C to 29°C at any relative humidity between 10 to 70 percent (S6.5(a)). The headform and test vehicle must be soaked in an ambient air environment in the specified range for a minimum of 1 hour prior to the test (S6.5).

The ambient air temperature must be monitored and continuously recorded within 1 meter of the headform. The temperature sensors shall be accurate at least to within 0.1°C. The Contractor shall mark the ambient air temperature recording with the date, time and technician's name at the beginning of the 1 hour soak and when the test commences. Temperature recordings shall be furnished to the COTR with final test reports.

12.4 IMPACT SPEED CONTROL

The speed and delay time of the ejection impactor is dependent on the speed and delay time requested by the COTR and must be controlled to obtain and maintain the impactor speed and delay time within ± 0.5 km/h and ± 0.1 second, respectively. The ejection impactor speeds specified must be achieved after propulsion has ceased (S5.5).

12.5 IMPACT SPEED MEASUREMENT

The impact speed will be determined with a tolerance of no more than ± 0.25 km/h.

12.6 IMPACT DISPLACEMENT MEASUREMENT

The linear displacement will be determined by the use of a linear variable differential transformer (LVDT) or a linear potentiometer that must be capable of measuring the displacement of the ejection impactor to an accuracy of ± 1.0 millimeters or less. Alternate methods for measuring linear displacement of the loading device shall be discussed in advance with the COTR.

12.7 TEST DATA ACQUISITION AND REDUCTION

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

The Contractor shall furnish data recording equipment having a sufficient number of channels available for recording the necessary time histories of each test. Each channel will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211.

A precision time system compatible with the test equipment shall be used to provide a time reference for all recorded data. A system that identifies the precise instant of ejection impactor firing will be incorporated with the time reference signal.

The contractor must evaluate the entire test equipment system and provide the NHTSA COTR with the overall tolerances for approval before testing can be started.

13. COMPLIANCE TEST EXECUTION

- A. 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.
- B. DETERMINE GENERAL TEST AND VEHICLE PARAMETER DATA USING DATA SHEETS 2, 3 & 4.
- C. DETERMINE IMPACT TARGET LOCATIONS USING DATA SHEET 5 AND 5A (if applicable).
- D. DETERMINE THE ZERO DISPLACEMENT PLANE LOCATIONS USING DATA SHEET 6.
- E. PRE-BREAK THE GLAZING AS NEEDED USING DATA SHEET 7.
- F. ALIGN THE IMPACTOR AND BEGIN TESTING TARGETS USING DATA SHEET 8.

14. POST TEST REQUIREMENTS

Take the necessary post test photographs as specified in Section 10.

Describe the damage, if any, and record on Summary Sheet.

Copies of all data plots and check sheets shall be included in the report.

The Contractor shall deliver to NHTSA a disk (CD/DVD ROM) with the entire test data formatted as specified in the NHTSA Test Reference Guide -Volume II: Component Tests.

Data entry software (ENTRÉE) shall be downloaded from the NHTSA 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.f7761ac9dcb3a375141d01105631eccc/>

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 disposal of all vehicles. Samples of the required reports are found in the report forms section.

15.2 NOTICE OF APPARENT 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 REPORTS

15.3.1 COPIES

In the case of an apparent test failure, two (2) paper copies and three (3) electronic copies in both Word and PDF formats of the Final Test Report shall be submitted to the COTR for acceptance within three (3) 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 (1) paper copy and two (2) 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 and other deliverables.

Contractors are required to submit the first draft test report, along with the high speed videos, contractor check sheets and electronic data within two weeks 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 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.

15.3.3 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 226-CTL-XX-001, where —

- 226 is the FMVSS tested
- CTL 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 226
 Ejection Mitigation
 * * * * *
 World Motors Corporation
 20XX World 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)



- (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

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: _____

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

226-CTL-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 226 Compliance Testing
of a 20XX World XYZ 4-door sedan
NHTSA No. CX0401

Block 5 — REPORT DATE

Month Day, 20XX

Block 6 — PERFORMING ORGANIZATION CODE

CTL (NHTSA's three digit alpha-code for test lab.)

Block 7 — AUTHOR(S)

John Smith, Project Manager
Bill Doe, Project Engineer

Block 8 — PERFORMING ORGANIZATION REPORT NUMBER

CTL-DOT-XXX-001

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

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

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. TP226-XX. 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 226

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

D. TABLE OF CONTENTS

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

Section 1 – Purpose of Compliance Test

Section 2 – Test Procedure and Discussion of Test

Section 3 – Test Data

Section 4 – Test Equipment List and Calibration Information

Section 5 – Photographs

Section 6 – Other Documentation

Section 7 – Laboratory Notice of Test Failure (if applicable)

SECTION 1 – PURPOSE OF COMPLIANCE TEST

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

This test was part of the FY__ FMVSS 226 Ejection Mitigation Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-XX-D-XXXXX. The purpose of this test was to evaluate ejection mitigation in a (description of vehicle being tested). The impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-226-_____, dated _____, 20XX).

NOTE: This section should be double-spaced and requires an entire separate page.

SECTION 2 – TEST PROCEDURE AND DISCUSSION OF TEST

This section gives a summary of the ejection mitigation events. The following is an example of the content needed in this section:

A 20XX World XYZ 4-door sedan was tested on xxxxx by Compliance Testing Laboratories, Inc. in Detroit, Michigan. The window targets tested as part of the compliance test are: xxxxxxx. Pretest and post test photographs of the test vehicle, xxxx, are included in this report.

A xxxx was placed in xxxxxx according to instructions specified in the OVSC Ejection Mitigation Laboratory Test Procedure dated _____(fill in date). Each event was documented by ___cameras. Camera locations and other pertinent camera information are included in this report.

The xxxxx headforms and impactor were instrumented with the following instrumentation:

SECTION 3 – TEST DATA

REPORT OF VEHICLE CONDITION AT THE COMPLETION OF TESTING

LIST OF FMVSS TESTS PERFORMED BY THIS LAB:

Model Year/Make/Model/Body Style: _____
NHTSA No. _____

REMARKS: _____

Equipment that is no longer on the test vehicle as noted on previous page: _____

Explanation for equipment removal: _____

Test Vehicle Condition: _____

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

RELEASE OF TEST VEHICLE

The vehicle described above is released from _____ to be delivered to
(Laboratory)

(Laboratory)

Date: _____ Time: _____ Odometer: _____

Lab Representative: _____
Signature Title

Carrier/Customer Representative: _____
Signature Date

DATA SHEET No. 2
CERTIFICATION LABEL AND TIRE PLACARD INFORMATION

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Record vehicle data using the information listed on the certification label, tire sidewall and tire placard.

CERTIFICATION LABEL (Part 567)

Manufacturer _____

Date of Manufacture _____ VIN _____

Vehicle certified as: _____ Passenger car _____ MPV _____ Truck _____ Bus

GVWR: _____ kg; GAWR FRONT: _____ kg GAWR REAR: _____ kg

TIRE PLACARD (571.110)

Vehicle Capacity Weight (VCW) _____

Designated Seating Capacity: Front _____; Rear _____; TOTAL _____

Recommended Cold Tire Pressure: FRONT: _____ kpa REAR: _____ kpa

Tire Pressure w/Maximum Capacity Vehicle Load: FRONT: _____ kpa REAR: _____ kpa

Recommended Tire Size: _____; Load Range: _____

Tire size on Test Vehicle: _____

REMARKS:

I certify that I have read and performed each instruction.

Date

DATA SHEET No. 3

READINESS INDICATOR AND OWNER'S MANUAL INFORMATION (S4.2.2, S4.2.3)

NHTSA No. _____

Test Date: _____

Laboratory: _____

Test Technician(s): _____

1. Does the vehicle have an ejection mitigation countermeasure that deploys in the event of a rollover (Obtain the answer to this question from the COTR)?
 - Yes
 - No – This data sheet is complete

2. Readiness indicator:
 - 2.1. Does the vehicle have a readiness indicator for the ejection mitigation countermeasure (S4.2.2)?
 - Yes – Pass
 - No – FAIL – Go to 3
 - 2.2. Is the readiness indicator clearly visible from the driver's designated seating position (S4.2.2)?
 - Yes – Pass
 - No – FAIL
 - 2.3. Is a list of elements monitored by the indicator included in the vehicle's owner manual or in other written information provided to the consumer (S4.2.2)?
 - Yes – Pass
 - No – FAIL

3. Does the vehicle's owner manual or other written information provided by the manufacturer to the consumer describe the vehicle as having a deployable ejection mitigation countermeasure (S4.2.3(a))?
 - Yes – Pass
 - No – FAIL

4. Does the written information (S4.2.3(b))
 - 4.1. Discuss the readiness indicator and specify a list of elements being monitored by the indicator?
 - Yes – Pass
 - No – FAIL
 - 4.2. Discuss the purpose and location of the telltale?
 - Yes – Pass
 - No – FAIL
 - 4.3. Instruct the consumer on what steps to take if the telltale is illuminated?
 - Yes – Pass
 - No – FAIL

REMARKS:

I certify that I have read and performed each instruction.

Date

DATA SHEET No. 4
VEHICLE TEST WEIGHT & ATTITUDE

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

___ 1. After the test vehicle is received, add fluids to capacity and inflate tires to the manufacturer's specifications per tire placard. If no tire placard is available, inflate tires to the recommended pressure in the owner's manual.

Tire Placard Pressure (kpa):	RF _____ ;	LF _____ ;	RR _____ ;	LR _____
Owner's Manual Pressure (kpa) :	RF _____ ;	LF _____ ;	RR _____ ;	LR _____
Actual Inflated Pressure (kpa):	RF _____ ;	LF _____ ;	RR _____ ;	LR _____

___ 2. Place the vehicle on a flat, horizontal surface.

___ 3. Weigh the vehicle to determine the "Unloaded Vehicle Weight" (UVW).

Right Front = _____ kg	Right Rear = _____ kg
Left Front = _____ kg	Left Rear = _____ kg
TOTAL FRONT = _____ kg	TOTAL REAR = _____ kg
% Total Weight = _____ %	% Total Weight = _____ %

UVW = TOTAL FRONT PLUS TOTAL REAR = _____ kg

___ 4. Place the vehicle on a flat, horizontal surface. Exercise the suspension, pushing up and down on all four corners of the vehicle at least 5 times in an interval not to exceed 40 seconds.

___ 5. UVW Test Vehicle Attitude (all dimensions in degrees(°)):

___ 5.1. Measure the pitch angle (front-to-rear) relative to a horizontal plane along a fixed reference on the driver's and passenger's door sill. Mark where the angle is measured on the door sill. Record on Table 4.1.

___ 5.2. Measure the roll angle (left-to-right) relative to a horizontal plane along a fixed reference at the vehicle longitudinal centerline on the front and rear of the vehicle (such as the front and rear bumper or instrument panel and rear deck). Mark where each angle is measured. Record on Table 4.1.

___ 6. Support the vehicle off of its suspension, so that it maintains the UVW test attitude angles $\pm 0.5^\circ$. Record on Table 4.1. If the vehicle is lowered off of the support fixture to reposition the vehicle during testing, the "as tested" attitude must again be measured and recorded.

Table 4.1		Vehicle Attitude	
		UVW	As Tested
Pitch Angle Nose Down (ND) Nose Up (NU)	Right Door Sill		
	Left Door Sill		
Roll Angle	Front Bumper		
	Rear Bumper		

The support for the vehicle must be capable of supporting the vehicle weight, loads applied and preventing movement of the vehicle. In addition, it must safely allow for the locating, testing and filming of the impacts per the requirements of the standard and this test procedure.

 I certify that I have read and performed each instruction.

 Date

DATA SHEET No. 5
IMPACT TARGET LOCATION DETERMINATION (S5.2)

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Test Window: _____ Left Outboard _____ Right Outboard
 _____ Front _____ 2nd Row _____ 3rd Row _____ 4th Row

PRELIMINARY LOCATIONS

- ___ 1. Remove any flexible gasket material or weather stripping from the side daylight opening (S3).
- ___ 2. Project the side daylight opening laterally onto a vehicle vertical longitudinal plane (S5.2.1.1).
- ___ 3. Using a CMM, determine the location of an offset line within the daylight opening by projecting each point of the side daylight opening laterally onto a vehicle vertical longitudinal plane. Move each point by 25 ± 2 mm towards the center of the side daylight opening and perpendicular to a line tangent to the projection at that point, while maintaining the point on a vehicle vertical longitudinal plane (S5.2.1(a)) – see the red lines in Figure 5.1 (S5.2.1.1).
- ___ 4. Define and mark on the vehicle the rearward edge of the daylight opening by establishing a transverse vertical vehicle plane (check one of the following):

- ___ 4.1. 1400 mm behind the SgRP of the last row forward facing seat adjacent to the opening, in the case of a vehicle with fewer than 3 rows, or (S5.2.1.2(a))
- ___ 4.2. 600 mm behind the SgRP of the forward facing 3rd row seat adjacent to the opening, in the case of a vehicle with 3 or more seating rows, or (S5.2.1.2(a))
- ___ 4.3. 1400 mm behind the rearmost portion of the rearmost seat when the referenced seat is not fixed in the forward facing direction, seat back at manufacturer’s design seat back angle and seat in any adjustment position, or (S5.2.1.2 (b))

Manufacturer’s Design Seat Back Angle (°) _____
 Test Seat Back Angle (°) _____
 Seat Adjustment _____

- ___ 4.4. 600 mm behind the rearmost portion of the 3rd row seat when the referenced seat is not fixed in the forward facing direction, seat back at manufacturer’s design seat back angle and seat in any adjustment position, or (S5.2.1.2(b))

Manufacturer’s Design Seat Back Angle (°) _____
 Test Seat Back Angle (°) _____
 Seat Adjustment _____

- ___ 4.5 25 mm forward of a vertical plane tangent to and forward of a fixed transverse partition or bulkhead through which there is not occupant access and behind which are no designated seating positions. The vertical plane tangent to the partition or bulkhead is forward of the limiting plane defined in S5.2.1.2 (a) or (b) (S5.2.1.2(c)).

