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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE FOR THE NEW CAR ASSESSMENT PROGRAM SIDE IMPACT MOVING DEFORMABLE BARRIER TEST



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LABORATORY TEST PROCEDURES

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**REVISION CONTROL LOG
FOR NCAP LABORATORY
TEST PROCEDURES**

SIDE NCAP MOVING DEFORMABLE BARRIER TEST

TEST PROCEDURE		Side NCAP MDB		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00	09/30/2008			Draft procedure.
01	04/09/2009			Minor revisions/clarifications.
02	04/22/2009			Minor revisions.
03	01/11/2010			Amended collected channels. Additional minor revisions/clarifications.
04	06/23/2010			Seating procedure revision. Appendix D revision. As-Delivered Weight directions amended.
05	08/30/2011			Revisions/clarifications. Appendices A, B, and E revised.
06	05/21/2012			Revisions/clarifications to main procedure. Appendices C and E revised. Added Appendix G.
07	07/23/2012			Appendices A and E revised.
08	08/09/2012			Appendix C (seat belt placement) revised.
09	09/19/2012			Revisions to main procedure and Appendix E (photographs, calibration, Data Sheet 1).

1. PURPOSE AND APPLICATION

The New Car Assessment Program (NCAP) moving deformable barrier side impact test procedure is based on Section 7 of Federal Motor Vehicle Safety Standard (FMVSS) No. 214. Whereas the primary objective of the FMVSS No. 214 is to reduce the risk of serious and fatal injury to occupants of passenger vehicles in side impact crashes, the primary purpose of the NCAP side impact program is to provide consumers with comparative vehicle side impact protection information in their vehicle purchase decision. This will provide an incentive for vehicle manufacturers to design safer vehicles.

The Office of Crashworthiness Standards (OCWS) provides contracted laboratories with Laboratory Test Procedures, which serve as guidelines for obtaining crash test data. The data are used to support OCWS consumer information program in providing consumers with comparative crash test information. The purpose of the OCWS Laboratory Test Procedures is to present a uniform testing and data recording format and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OCWS Laboratory Test Procedure to be in conflict with any referenced materials or observing any deficiencies in a Laboratory Test Procedure is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of testing.

The OCWS Laboratory Test Procedures 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 crash test data. These Laboratory Test Procedures do not constitute an endorsement or recommendation for use of any product or method. However, the application of any such testing technique or equipment is subject to prior approval by the COTR.

NOTE: *The OCWS Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct tests for the OCWS, are not rules, regulations or NHTSA interpretations regarding the meaning of an associated FMVSS. The Laboratory Test Procedures are not intended to limit the requirements of the applicable FMVSS(s).*

In addition, the Laboratory Test Procedures may be modified by the OCWS at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests remain within the scope of the contract and are performed in a manner consistent with the Side NCAP test protocol and the applicable parts of S7 of FMVSS No. 214, "Moving Deformable Barrier (MDB) Requirements."

2. GENERAL REQUIREMENTS

For all tests conducted using this NCAP side impact moving deformable barrier test procedure, the contract laboratories are directed to use an impact speed of 61.90 km/h \pm 0.80 km/h. This is 8 km/h greater than the 53.9 km/h impact test speed required in the FMVSS No. 214D. The 61.90 km/h crash test may be viewed as an indicant test of the requirements of the FMVSS No. 214D.

The test is designed to simulate a 90-degree side impact where the impacting vehicle (the moving deformable barrier, or MDB) speed is twice that of the target vehicle. Since the target vehicle is stationary in this test, the impacting vehicle's velocity and orientation are adjusted to simulate an impact where both vehicles are moving.

Anthropomorphic testing devices (ATDs), or dummies, will be positioned in the target vehicle to assess its performance. The two ATDs chosen for this test are the EuroSID2 with rib extensions (ES-2re) and the SID-IIs, which represent a 50th-percentile male and a 5th-percentile female, respectively. ATD positioning shall be determined by the COTR.

When tested according to the test conditions outlined in this test procedure, each vehicle's occupants shall be evaluated using the following criteria:

2.1. *FMVSS No. 214 INJURY CRITERIA – ES-2re MALE DUMMY*

- A. HEAD INJURY CRITERION (HIC36) - The head injury criterion is computed from the resultant acceleration (A_R) in g units at the dummy head's center of gravity. The following expression describes HIC36:

$$HIC = \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} A_R dt \right]^{2.5} (t_2 - t_1)$$

where $A_R = [A_x^2 + A_y^2 + A_z^2]^{1/2}$ and t_2 and t_1 are any two points in time during the impact event which are separated by no more than 36 milliseconds.

The HIC36 shall not exceed **1000**.

- B. CHEST INJURY CRITERION - The chest injury criterion measured is the maximum chest deflection in any of the dummy's three ribs. The maximum rib deflection may not exceed **44 mm (1.73 inches)**.
- C. ABDOMINAL INJURY CRITERION – The abdominal injury criterion measured is the total abdominal force. This is the sum of the front, middle, and rear abdominal forces. The maximum total abdominal force shall not exceed **2,500 N (562 lbs)**.
- D. PELVIS INJURY CRITERION -- The pelvis injury criterion is the measured peak pubic symphysis force. This force shall not exceed **6,000 N (1350 lbs)**.

2.2. *FMVSS No. 214 INJURY CRITERIA – SID-IIs FEMALE DUMMY*

- A. HEAD INJURY CRITERION (HIC36) - The head injury criterion is computed from the resultant acceleration (A_R) in g units at the dummy head's center of gravity. The following expression describes HIC36:

$$HIC = \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} A_R dt \right]^{2.5} (t_2 - t_1)$$

where $A_R = [A_x^2 + A_y^2 + A_z^2]^{1/2}$ and t_2 and t_1 are any two points in time during the impact event which are separated by not more than 36 milliseconds.

The HIC shall not exceed **1000**.

- B. LOWER SPINE INJURY CRITERION – The injury criterion for the lower spine is the peak resultant lower spine acceleration. This acceleration may not exceed **82 g's**.
- C. PELVIS INJURY CRITERION – The sum of the acetabular and iliac pelvic forces may not exceed **5,525 N (1,242 lb)**.

2.3. TEST VEHICLE ASSESSMENT

- A. DOOR OPENING CRITERION - Any side door that is struck by the moving deformable barrier may not separate totally from the vehicle.

Any door (including a rear hatchback or tailgate) that is not struck by the moving deformable barrier must meet the following requirements;

- (1) The door shall not disengage from the latched position.
- (2) The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle.
- (3) Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

NOTE: Examination results must be recorded in the Final Test Report.

- B. FMVSS NO. 301 - STODDARD SPILLAGE

- (1) DUE TO BARRIER CRASH - Stoddard spillage shall not exceed 28 g from impact until motion of the vehicle has ceased, and shall not exceed a total of 142 g in the 5-minute period following cessation of motion. For the subsequent period of time that elapses prior to the static rollover, fuel spillage during any one-minute interval shall not exceed 28 g.
- (2) DUE TO STATIC ROLLOVER - Stoddard spillage in any rollover test, from the onset of rotational motion, shall not exceed a total of 142 g for the first five minutes of testing at each successive 90 degree increment. For the remaining test period, at each increment of 90 degrees, Stoddard spillage during any one minute interval shall not exceed 28 g.

NOTE: All results must be recorded in the Final Test Report.

- C. FMVSS NO. 305 (IF APPLICABLE) - ELECTROLYTE SPILLAGE, ELECTRICAL ISOLATION, AND BATTERY RETENTION

The test vehicle must meet the requirements outlined in CFR §571.305 S5.1, S5.2, and S5.3.

NOTE: All results must be recorded in a supplemental test report to be submitted along with the Final Test Report for this side NCAP MDB test.

3. SECURITY

The Contractor must provide appropriate security measures to protect the OCWS test vehicles, dummies, deformable honeycomb barrier face units and any government-furnished property (GFP) from unauthorized personnel during the testing program. The Contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of test vehicles and deformable honeycomb barrier units. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two business days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

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

The tested vehicles and tested honeycomb barrier faces, protected from the elements, shall be retained by the test contractor for a MINIMUM of 60 days so that OCWS personnel can be given an inspection opportunity.

NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE TESTING PROGRAM, SHALL BE ALLOWED TO WITNESS ANY OCWS VEHICLE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR. IT IS THE CONTRACTOR'S RESPONSIBILITY TO SECURE THE TEST SITE AREA DURING A TEST AND TO SHIELD THE IMPACT AREA FROM THE PUBLIC VIEW BY THE USE OF CANVAS OR OTHER BLOCKING DEVICES.

3.1 RULES FOR CONTRACTORS

- A. No vehicle manufacturer's representative(s) or anyone other than the Contractor's personnel working on the OCWS Contracts and NHTSA personnel shall be allowed to inspect OCWS vehicles or witness vehicle preparations without prior permission of the OCWS. Such permission can never be assumed.
- B. All communications with vehicle manufacturers shall be referred to the OCWS. The Contractor shall not release crash test data without the permission of the OCWS.
- C. Unless otherwise specified, the vehicle manufacturer's representative(s) shall only be authorized to visit the Contractor's test facility on the day that the test is scheduled, and the representative(s) must be escorted by OCWS and/or contractor personnel.
- D. Test vehicle inspection by the vehicle manufacturer's representative(s) shall be limited to 30 minutes prior to the start of vehicle impact test. Post-test inspection shall be limited to 1 hour after contractor personnel have completed their test tasks.
- E. Photographs and videotapes of the test vehicle, associated test equipment and test event shall be allowed. However, test personnel shall not be included in any photographic coverage, and videotaping of vehicle preparation must be approved by OCWS. The Contractor's personnel shall not respond to any questions from the manufacturer's representatives regarding the OCWS test. All questions shall be referred to the COTR, an OCWS representative present at the test site, or to OCWS.
- F. The Contractor shall permit public access to and inspection of the test vehicles and related data during the times specified by the OCWS COTR. OCWS shall advise interested parties that such access and inspection shall be limited to a specified day and specified hours and require prior approval from the Office of Crashworthiness Standards. The Contractor shall refer all visit requests from vehicle manufacturer's representatives to the Office of Crashworthiness Standards. This service shall be included as an incidental part of the crash test program and will not result in any additional cost to the OCWS. The Contractor shall make his own arrangements with interested parties for expenses incurred beyond providing access and inspection services.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle testing area, dummy calibration area, test fixtures and instrumentation in a neat, clean and painted condition. All test instruments shall be 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 testing. Tests shall be completed as required in the contract. The COTR will make adjustments to the crash test

schedule in cases of unusual circumstances, such as inclement weather or difficulty experienced by the agency in the procurement of a particular vehicle make and model.

Scheduling shall be adjusted to permit the agency's other sample motor vehicles to be tested to other FMVSS as may be required by the NHTSA. All testing shall be coordinated to allow monitoring by the COTR.

6. PRETEST REQUIREMENTS

6.1 PROJECT PLAN

The Contractor must submit a detailed test procedure to the COTR before initiating the test program. The procedure must include a step-by-step description of the methodology to be used. The Contractor's test procedure shall contain a complete listing of test equipment and a detailed check-off list. There shall be no contradiction between the OCWS laboratory test procedure and the Contractor's in-house test procedure. The list of test equipment shall include instrument accuracy and calibration dates.

6.2 FACILITY AND EQUIPMENT

A. TEST SURFACE

The test surface on which the vehicle rests prior to impact shall be level, smooth, and of uniform construction. Additionally, the path of the target vehicle after being struck by the MDB must be taken into consideration when determining an adequate smooth, flat concrete area for the side impact test surface. The surface must be large enough to support the test vehicle throughout the event.

B. TOW ROAD

The tow road surface must be straight, level, smooth and of uniform construction. The tow road must have sufficient length to allow for stabilization of the MDB velocity (zero acceleration) prior to side impact with the test vehicle and to allow time for the MDB to be stopped from a test speed of $61.90 \text{ km/h} \pm 0.80 \text{ km/h}$ in case of a test abort.