___ 5. Position impactor target at any location inside the offset-line where the target is tangent to within ± 2 mm of the offset-line at two or three points (S5.2.2(b)) – see Figure 5.1.

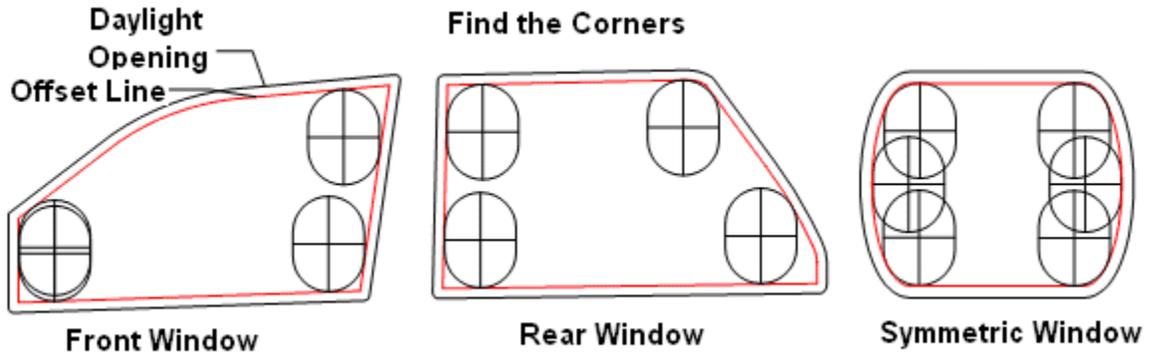


Figure 5.1

TARGET DETERMINATION

___ 6. Use a CMM to determine the location of the geometric center of the side daylight opening, and record (in millimeters) the X and Z coordinates of its location with respect to its forwardmost-lowest corner – see Figure 5.2.

X: _____. Z: _____.

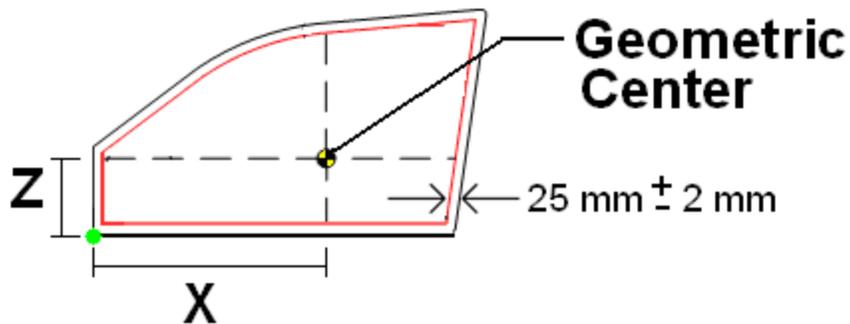


Figure 5.2

___ 7. Divide the side daylight opening into four quadrants (lower-front, lower-rear, upper-front and upper-rear) by passing a vertical line and a horizontal line, in a vehicle vertical longitudinal plane, through the geometric center of the daylight opening (S5.2.3) – see Figure 5.3.

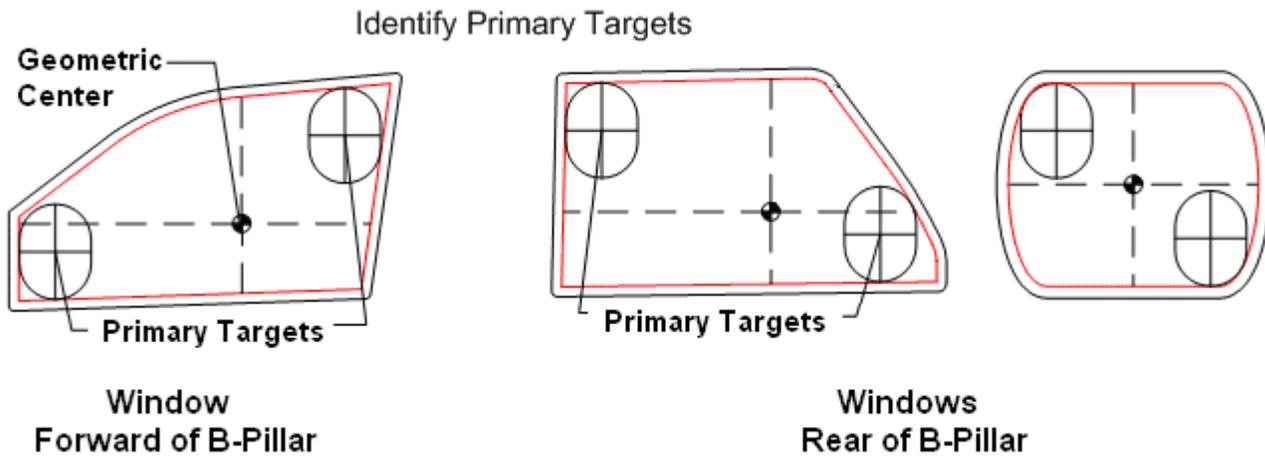


Figure 5.3

IDENTIFICATION OF PRIMARY TARGET LOCATIONS

___ 8. Identify the primary quadrant where the center of each target is located.

___ 8.1. Side daylight opening is forward of the vehicle B-pillar, the primary quadrants are the forward-lower and rearward-upper (S5.2.3.1).

___ 8.2. Side daylight opening is rearward of the B-pillar, the primary quadrants are the forward-upper and rearward-lower (S5.2.3.2).

___ 9. Identify below if more than one impact target outline exists. **NOTE:** If there is more than one target center in each primary target quadrant, maintain the lowest target in the lower quadrants and the highest targets in the upper quadrants. If there is no target center within the quadrant, use the target whose center is closest to the quadrant (S5.2.3.3).

___ 10. Using the CMM, record in millimeters the X and Z coordinates of the target center of the primary target locations with respect to the forwardmost-lowest corner of the daylight opening – see Figure 5.4.

Front Window:		Rear Window:
Lower-Front: X: _____ Z: _____		Upper-Front: X: _____ Z: _____
Upper-Rear: X: _____ Z: _____		Lower-Rear: X: _____ Z: _____

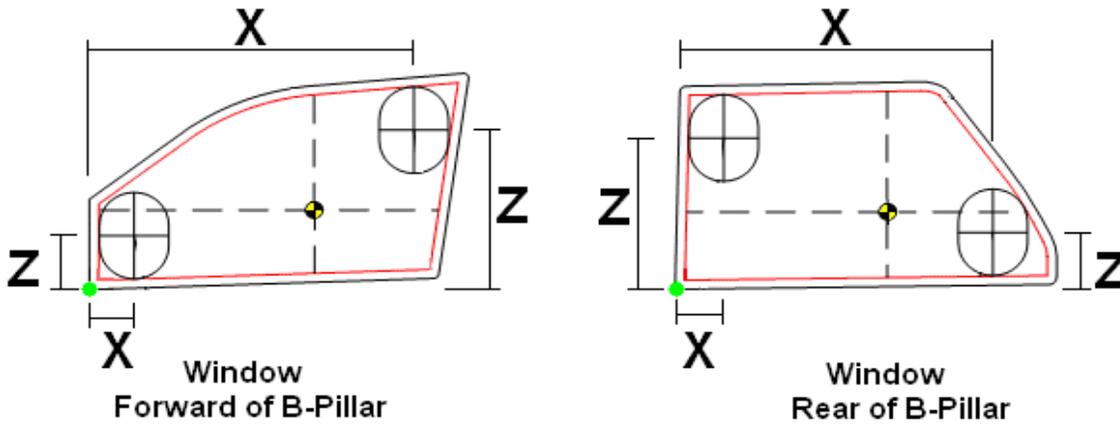


Figure 5.4

IDENTIFICATION OF SECONDARY TARGET LOCATIONS

___ 11. Measure and record the horizontal distance between the centers of the primary targets (A and B, front and rear window respectively - see Figure 5.5) : A _____ B _____

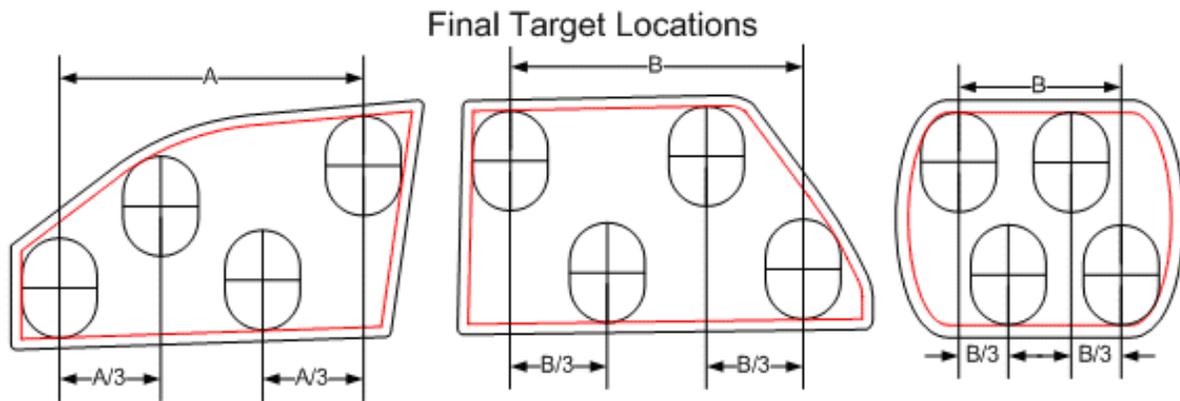


Figure 5.5

___ 11.1. Side daylight opening is forward of the B-pillar: Place one secondary target centered rearward of the forward primary target by one-third of the horizontal distance between the primary target outlines ($A/3$) and tangent with upper portion of the offset-line. Place another secondary target outline centered rearward of the forward primary target by two-thirds of the horizontal distance between the primary targets and tangent with the lower portion of the offset-line (S5.2.3.1).

___ 11.2. Side daylight opening is rearward of the B-pillar: Place one secondary target centered rearward of the forward primary target by one-third of the horizontal distance between the primary target outlines ($B/3$) and tangent with lower portion of the offset-line. Place another secondary target outline centered rearward of the forward primary target by two-thirds of the horizontal distance between the primary targets and tangent with the upper portion of the offset-line (S5.2.3.2).

___12. Using CMM measurements, record in millimeters the X and Z coordinates of the target center of the secondary target locations for the side daylight opening of the test window, with respect to the forwardmost-lowest corner of each daylight opening – see Figure 5.6.

Front Window:
 Upper-Front: X: _____ Z: _____
 Lower-Rear: X: _____ Z: _____

Rear Window:
 Lower-Front: X: _____ Z: _____
 Upper-Rear: X: _____ Z: _____

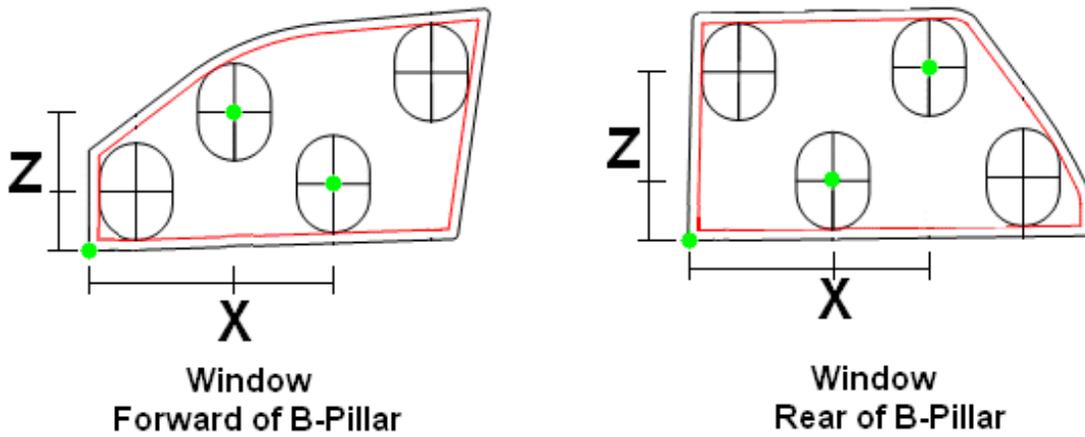


Figure 5.6

NOTE: As a window gets smaller (see Figures 5.7 and 5.8), it is not necessary to have 4 impact locations.

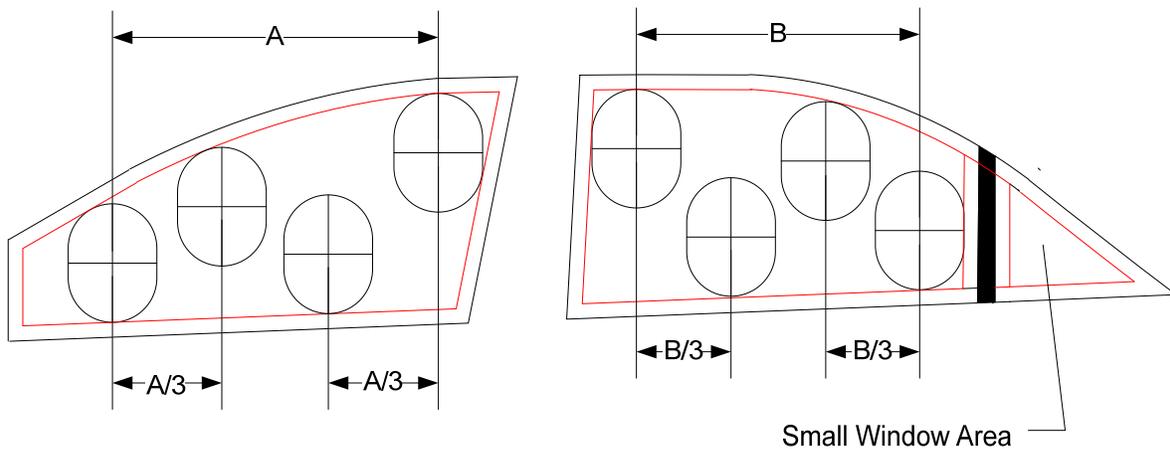


Figure 5.7

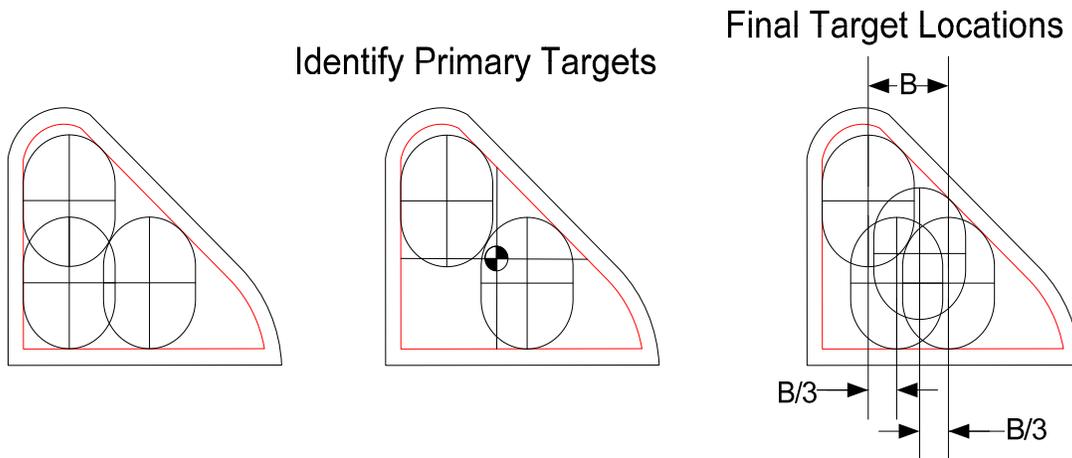


Figure 5.8

TARGET SEPARATION, ELIMINATION AND RECONSTITUTION

___ 13. Using the CMM measurements, record the horizontal and vertical distance between the centers of the targets. If the horizontal distance between the target centers is less than 135 mm **and** the vertical distance is less than 170 mm, eliminate the targets in the order of priority given in steps 1 through 4 of Table 5.1. In each case for elimination, both target centers must be closer than 135 mm and 170 mm in the horizontal and vertical directions, respectively (S5.2.5.1.1).

Priority	Target Center Distance	Actual Distance	Target to Eliminate
1	Upper Secondary to Lower Secondary	Horizontal: _____ mm Vertical: _____ mm	___ Upper Secondary
2	Upper Primary to Upper or Remaining Secondary	Horizontal: _____ mm Vertical: _____ mm	___ Upper or Remaining Secondary
3	Lower Primary to Lower or Remaining Secondary	Horizontal: _____ mm Vertical: _____ mm	___ Lower or Remaining Secondary
4	Upper Primary to Lower Primary	Horizontal: _____ mm Vertical: _____ mm	___ Upper Primary

Table 5.1 – Priority of Targets

- ___ 14. Are there ONLY two targets remaining? ___ Yes, go to 15 ___ No, go to 17.
- ___ 15. Is the absolute distance between targets greater than 360 mm (see Figures 5.9 and 5.10)?
_____ mm ___ Yes, go to 16 ___ No, go to 17.
- ___ 16. Place a target such that the center of its outline bisects a line connecting the centers of the remaining targets (S5.2.5.1.2).

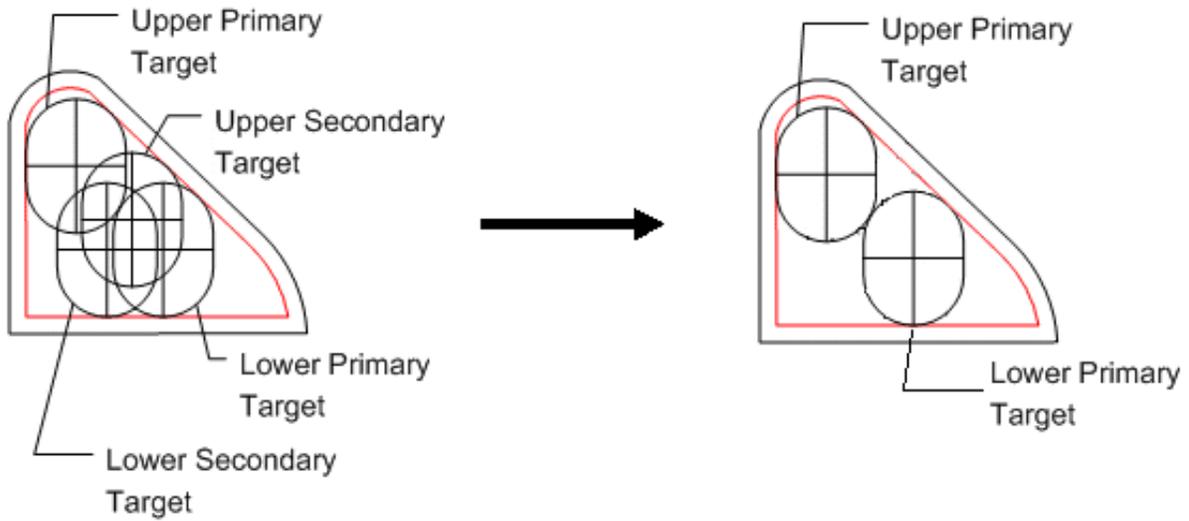


Figure 5.9

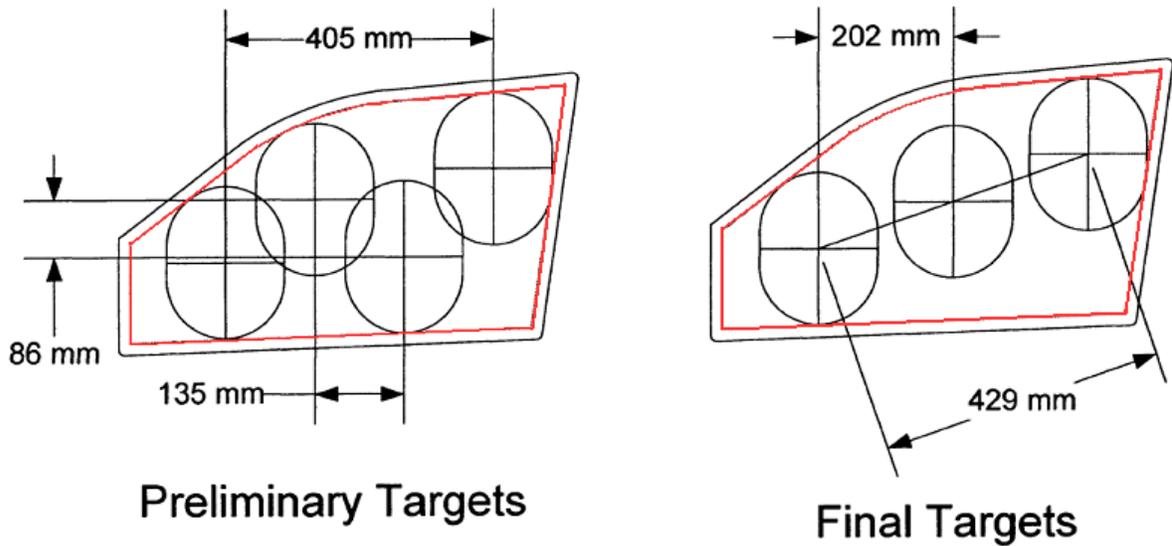


Figure 5.10

___17. Using the CMM measurements, record final target center coordinates.

TARGET LOCATION (i.e. Left Outboard, Primary, Front Row, Lower Front)	COORDINATES (mm)	
	X	Z

___ 18. Are there less than four (4) targets remaining? ___ Yes, go to Data Sheet No. 5A Target Reorientation . ___ No, go to 19.

___ 19. Reinstall any flexible gasket material or weather stripping previously removed in Step 1.

I certify that I have read and performed each instruction.

Date

DATA SHEET No. 5A Reorientation
IMPACT TARGET LOCATION DETERMINATION (S5.2.5.2, S5.2.5.3)
TARGET REORIENTATION

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Test Window: _____ Left Outboard _____ Right Outboard
 _____ Front _____ 2nd Row _____ 3rd Row _____ 4th Row

REORIENTATION - 90 ° ROTATION (S5.2.5.2)

___ 1. Reorient the impactor target by rotating it 90° about the y axis of the target (within ±1°) of the vehicle longitudinal axis, pointing in the direction of the vehicle + x axis). Position the reoriented impactor target at any location inside the offset-line where the target outline is tangent to within ±2 mm of the offset-line at two or three points (S5.2.2(b)).

IDENTIFICATION OF PRIMARY TARGET LOCATIONS

___ 2. Identify the primary quadrant where the center of each target is located.

___ 2.1. Side daylight opening is forward of the vehicle B-pillar, the primary quadrants are the forward-lower and rearward-upper (S5.2.3.1).

___ 2.2. Side daylight opening is rearward of the B-pillar, the primary quadrants are the forward-upper and rearward-lower (S5.2.3.2).

___ 3. Identify below if more than one impact target outline exists. **NOTE:** If there is more than one target outline center in each primary target quadrant, maintain the lowest target in the lower quadrants and the highest targets in the upper quadrants. If there is no target center within the quadrant, use the target whose center is closest to the quadrant (S5.2.3.3).

___ 4. Using the CMM, record in millimeters the X and Z coordinates of the target center of the primary target locations with respect to the forwardmost-lowest corner of the daylight opening – see Figure 5.4.

Front Window:	Rear Window:
Lower-Front: X: _____ Z: _____	Upper-Front: X: _____ Z: _____
Upper-Rear: X: _____ Z: _____	Lower-Rear: X: _____ Z: _____

TARGET SEPARATION, ELIMINATION AND RECONSTITUTION

___7. Using the CMM measurements, record the horizontal and vertical distance between the centers of the targets. If the horizontal distance between the target centers is less 170 ± 2 mm **and** the vertical distance is less than 135 ± 2 mm, eliminate the targets in the order of priority given in steps 1 through 4 of Table 5A.1. In each case for elimination, both target centers must be closer than 170 mm and 135 mm in the horizontal and vertical directions, respectively (S5.2.5.1.1).

Priority	Target Center Distance	Actual Distance	Target to Eliminate
1	Upper Secondary to Lower Secondary	Horizontal: _____ mm Vertical: _____ mm	___ Upper Secondary
2	Upper Primary to Upper or Remaining Secondary	Horizontal: _____ mm Vertical: _____ mm	___ Upper or Remaining Secondary
3	Lower Primary to Lower or Remaining Secondary	Horizontal: _____ mm Vertical: _____ mm	___ Lower or Remaining Secondary
4	Upper Primary to Lower Primary	Horizontal: _____ mm Vertical: _____ mm	___ Upper Primary

Table 5A.1 – Priority of Targets

- ___8. Are there ONLY two targets remaining? ___ Yes, go to 9 ___ No, go to 11.
 ___9. Is the absolute distance between targets greater than 360 mm (see Figures 5.9 and 5.10)?
 _____ mm ___ Yes, go to 10 ___ No, go to 11.
 ___10. Place a target such that the center of its outline bisects a line connecting the centers of the remaining targets (S5.2.5.1.2).
 ___11. Using the CMM measurements, record final target center coordinates.