C. TEST VEHICLE PREPARATION BUILDING/STRUCTURE

A test vehicle preparation building/structure must be constructed if the test surface is located outdoors to enclose the area where the test vehicle is prepared immediately prior to the impact test. This building or structure shall be temperature-controlled and large enough to house the test vehicle, test equipment and instrumentation while allowing room for personnel to move freely about the test vehicle. The temperature inside the test vehicle must be maintained between 20.6° C and 22.2° C (69° F and 72° F) for a minimum of four (4) hours prior to the side impact event.

D. TOW AND GUIDANCE SYSTEM

The tow system must be capable of ensuring that the MDB shall impact the test vehicle at a speed of $61.90 \pm 0.80 \text{ km/h}$. The MDB shall be continuously towed until 305 mm from impact, with a tolerance window of 610 mm to 150 mm. The tow cable attachment device must release from the tow cable within the tolerance window. The MDB velocity measurement shall be taken **after** cable release.

There shall be steel cable attaching the MDB to the tow system. The length of this cable shall not change significantly ($\pm 25 \text{ mm}$) from test to test.

A lateral guidance system is required to assure that the MDB shall impact the side of the target or test vehicle at the designated angle even though the MDB is crabbed to an angle of 27 ± 1 degrees with the forward line of motion. It must also ensure that the MDB impacts the test vehicle within ± 51 mm (2 in) of the vertical impact reference line as specified later in this procedure (**Section 9.4A**).

E. MOVING DEFORMABLE BARRIER

The Contractor shall provide a moving deformable barrier as specified in Part 587 and **Figure 1**. Dimensions of the MDB and a summary of MDB & honeycomb face details are provided below:

- (1) The total weight of the MDB with impact face shall be $1,361 \pm 4.5$ kg [1,356.5 kg - 1,365.5 kg]. The total configured weight of the MDB with impact face, two cameras, camera mounts, light trap vane, and ballast reduced shall be 1,367.6 kg as stated in 49 CFR 587.6.
- (2) The overall length of the MDB with impact face must be $4,115 \pm 25$ mm.
- (3) The overall length of the MDB, excluding impact face, must be 3,632 mm (includes 50.8 mm thick mounting block).
- (4) The overall width of the framework carriage must be 1,251 mm.
- (5) The tracking width (centerline to centerline of front or rear wheels) must be 1,880 mm.
- (6) The wheelbase for the framework carriage must be $2,591 \pm 25$ mm.
- (7) The inertial properties of the MDB (with two cameras and camera mounts and a light trap vane and ballast reduced) are specified. The center of gravity (CG) shall be located:

$$\begin{aligned} X &= 1,123 \pm 25 \text{ mm rear of front axle} \\ Y &= 7.6 \pm 25 \text{ mm left of longitudinal centerline} \\ Z &= 500 \pm 25 \text{ mm from ground} \end{aligned}$$

Moments of inertia (tolerance 5% for testing purposes) are as follows:

$$\begin{aligned} \text{Pitch} &= 2,263 \text{ kg-m}^2 \\ \text{Roll} &= 508 \text{ kg-m}^2 \\ \text{Yaw} &= 2,572 \text{ kg-m}^2 \end{aligned}$$

- (8) The shape of the honeycomb impact face is given by the following measurements:
 - Width = $1,676 \pm 6$ mm
 - Height = 559 ± 6 mm
 - Ground Clearance = 279 ± 3 mm
 - Depth at Bumper Height = 483 ± 6 mm
 - Depth at upper impact face = 381 ± 6 mm
- (9) The force-deflection properties (crush strength) for honeycomb impact face shall be 310 ± 17 kpa and $1,690 \pm 103$ kpa for the bumper.

- (10) The position of all four wheels on the framework carriage must be 27 ± 1 degrees.

All measurements in the following diagram are given in millimeters.