TARGET LOCATION (i.e. Left Outboard, Primary, Front Row, Lower Front)	COORDINATES (mm)	
	X	Z

- ___12. Are there less than four (4) targets remaining? ___ Yes, go to 13 ___ No, go to 17.
 ___13. Do the remaining targets exceed the number of targets determined with the original orientation of the target (Data Sheet 5, Item No. 17)? ___ Yes, go to 17 ___ No, go to 14.

___ 14. Are there no targets in the side daylight opening? ___ Yes, go to 15 ___ No, go to 18.

REORIENTATION – INCREMENTAL ROTATION

___ 15. Start with the target in the position defined in S5.2.2.2(a), reorient the target by rotating it in 5° increments about the y axis of the target by rotating the target +z axis toward the vehicle +x axis. At each increment of rotation, attempt to fit the target within the offset line. At the first increment of rotation where the target will fit, place the target center as close as possible to the geometric center of the side daylight opening. If more than one position exists that is closest to the geometric center of the side daylight opening, select the lowest. (S5.2.5.3)

Incremental Rotation: _____ Target Angle (°): _____

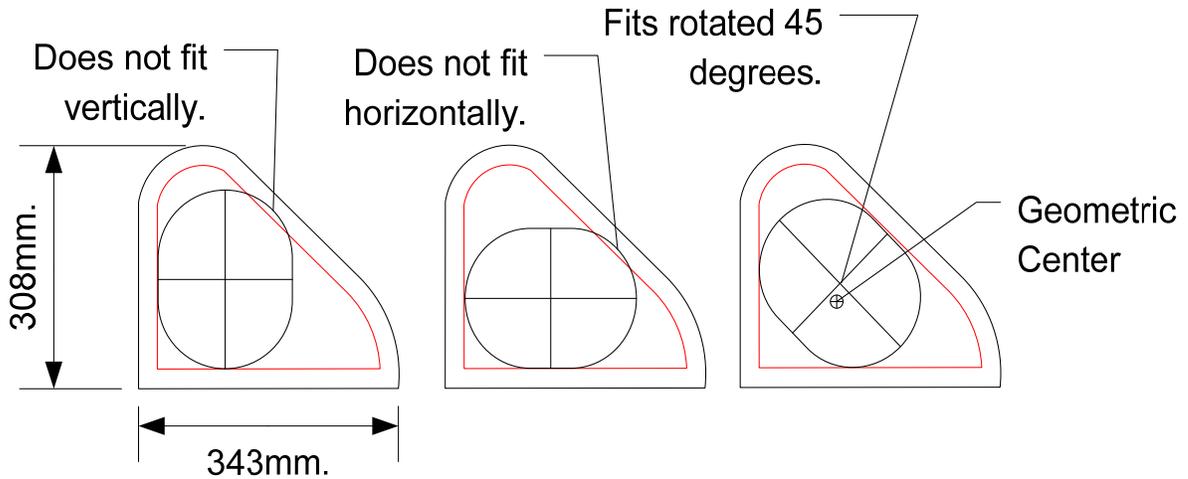


Figure 5A.2

___ 16. Using the CMM measurements, record the final target center coordinates.

TARGET LOCATION	COORDINATES (mm)	
	X	Z

___ 17. Reinstall any flexible gasket material or weather stripping previously removed in Step 1 of Data Sheet No. 5. Target locations identified in Data Sheet 5A are the final target locations.

___ 18. Reinstall any flexible gasket material or weather stripping previously removed in Step 1 of Data Sheet No. 5. Target locations identified in Data Sheet 5 are the final target locations.

I certify that I have read and performed each instruction.

Date

DATA SHEET No. 6

ZERO DISPLACEMENT PLANE DETERMINATION (S5.3)

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Test window: _____ Left Outboard _____ Right Outboard
 _____ Front _____ 2nd Row _____ 3rd Row _____ 4th Row

Target: _____

The reference position defines the point of zero excursion outside of the test vehicle. Once the impactor is positioned to strike a particular target location, pull the headform out until it just touches the closed, unbroken window. If the headform goes beyond this position outside the vehicle during a test, it will be considered to be **positive** excursion. If the headform does not go beyond this position during a test, it will be considered to be **negative** excursion.

DETERMINATION OF ZERO DISPLACEMENT PLANE (S5.3):

- ___ 1. Close the window to be tested.
- ___ 2. Align the ejection headform targeting point within ± 2 mm of the center of the target location to be tested.
- ___ 3. Move the ejection headform towards the target (with no more than 20 N of force being applied) until contact with the window. Mark the window at the contact location. Mark the headform at the contact location.
- ___ 4. Identify a reference point and record the headform-to-window contact below as the zero displacement location for the target. The zero displacement location marks the most outboard surface of the ejection headform when aligned with the target and just touching the window and is used to define the zero displacement plane.

Reference Point (mm): _____ X _____ Y _____ Z
 Zero Displacement (mm): _____ X _____ Y _____ Z

- ___ 5. Return the ejection headform to its original position and record the initial headform location (at the marked contact area on the head) below.

Initial Position (mm): _____ X _____ Y _____ Z

NOTE: Determine the zero displacement plane for each target prior to pre-breaking or removing a window.

 I certify that I have read and performed each instruction.

 Date

DATA SHEET No. 7
GLAZING PRE-BREAKING (S5.4.1)

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Test window: _____ Driver _____ Passenger
 _____ Front _____ 2nd Row _____ 3rd Row _____ 4th Row

Prior to impact testing, the glazing covering the target location must be open, removed or pre-broken, at the option of the manufacturer (S5.4). Contact the COTR to determine how the vehicle manufacturer certified the daylight opening of the vehicle.

- ___ 1. Manufacturer opened or removed the window. ___ Yes, this sheet is complete. ___ No, go to 2.
- ___ 2. Using the CMM, locate the geometric center of the side daylight opening. (S5.4.1.1)
- ___ 3. Mark the outside surface of the window glazing in a horizontal and vertical grid of points separated by 75 ± 2 mm with one point coincident within ± 2 mm of the geometric center of the side daylight opening – see Figure 7.1 (5.4.1.1)
- ___ 4. Mark the inside surface of the window glazing in a horizontal grid of points separated by 75 ± 2 mm with the entire grid horizontally offset by 37.5 ± 2 mm from the grid marked on the outside (in item no. 3 above).

**75 mm Offset
 Hole Punch Pattern**

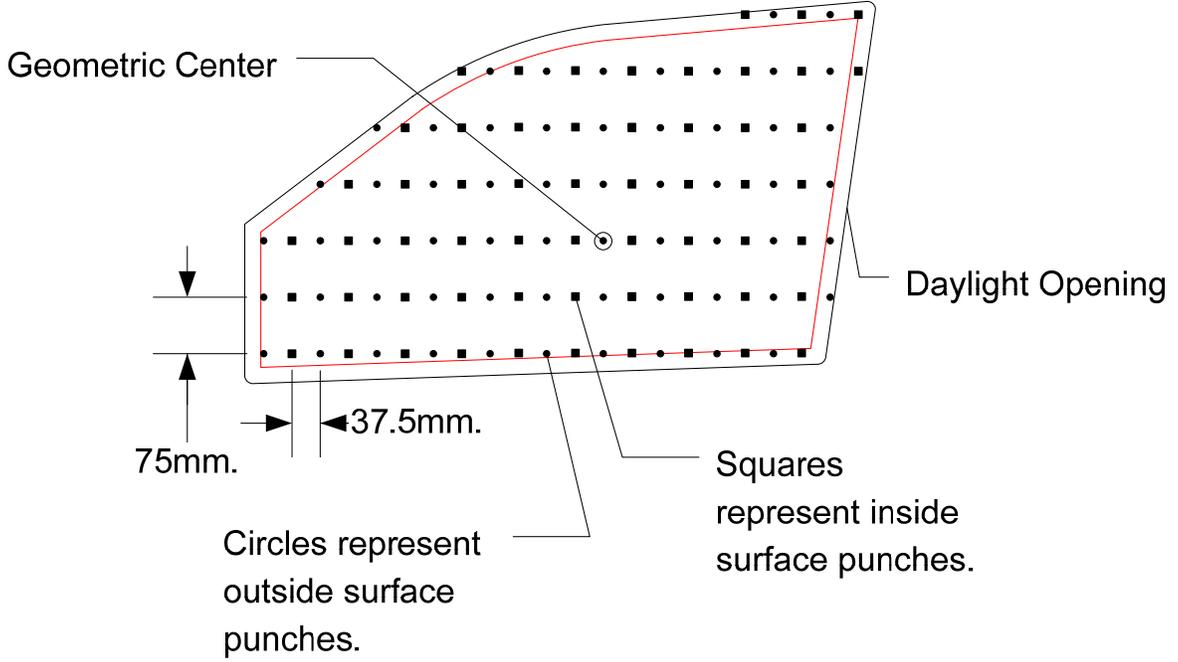


Figure 7.1

- ___ 5. Using a spring loaded automatic center punch with a punch tip of 5 ± 2 mm diameter (prior to coming to a point) and a spring adjustment of $150 \text{ N} \pm 25 \text{ N}$ of force to activate the punch, punch the grid beginning on the inside surface of the glazing, starting with the lowest and most forward hole in the pattern. Apply pressure to the center punch in a direction $\pm 10^\circ$ perpendicular to the window surface. Place a 100 mm x 100 mm x 18 mm wood block on the opposite side of the glazing as a reaction surface against the punch. **[NOTE:** If punching a hole causes the glazing to disintegrate, halt the breakage procedure and proceed with the headform impact tests.] Continue punching the grid, moving rearward in the grid. When the end of a row is reached, move to the most forward hole in the next higher row. (S5.4.1.2)
- ___ 6. After completing the punching the grid on the inside surface, repeat the process on the outside surface.

I certify that I have read and performed each instruction.

Date

DATA SHEET No. 8
IMPACT TEST

NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Test window: _____ Left Outboard _____ Right Outboard
 _____ Front _____ 2nd Row _____ 3rd Row _____ 4th Row

Target: _____

___ 1. Align the impactor in the vehicle such that it strikes the target from the inside of the vehicle, head outward. Its direction of motion should be horizontal and perpendicular to the vehicle's longitudinal centerline.

Targets determined by the procedures of S5.2.2 through S5.2.5.1 (S5.6.1), as follows:

- ___ 1.1. X axis of the ejection headform aligned within $\pm 1^\circ$ of the vehicle longitudinal axis, respectively (S5.6.1); ___ Yes ___ No
 If No, realign headform. Record Angle: _____.
- ___ 1.2. The Y axis of the ejection headform within $\pm 1^\circ$ of the vehicle transverse axis.
 ___ Yes ___ No
 If No, realign headform. Record Angle: _____.
- ___ 1.3. The Z axis of the ejection headform within $\pm 1^\circ$ of the vehicle vertical axis.
 ___ Yes ___ No
 If No, realign headform. Record Angle: _____.
- ___ 1.4. Is the targeting point of the ejection headform aligned within ± 2 mm of the target center; ___ Yes ___ No
 If No, realign headform. Record Final Offset: _____.

Targets rotated 90° determined by the procedures of S5.2.5.2 (S5.6.2), as follows:

- ___ 1.5. X axis of the ejection headform aligned within $\pm 1^\circ$ of the vehicle vertical axis, respectively (S5.6.1); ___ Yes ___ No
 If No, realign headform. Record Angle: _____.
- ___ 1.6. The Y axis of the ejection headform within $\pm 1^\circ$ of the vehicle transverse axis.
 ___ Yes ___ No
 If No, realign headform. Record Angle: _____.
- ___ 1.7. The Z axis of the ejection headform within $\pm 1^\circ$ of the vehicle longitudinal axis.
 ___ Yes ___ No
 If No, realign headform. Record Angle: _____.
- ___ 1.8. Is the targeting point of the ejection headform aligned within ± 2 mm of the target center; ___ Yes ___ No
 If No, realign headform. Record Final Offset: _____.

Targets incrementally rotated as determined by the procedures of S5.2.5.3 (S5.6.3), as follows:

- ___ 1.9. X and Z axis of the ejection headform aligned within $\pm 1^\circ$ of the rotated target angle axis determined per Data Sheet no. 5A (S5.6.1); ___Yes ___No
If No, realign headform. Record Angle: _____.
- ___ 1.10. The Y axis of the ejection headform within $\pm 1^\circ$ of the vehicle transverse axis.
___Yes ___No
If No, realign headform. Record Angle: _____.
- ___ 1.11. Is the targeting point aligned within ± 2 mm of the target center; ___Yes ___No
If No, realign headform. Record Final Offset: _____.
- ___ 2. Doors are fully closed and latched but not locked on the vehicle side of the target being tested (S6.2).
NOTE: Side door(s) on the opposite side of the longitudinal centerline of the vehicle from the target to be impacted can be opened or removed. Any rear hatchback or tail gate may be open or removed for testing any target.
- ___ 3. Steering wheel, steering column, seats, grab handles, and exterior mirrors may be removed during targeting and testing (S6.3).
Steering wheel removed: ___Yes ___No
Steering column removed: ___Yes ___No
Seat removed: ___Yes, record location : _____ ___No
Grab handle(s) removed: ___Yes, record location: _____ ___No
Exterior mirror(s) removed: ___Yes, record location: _____ ___No
- ___ 4. Other vehicle components and structures removed to allow positioning of the ejection propulsion mechanism and provide an unobstructed path for the headform (S6.4).
___Yes, record item and location : _____ ___No
- ___ 5. Zero displacement plane for the target has been located and marked. Data Sheet No. 6 is complete.
- ___ 6. Window position ___open, ___removed or ___prebroken. Data Sheet No. 7 is complete.
- ___ 7. Prepare the high-speed video cameras. Record location.
- ___ 8. Photograph pretest setup as specified in Section 10.
- ___ 9. Ejection headform exposed to the temperature between 18 - 29°C and a relative humidity between 10-70% for a continuous period of not less than 1 hour (S6.5).
- ___ 10. Ambient temperature is between 18 – 29°C and a relative humidity between 10 - 70%.
Temperature ____°C Humidity ____%
- ___ 11. Instrumentation pretest checks performed.
- ___ 12. Ejection countermeasure connected to firing system per the manufacturer’s instructions, provided by COTR. ___N/A.

IMPACT SPEEDS AND DELAY TIME (S5.5)

- ___ 13. Vehicle has an ejection mitigation countermeasure that deploys in a rollover
___Yes, go to 14 ___No, go to 19
- ___ 14. Test is to be conducted at a speed of ___ 16 km/h, go to 15 or ___ 20 km/h, go to 19.
Provided by COTR.
- ___ 15. Propel the ejection headform such that it strikes the target location 6.0 ± 0.1 seconds after activation of the ejection mitigation countermeasure and at a velocity of 16 ± 0.5 km/h.
(S5.5(b)) Actual Test Speed ____ km/h. Actual Time ____seconds.

- ___ 16. Measure and record the distance beyond the zero displacement plane: _____ mm.
 ___ 100 mm or less (Pass) ___ Greater than 100 mm (Fail)
- ___ 17. Propel the ejection headform such that it strikes the target location 1.5 ± 0.1 seconds after activation of the ejection mitigation countermeasure and at a velocity of 20 ± 0.5 km/h.
 (S5.5(a)) Actual Test Speed _____ km/h. Actual Time _____ seconds.
- ___ 18. Measure and record the distance beyond the zero displacement plane: _____ mm.
 ___ 100 mm or less (Pass) ___ Greater than 100 mm (Fail)
- ___ 19. Vehicle does not have an ejection mitigation countermeasure that deploys in a rollover.
 Propel the ejection headform such that it strikes the target location at a velocity of 20 ± 0.5 km/h (S5.5(a)). Actual Test Speed _____ km/h.
- ___ 20. Measure and record the distance beyond the zero displacement plane: _____ mm.
 ___ 100 mm or less (Pass) ___ Greater than 100 mm (Fail)
- ___ 21. Photograph post test results.
- ___ 22. Extend the impactor to the zero displacement plane and determine if the X, Y, and Z axes of the headform are aligned within ± 1° of its launch orientation. ___ Yes ___ No

I certify that I have read and performed each instruction.

Date

TEST SUMMARY SHEET

NHTSA No. _____
 Laboratory: _____

Test Date: _____
 Test Technician(s): _____

Specify for each side daylight opening:

Side: Left Outboard/Right Outboard

Row: Front, 2nd Row, 3rd Row, 4th Row, etc.

Target selected: Primary/Secondary

Target tested: lower-front, lower-rear, upper-front, upper rear, etc.

Test Speeds:

16 ± 0.5 km/h, 6.0 ± 0.1 seconds after activation of ejection mitigation countermeasure.

20 ± 0.5 km/h, 1.5 ± 0.1 seconds after activation of ejection mitigation countermeasure.

NOTE: When the ejection propulsion mechanism propels the ejection impactor into the impact target locations of each side daylight opening of a vehicle according to the test procedures specified in S5 of this Standard No. 226, the most outboard surface of the ejection headform must not displace more than 100 millimeters beyond the zero displacement plane (S4.2.1).

TARGET LOCATION (i.e. Driver Side, Primary, Front Row, Lower Front)	COORDINATES (mm)		TEST SPEED (km/h)	ZERO DISPLACEMENT PLANE COORDINATES (mm)			DISTANCE BEYOND ZERO PLANE (mm) (100 mm Max)	PASS/FAIL
	X	Z		X	Y	Z		

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

TEST REPORT SUMMARY SHEET FOR EACH TARGET TESTED

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

Pre-Test Data

Test window: _____ Left Outboard _____ Right Outboard
 _____ Front _____ 2nd Row _____ 3rd Row _____ 4th Row

Target location selected: _____ primary _____ secondary
 _____ lower-front _____ lower-rear _____ upper-front _____ upper rear

1. Is the impactor aligned such that it strikes the target from the inside of the vehicle?
 ___ Yes ___ No
2. Lateral distance from the impactor to the zero displacement plane of the selected target:
 _____ mm
3. Displacement measuring device set to zero at the zero displacement plane: ___ Yes ___ No
4. Doors are fully closed and latched but not locked: ___ Yes ___ No (S6.2(a))
5. Window is: ___ open ___ removed ___ pre-broken (disintegrated: ___ Yes ___ No)
6. Rear hatchback or tail gate: ___ open ___ closed ___ removed (as provided in S6.2(c))
7. Convertible tops, if any, are in the closed passenger compartment configuration: ___ Yes ___ No
9. Steering wheel: _____ in place _____ removed
10. Steering column: _____ in place _____ removed
11. Seats: _____ in place _____ removed
12. Grab handles: _____ in place _____ removed
13. Exterior mirrors: _____ in place _____ removed
14. Other vehicle components and structures removed: _____
15. Ejection headform temperature _____ °C Relative humidity _____ %

NOTE: The headform must be soaked in an ambient air environment in the specified range for a minimum of 1 hour prior to the test. The ambient air temperature must be monitored within 1 meter of the headform.

16. Headform impact speed set to _____ ± 0.5 km/h, _____ ± 0.1 seconds after activation of ejection mitigation countermeasure.
 Actual Test Speed _____ km/h Actual Time _____ seconds

17. Maximum distance traveled by the headform:
 _____ mm ___ before or ___ after the zero displacement plane.
18. Did the ejection headform displace more than 100 mm beyond the zero displacement plane?
 No ___ – PASS; Yes ___ – FAIL

REMARKS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

LABORATORY NOTICE OF APPARENT TEST FAILURE TO OVSC

FMVSS NO.: _____ TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: _____ DELIVERY 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: _____

18. TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

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

REMARKS:

APPENDIX A

Ejection Mitigation Impactor Headform Parts List and Drawing Package

Parts List
Ejection Mitigation Headform Drawing Package
December 2010

Prepared by:
OFFICE OF CRASHWORTHINESS STANDARDS
and
VEHICLE RESEARCH and TEST CENTER
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Parts/Drawings List
Ejection Mitigation Headform

December 2010

Order	NUMBER	DESCRIPTION	REV	NO. SHT	QTY.
1	92041-101	Skull/Headskin Assembly		2	1
2	92041-100	Head Skin and Skull		1	1
3	92041-102	Skull		2	1
4	9000002	Insert, Keensert RKK 1/4-20 x 3/8	-	-	8
5	92041-103	Headskin		2	1
6	92041-104	Backplate		1	1
7	9000144	Screw, SHCS 1/4-20 x 5/8	-	-	4

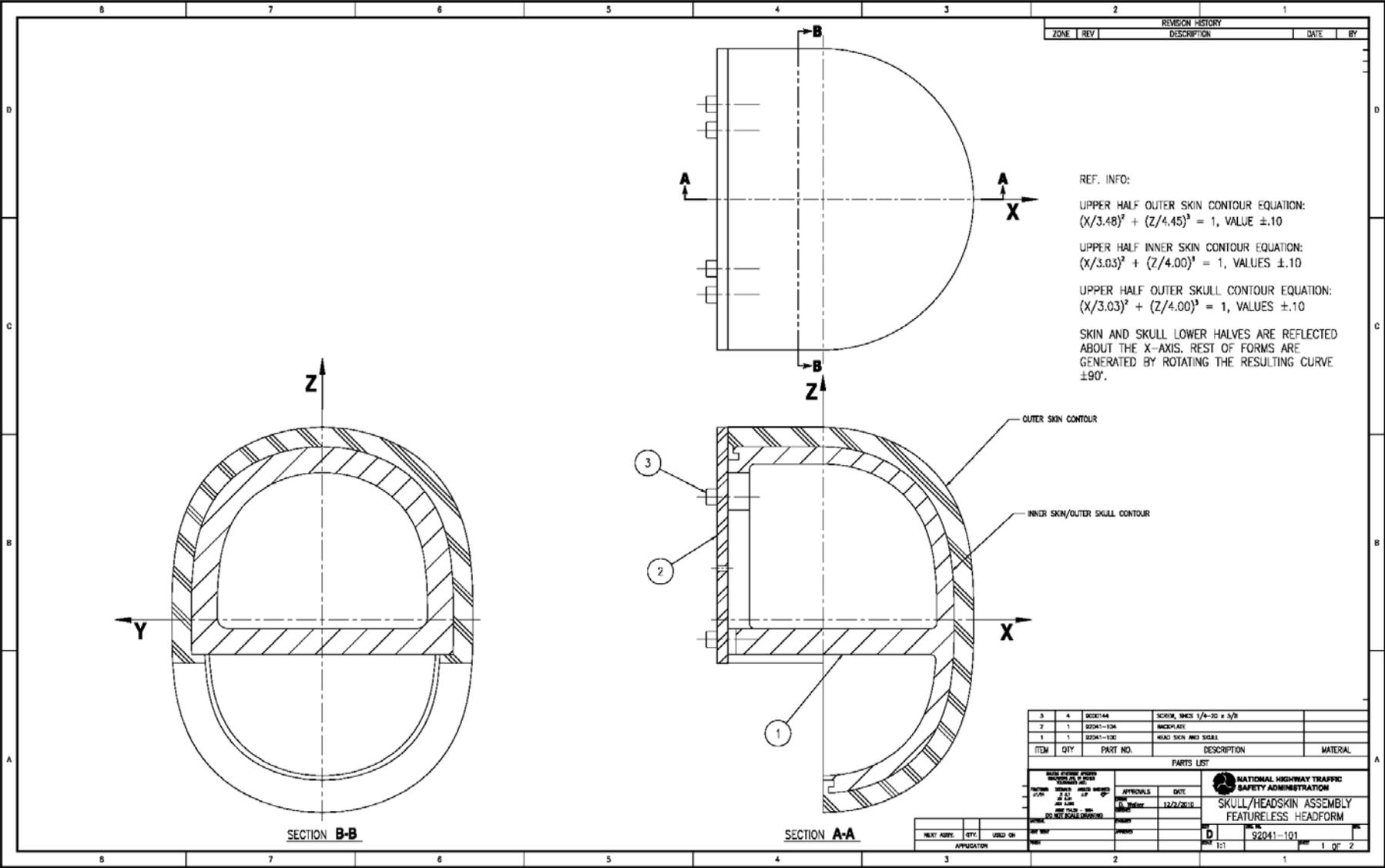
1. No drawings for hardware.