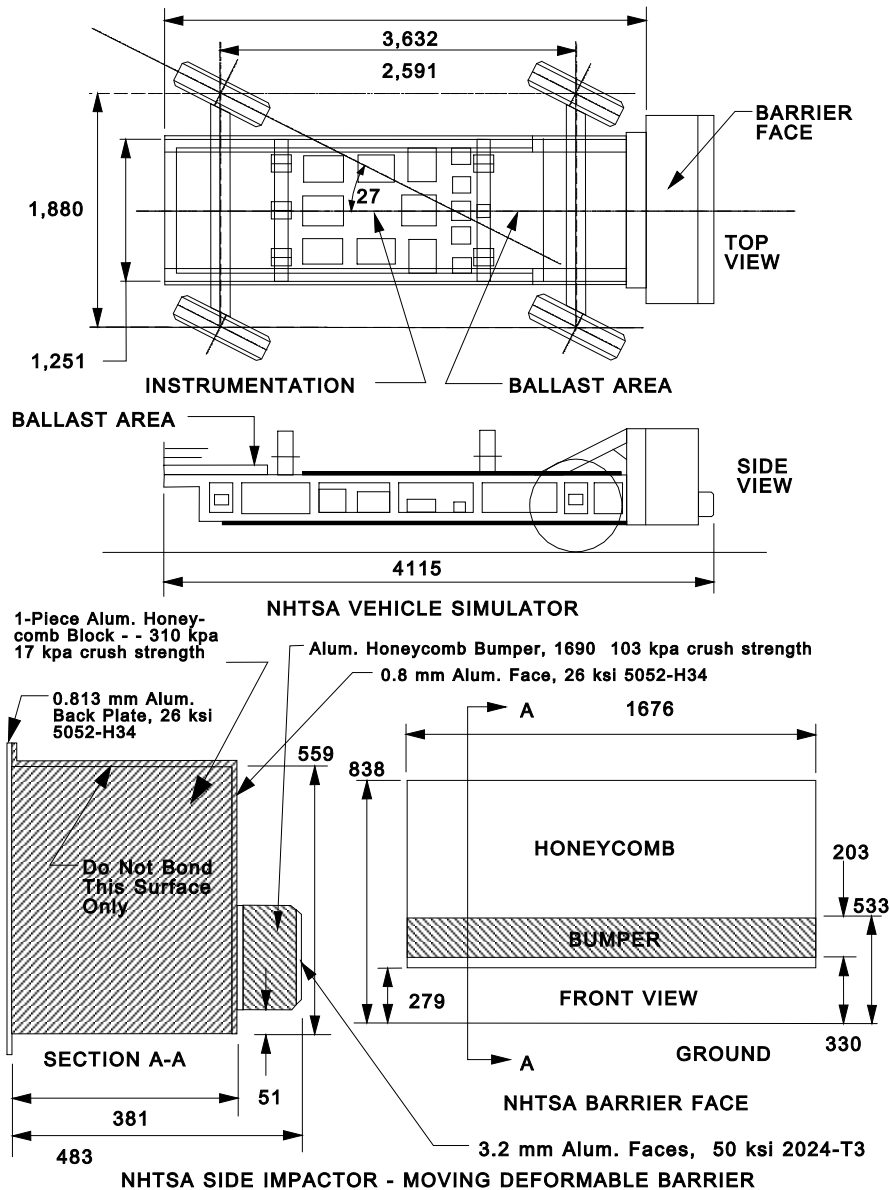


Figure 1 – Moving Deformable Barrier Dimensions

F. MOVING DEFORMABLE BARRIER VELOCITY MEASUREMENT

The MDB shall impact the side of the target or test vehicle at the predetermined speed and the MDB's velocity shall be approximately constant (zero acceleration) for the last 1.5 meters of crabbed forward motion before impact. The reported impact velocity shall take into consideration all of the response characteristics of the entire velocity measurement system utilized in its determination.

Impact velocity shall be measured by no less than two sets of independent timing devices accurate to within ± 0.08 km/h and be calibrated by an instrument traceable to the National Institute of Standards and Technology. The impact velocity measurement recorded closest to the point of impact should be regarded as the primary measurement. The physical locations of the recorded primary and redundant impact velocity readouts should remain the same from test to test; for example, the laboratory may always choose to display the primary speed on the left-hand side, etc. If the display location of the primary and redundant speeds will change, the COTR should be notified prior to the test. Recorded values in these timing devices, displayed to the hundredths, shall be permanently documented in a video or photograph. They should also both be reported on the applicable Data Sheet in **APPENDIX E**.