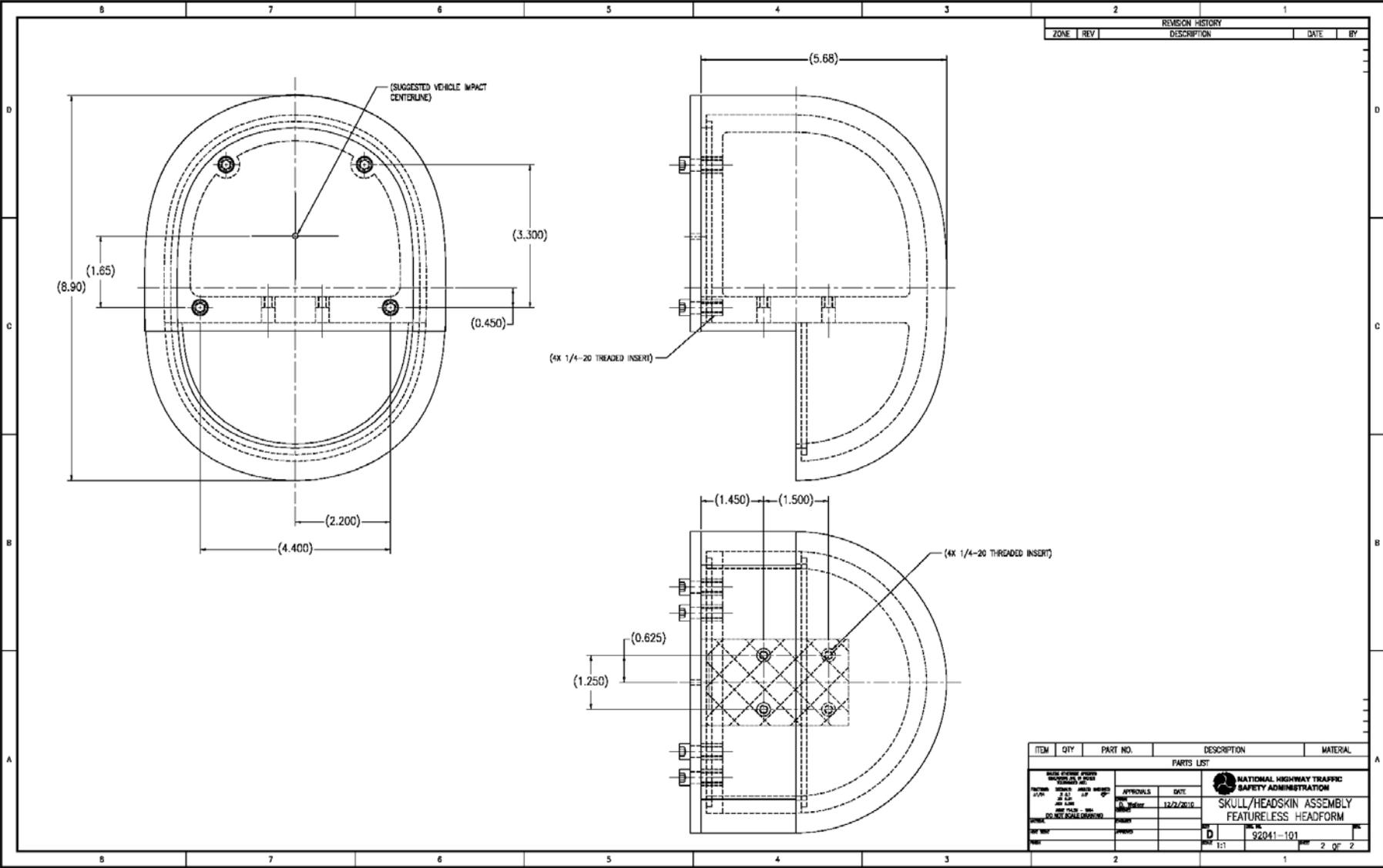
Page 2 of 2

**Parts List and Drawings
Ejection Mitigation Headform Drawing Package**

December 2010

**Prepared by:
OFFICE OF CRASHWORTHINESS STANDARDS
and
VEHICLE RESEARCH and TEST CENTER
NATIONAL HIGHWAY TRAFFIC SAFETY
ADMINISTRATION**



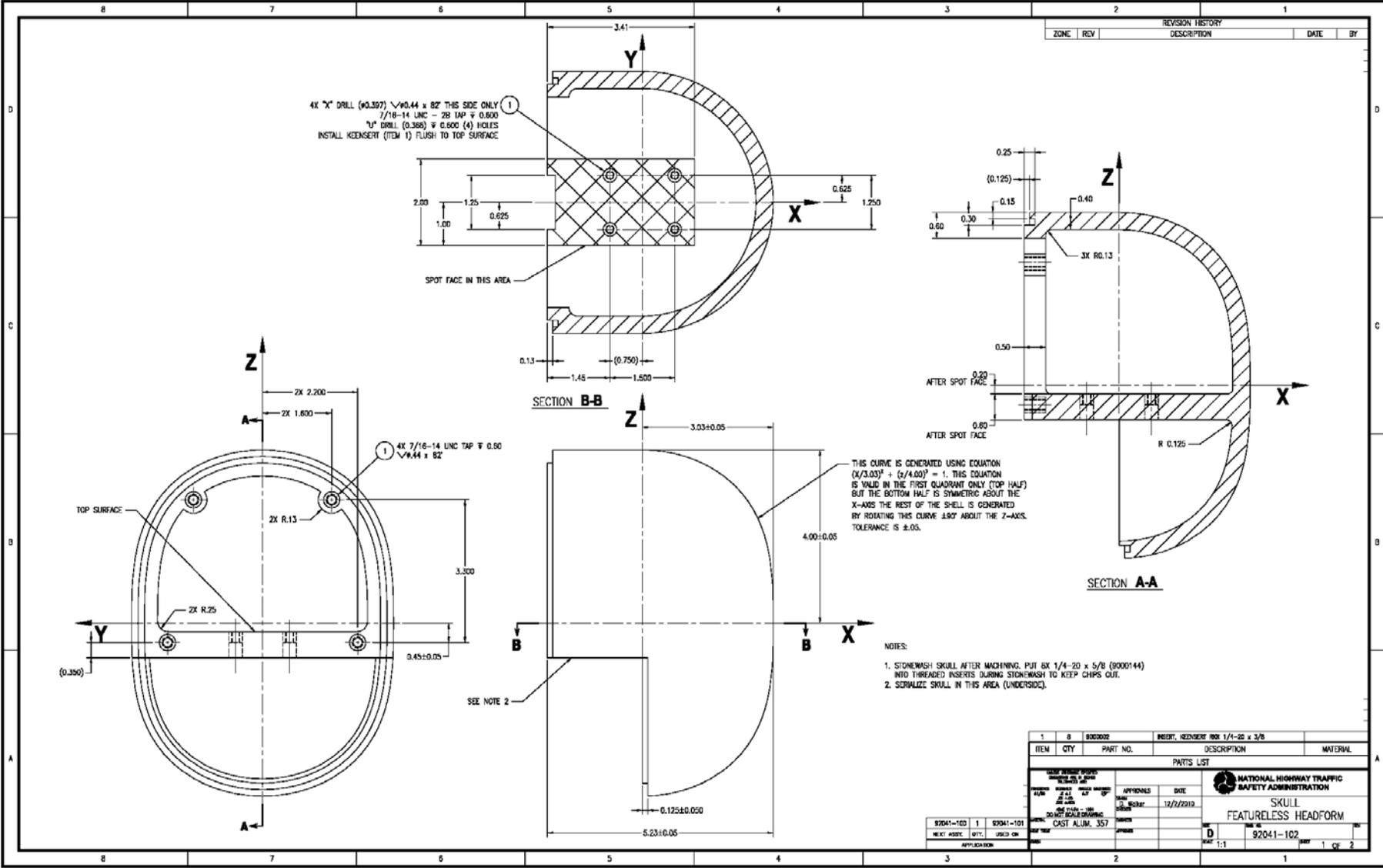


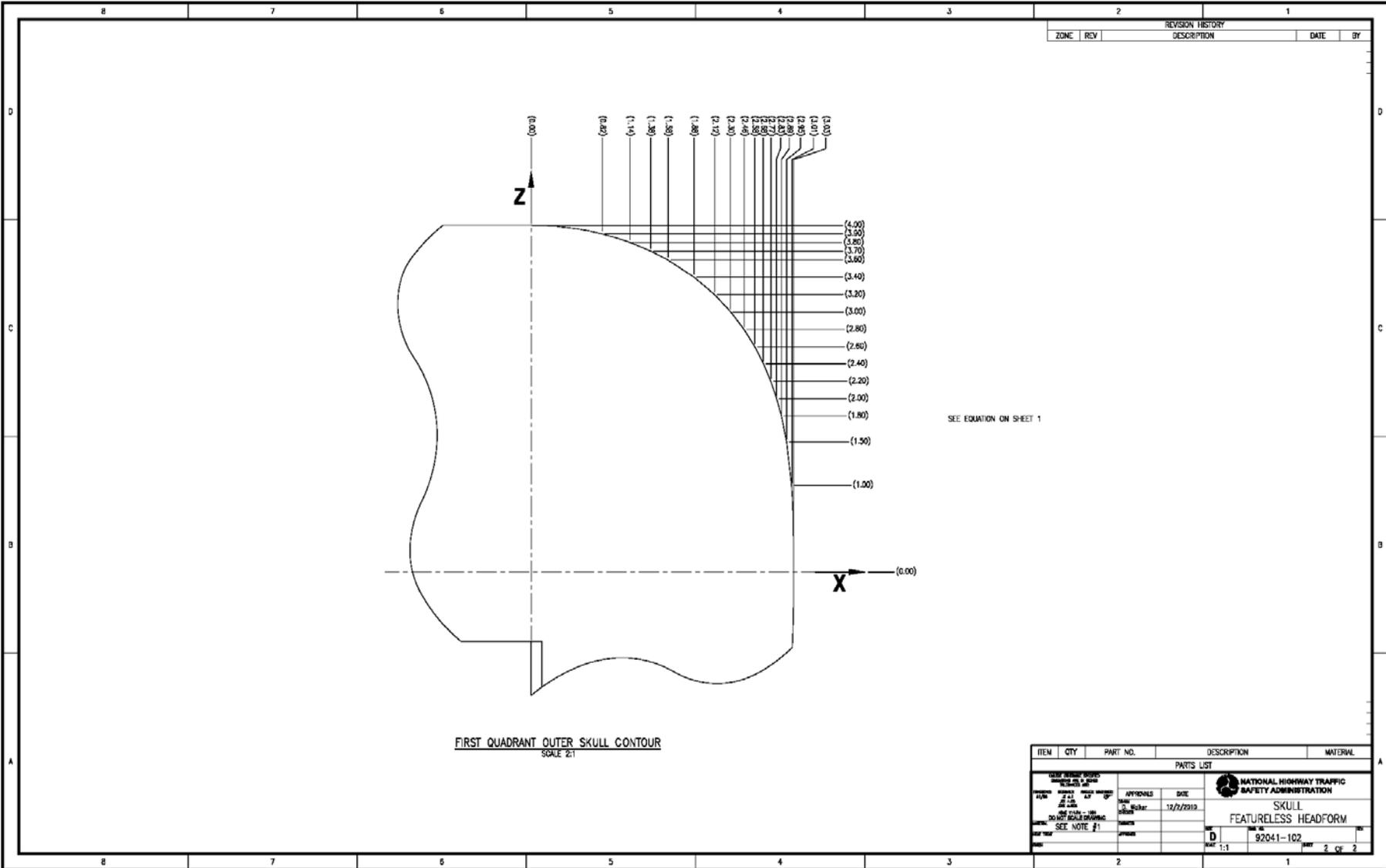
8	7	6	5	4	3	2	1
						REVISION HISTORY	
						ZONE	REV
						DESCRIPTION	DATE
						BY	
D							D
C							C
B							B
A							A
8	7	6	5	4	3	2	1

THIS ASSEMBLY IS USED IN THE COMPLETE HEAD ASSEMBLY 92041-101
 A HEADSKIN IS MOLDED PER DWG. 92041-103 AND IT IS ASSEMBLED TO
 SKULL 92041-102. THE ASSEMBLY IS SHOWN ON DWG. 92041-101. DETAILS
 OF THE SKULL ARE ON DWG. 92041-102 AND DETAILS OF THE HEADSKIN
 ARE ON DWG. 92041-103.

2	1	92041-103	HEADSKIN
1	1	92041-102	SKULL
ITEM	QTY	PART NO.	DESCRIPTION
PARTS LIST			
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION			
HEAD SKIN AND SKUL			DATE
FEATURELESS HEADFORM			12/2/2012
D			
92041-100			REV
NONE			1 OF 1

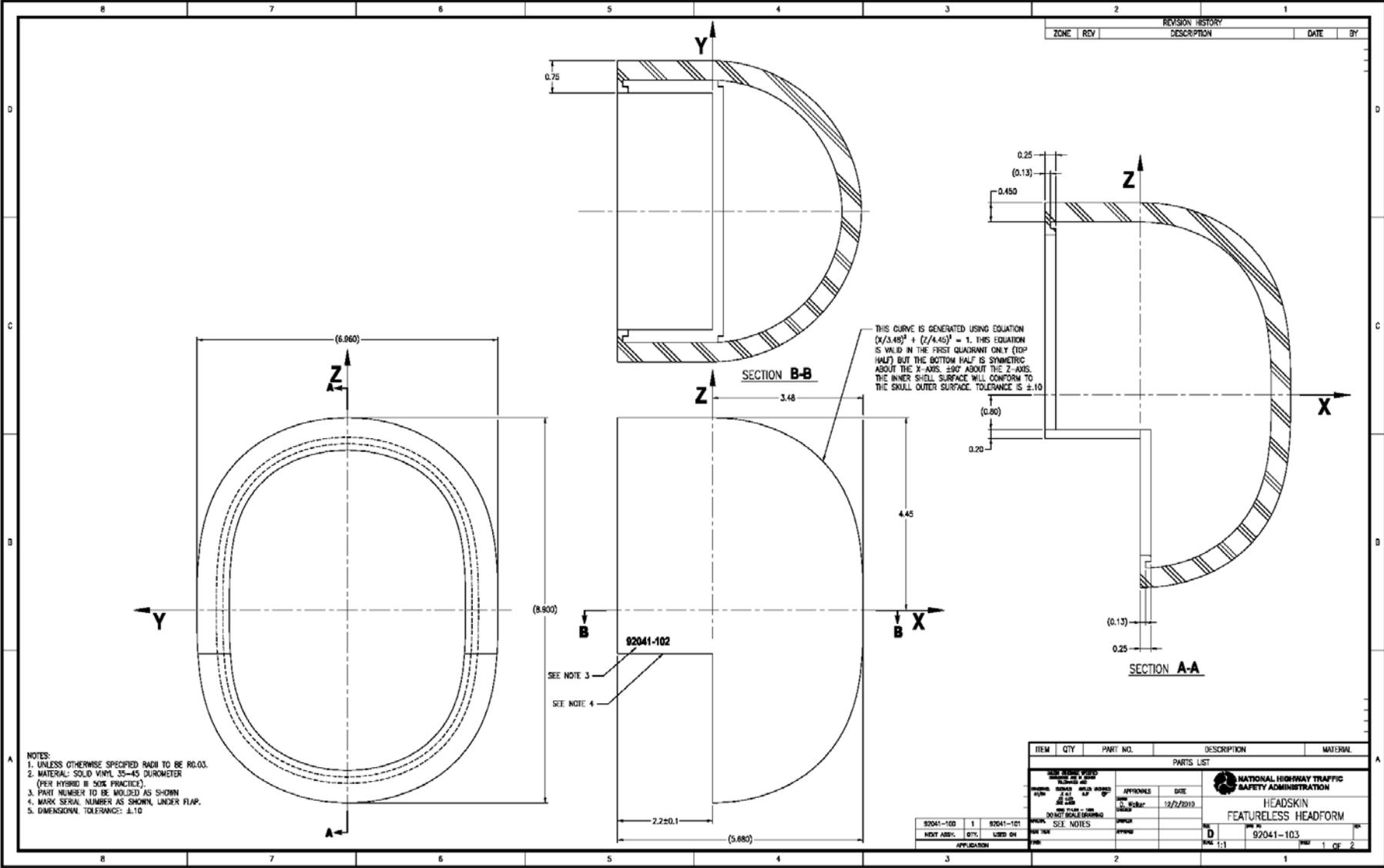
92041-101	1	92041-101	APPLICATION
NEXT ASSY	QTY	USED ON	PART

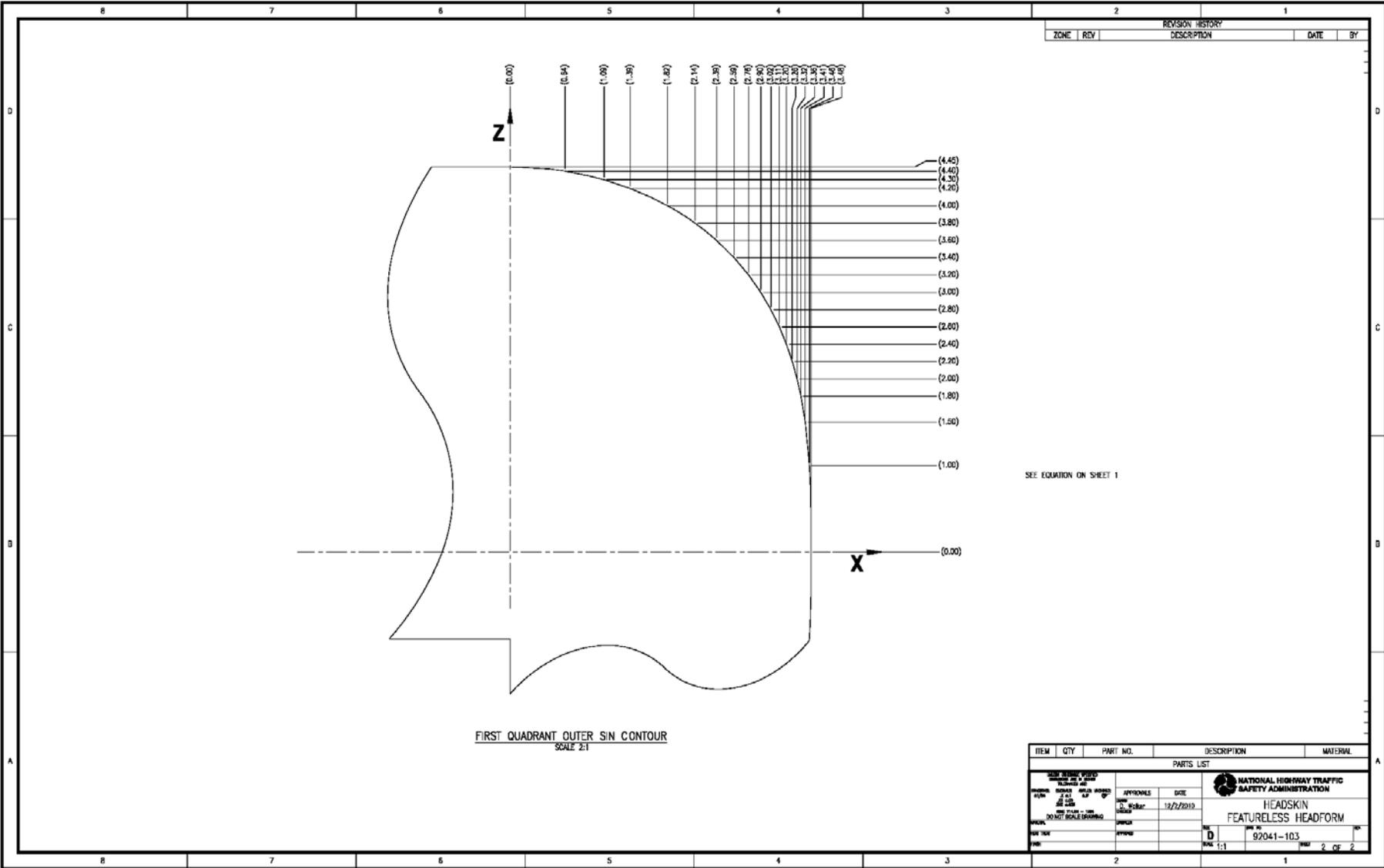


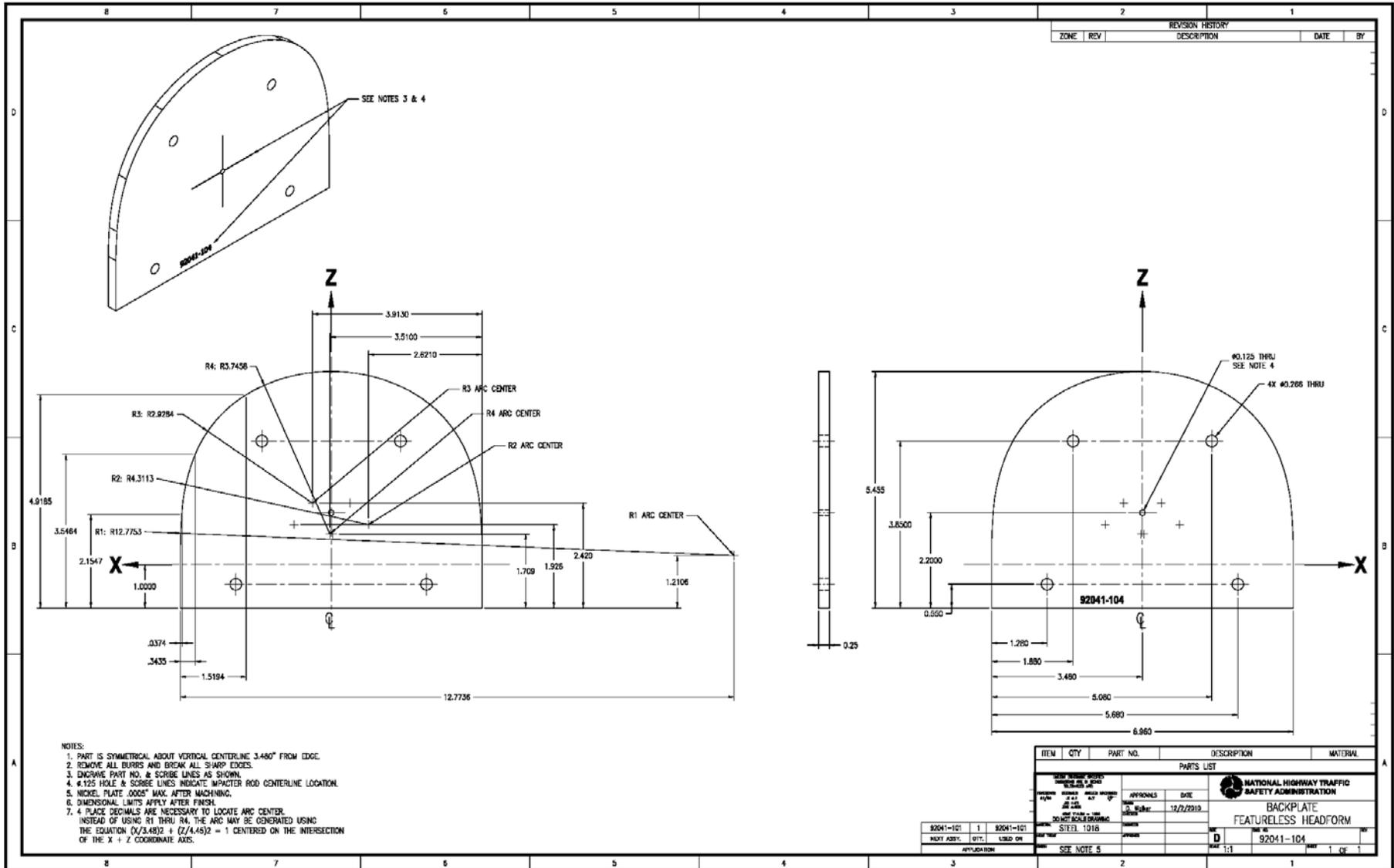


REVISION HISTORY			
ZONE	REV	DESCRIPTION	DATE

ITEM	QTY	PART NO.	DESCRIPTION	MATERIAL
PARTS LIST				
<small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</small>			NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	
<small>APPROVALS</small> DATE: 12/22/2019 BY: [Signature] TITLE: [Title]	SKULL FEATURELESS HEADFORM			
<small>DO NOT SCALE DRAWING</small> SEE NOTE #1	PART NO: 92041-102 MAT: 1:1 PART 2 OF 2			







APPENDIX B

IMPACTOR PERFORMANCE QUALIFICATIONS

DATA SHEET B
IMPACTOR PERFORMANCE QUALIFICATIONS

NHTSA No. _____
Laboratory: _____

Test Date: _____
Test Technician(s): _____

STATIC DEFLECTION

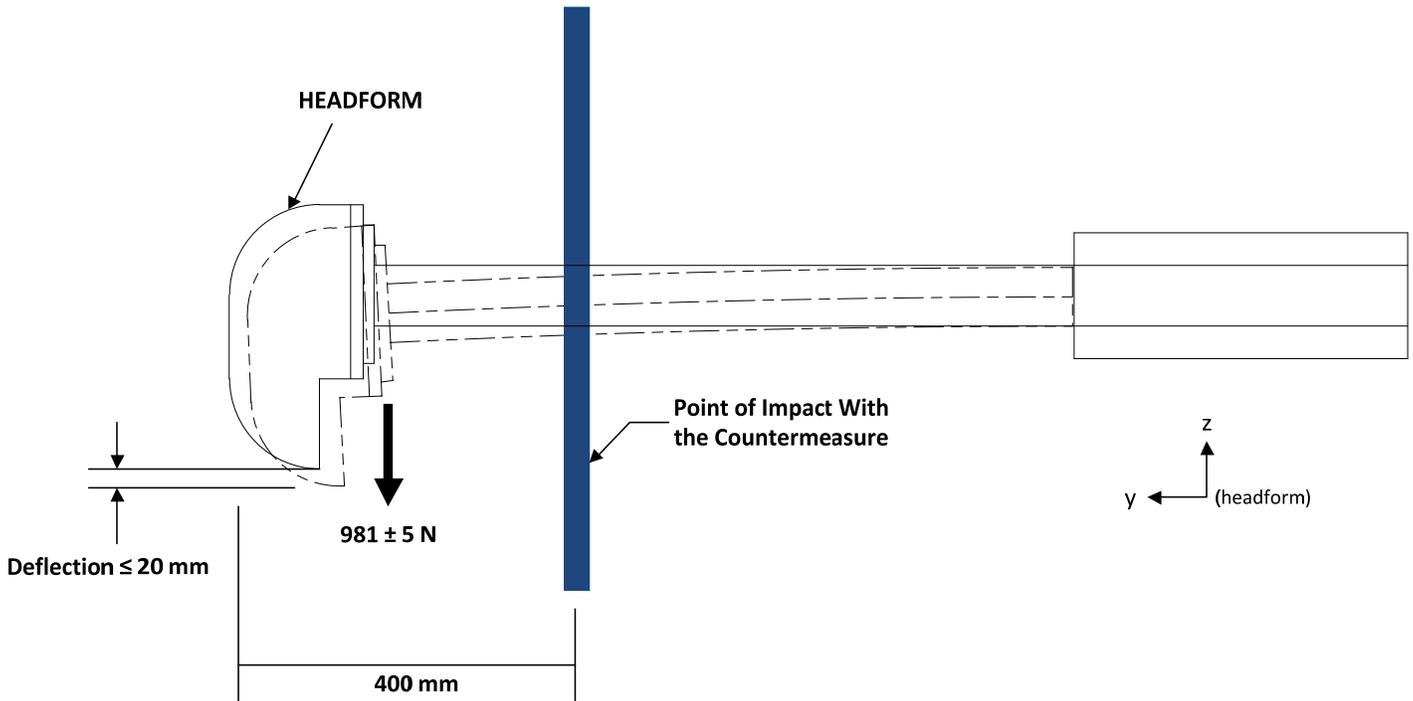


Figure B-1

- ___ 1. The ejection impactor has a mass of $18 \text{ kg} \pm 0.05 \text{ kg}$. The shaft is parallel to the y axis of the headform (S7.1).
- ___ 2. The ejection headform has the dimensions shown in Figure 2 of this test procedure and is depicted in Ejection Mitigation Headform Drawing Package (Appendix A), dated December 2010 (incorporated by reference; see § 571.5) (S7.1.1).

STATIC DEFLECTION

- ___ 3. The ejection headform must not deflect more than 20 mm (x-z plane) when a $981 \text{ N} \pm 5 \text{ N}$ force is applied in a $-z$ direction in a vehicle vertical longitudinal plane through the y axis of the headform and no more than 5 mm rear of the posterior surface of the headform. Illustrated in Figure B-1. The deflection measurement must be made with the ejection impactor attached to the ejection propulsion mechanism and extended 400 mm outboard of the theoretical point of impact with the countermeasure (S7.2). Deflection: _____ mm. Also record on Table B – Impactor Performance Qualifications Summary. Is the deflection 20 mm or less?
___ Yes, Pass ___ No, Fail.

___4. The ejection headform must not deflect more than 20 mm (x-z plane) when a $981\text{ N} \pm 5\text{ N}$ force is applied in a +z direction in a vehicle vertical longitudinal plane through the y axis of the headform and no more than 5 mm rear of the posterior surface of the headform. The deflection measurement must be made with the ejection impactor attached to the ejection propulsion mechanism and extended 400 mm outboard of the theoretical point of impact with the countermeasure (S7.2). Deflection: _____ mm. Also record on Table B – Impactor Performance Qualifications Summary. Is the deflection 20 mm or less?

___ Yes, Pass ___ No, Fail.

___5. The ejection headform must not deflect more than 20 mm (x-z plane) when a $981\text{ N} \pm 5\text{ N}$ force is applied in a -x direction in a vehicle vertical longitudinal plane through the y axis of the headform and no more than 5 mm rear of the posterior surface of the headform. The deflection measurement must be made with the ejection impactor attached to the ejection propulsion mechanism and extended 400 mm outboard of the theoretical point of impact with the countermeasure (S7.2). Deflection: _____ mm. Also record on Table B – Impactor Performance Qualifications Summary. Is the deflection 20 mm or less?

___ Yes, Pass ___ No, Fail.

___6. The ejection headform must not deflect more than 20 mm (x-z plane) when a $981\text{ N} \pm 5\text{ N}$ force is applied in a +x direction in a vehicle vertical longitudinal plane through the y axis of the headform and no more than 5 mm rear of the posterior surface of the headform. The deflection measurement must be made with the ejection impactor attached to the ejection propulsion mechanism and extended 400 mm outboard of the theoretical point of impact with the countermeasure (S7.2). Deflection: _____ mm. Also record on Table B – Impactor Performance Qualifications Summary. Is the deflection 20 mm or less?

___ Yes, Pass ___ No, Fail.

FRictional CHARACTERISTICS

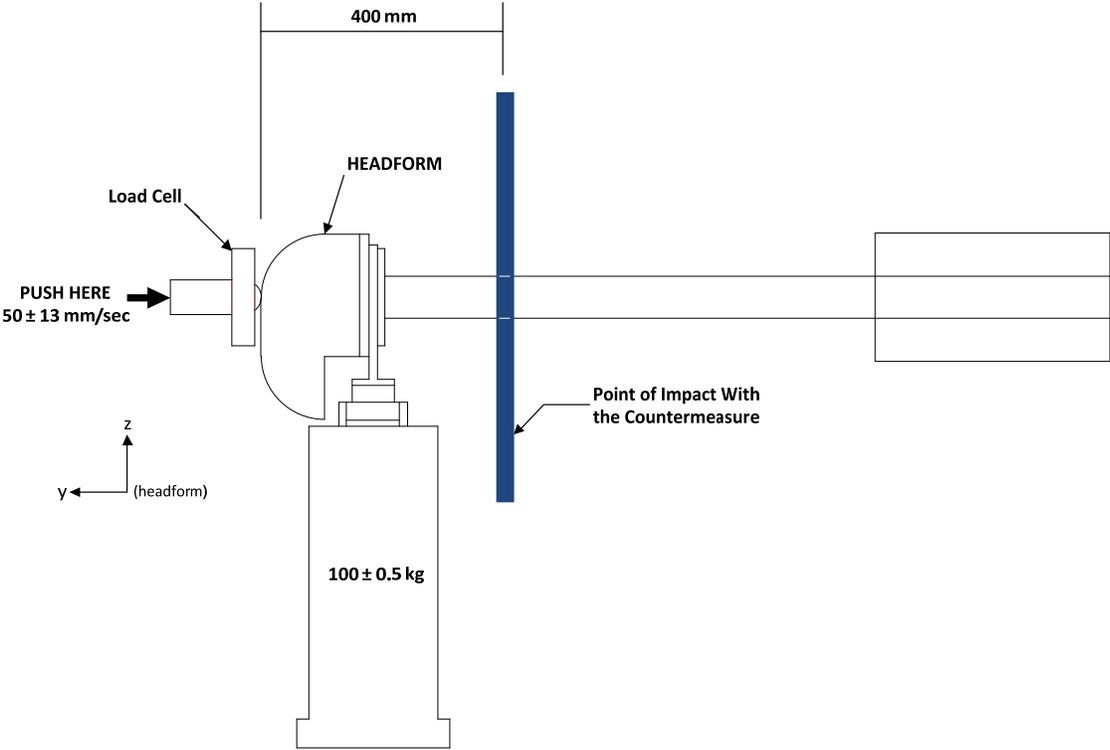


Figure B-2

FRictional CHARACTERISTICS

7. Measure the average force necessary to move the ejection impactor 200 mm rearward into the ejection propulsion mechanism at a rate of 50 ± 13 mm per second, starting at a point 400 mm outboard of the theoretical point of impact with the countermeasure. Illustrated in Figure B-2. The measurement must be made with the $100 \text{ kg} \pm 0.5 \text{ kg}$ mass attached to the impactor with its center of gravity passing through the axis of motion and no more than 5 mm rear of the posterior surface of the headform, exclude the force measured over the first 25 mm of travel and recorded at a minimum frequency of 100 Hz. The attached mass assembly must be rigid so as not to swing. Perform the measurement a total of five consecutive times. Run a total of five (5) tests. Calculate the average of Force 1 through Force 5.

Force 1: _____ N	Std Deviation: _____	Rate: _____ mm/sec
Force 2: _____ N	Std Deviation: _____	Rate: _____ mm/sec
Force 3: _____ N	Std Deviation: _____	Rate: _____ mm/sec
Force 4: _____ N	Std Deviation: _____	Rate: _____ mm/sec
Force 5: _____ N	Std Deviation: _____	Rate: _____ mm/sec

Average Force (0 degrees): _____ N

Also record force and standard deviation values on Table B – Impactor Performance Qualifications Summary.

___8. Rotate the ejection impactor and any associated bearings and bearing housing 90 degrees (+x) about the headform y axis and secure it. Measure the average force necessary to move the ejection impactor 200 mm rearward into the ejection propulsion mechanism at a rate of 50 ± 13 mm per second, starting at a point 400 mm outboard of the theoretical point of impact with the countermeasure. The measurement must be made with the $100 \text{ kg} \pm 0.5 \text{ kg}$ mass attached to the impactor with its center of gravity passing through the axis of motion and no more than 5 mm rear of the posterior surface of the headform, exclude the force measured over the first 25 mm of travel and recorded at a minimum frequency of 100 Hz. Run a total of five (5) tests. Calculate the average of Force 1 through Force 5.

Force 1: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 2: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 3: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 4: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 5: ___N	Std Deviation: ___	Rate: ___mm/sec

Average Force (90 degrees): ___N

Also record force and standard deviation values on Table B – Impactor Performance Qualifications Summary.

___9. Rotate the ejection impactor and any associated bearings and bearing housing 180 degrees (-z) about the headform y axis and secure it. Measure the average force necessary to move the ejection impactor 200 mm rearward into the ejection propulsion mechanism at a rate of 50 ± 13 mm per second, starting at a point 400 mm outboard of the theoretical point of impact with the countermeasure. The measurement must be made with the $100 \text{ kg} \pm 0.5 \text{ kg}$ mass attached to the impactor with its center of gravity passing through the axis of motion and no more than 5 mm rear of the posterior surface of the headform, exclude the force measured over the first 25 mm of travel and recorded at a minimum frequency of 100 Hz. Run a total of five (5) tests. Calculate the average of Force 1 through Force 5.

Force 1: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 2: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 3: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 4: ___N	Std Deviation: ___	Rate: ___mm/sec
Force 5: ___N	Std Deviation: ___	Rate: ___mm/sec

Average Force (180 degrees): ___N

Also record force and standard deviation values on Table B – Impactor Performance Qualifications Summary.

___10. Rotate the ejection impactor and any associated bearings and bearing housing 270 degrees (-x) about the headform y axis and secure it. Measure the average force necessary to move the ejection impactor 200 mm rearward into the ejection propulsion mechanism at a continuous rate of 50 ± 13 mm per second, starting at a point 400 mm outboard of the theoretical point of impact with the countermeasure. The measurement must be made with the $100 \text{ kg} \pm 0.5 \text{ kg}$ mass attached to the impactor with its center of gravity passing through the axis of motion and no more than 5 mm rear of the posterior surface of the headform, exclude the force measured

over the first 25 mm of travel and recorded at a minimum frequency of 100 Hz. Run a total of five (5) tests. Calculate the average of Force 1 through Force 5.

Force 1: ____ N Std Deviation: ____ Rate: ____ mm/sec
 Force 2: ____ N Std Deviation: ____ Rate: ____ mm/sec
 Force 3: ____ N Std Deviation: ____ Rate: ____ mm/sec
 Force 4: ____ N Std Deviation: ____ Rate: ____ mm/sec
 Force 5: ____ N Std Deviation: ____ Rate: ____ mm/sec

Average Force (270 degrees): ____ N

Also record force and standard deviation values on Table B – Impactor Performance Qualifications Summary.

- ___ 11. Calculate and record the dynamic coefficient of friction (μ_k) for the maximum of the force average values, determined in 7 thru 10 above, where

$$\mu_k = F_{\text{max of force avg (N)}} / 9.81 \text{ m/sec}^2 (\text{Mass}_{\text{ejection impactor (kg)}} + \text{Mass}_{\text{attached (kg)}})$$

Mass_{ejection impactor}: ____ kg Mass_{attached}: ____ kg $\mu_k =$ _____
 Is $\mu_k \leq 0.25$? ____ Yes, Pass ____ No, Fail.

TARGETING ACCURACY

- ___ 12. Determine the stroke distance “D,” along the axis of travel from the impactor’s launch point to a theoretical point of impact with the countermeasure, to obtain a speed of 20 ± 0.5 km/h. Determine that the ejection mitigation test device can deliver the ejection impactor targeting point to within ± 10 mm of an axis normal to and passing through the target center, as the impactor passes through a zone defined by vertical longitudinal planes 50 mm forward and rearward of “D” (S7.4).

Stroke Distance “D”: _____ mm Speed: ____ km/h
 Ejection Impactor Targeting Point Impact Relative to Target Center: _____ mm
 Is the impact within ± 10 mm of target center? ____ Yes, Pass ____ No, Fail

___13. Determine the stroke distance “D,” along the axis of travel from the impactor’s launch point to a theoretical point of impact with the countermeasure, to obtain a speed of 16 ± 0.5 km/h. Determine that the ejection mitigation test device can deliver the ejection impactor targeting point to within ± 10 mm of an axis normal to and passing through the target center, as the impactor passes through a zone defined by vertical longitudinal planes 50 mm forward and rearward of “D” (S7.4).

Stroke Distance “D”: _____ mm Speed: _____ km/h
 Ejection Impactor Targeting Point Impact Relative to Target Center: _____ mm
 Is the impact within ± 10 mm of target center? _____ Yes, Pass _____ No, Fail

_____ I certify that I have read and performed each instruction. _____ Date

		Run	(+) Z (0 degrees)	(+) X (90 degrees)	(-) Z (180 degrees)	(-) X (270 degrees)	Maximum
Headform Radial Deflection (mm)	D	1					
Loaded Dynamic Friction Force (N) (nominal force needed to maintain motion)	F(d)	1					
		2					
		3					
		4					
		5					
		Avg.					
	μ_k	-					
	F(dev)	1					
		2					
		3					
		4					
5							

Table B - Impactor Performance Qualifications Summary