G. TEST BRAKE ABORT SYSTEM

The MDB shall be equipped with an on-board brake abort system. Abort criteria consists of MDB velocity, data acquisition and instrumentation system readiness, and stability of the MDB on the tow road. It is recommended that the first two criteria are to be automatically monitored by the test control system while the third is manually monitored by the test director. For added safety, a manual abort shall be available from start until the point at which it is impossible to stop the MDB without impacting the test vehicle.

H. ALUMINUM HONEYCOMB BARRIER FACE UNITS

The Contractor is responsible for procuring aluminum honeycomb barrier face units from a honeycomb barrier manufacturer. The Contractor shall conduct a detailed inspection of the honeycomb barrier for shipping damage. The Contractor shall retain a copy of the barrier manufacturer's test data used to certify the barrier face and make it available for review by the COTR. This shall consist of certification information for the 310 kpa and 1,690 kpa barrier face portions. The Contractor shall have the equipment or access to equipment that will allow them to test honeycomb samples according to the test procedure called for in **APPENDIX D**, "Aluminum Honeycomb Crush Strength Certification", to ensure the samples provided meet the requirements of the standard. See **APPENDIX D** for more details.

The COTR must be notified within 24 hours after a group of certified aluminum honeycomb face units have been delivered.

I. STATIC ROLLOVER DEVICE

A static rollover device, provided by the laboratory and used to conduct an FMVSS No. 301 and/or FMVSS No. 305 test, must be capable of rotating the impacted test vehicle about its longitudinal axis, with the axis kept horizontal, to each successive increment of 90°, 180°, and 270° at a uniform rate. Ninety degrees (90°) of rotation must take place within 1 to 3 minutes.

J. DATA ACQUISITION SYSTEM

The contractor-furnished data acquisition system shall have a sufficient number of channels available for recording and processing signals from the test dummies and vehicle sensors starting 30 ms prior to impact. The system must record time histories of the instrumentation specified for each test dummy used in the test. Each data channel shall be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the appropriate section of SAE Recommended Practice SAE J211/1 MAR95. The following schematic (**Figure 2**) depicts a typical configuration for a vehicle and occupant impact test data acquisition system.

TYPICAL VEHICLE AND OCCUPANT IMPACT TEST DATA ACQUISITION SYSTEM

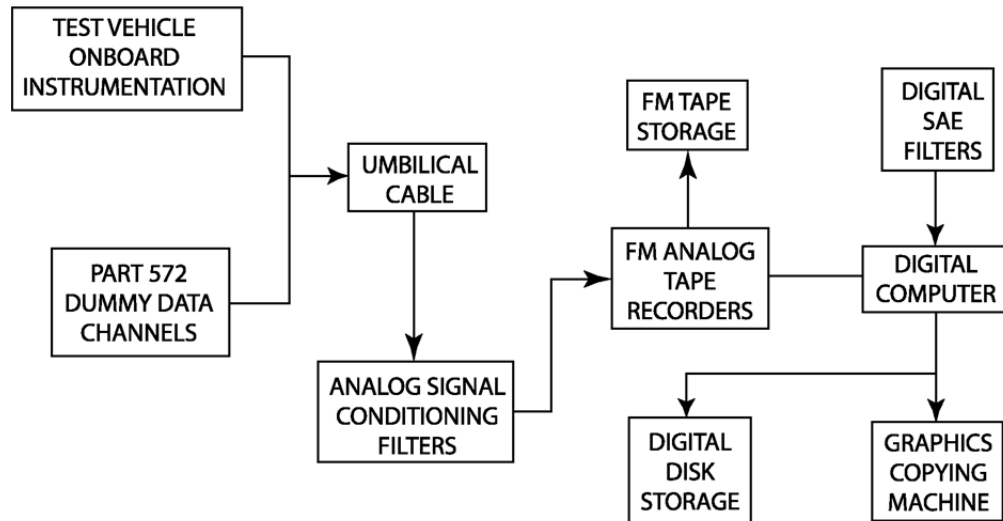


Figure 2 – Typical Vehicle and Occupant Impact Test Data Acquisition System

7. GOVERNMENT-FURNISHED PROPERTY (GFP)

The Government will furnish the Contractor with test vehicles and non-instrumented test dummies. Contractors are required to supply all equipment and instrumentation necessary to properly conduct vehicle side impact testing according to this test procedure. This may include, but is not limited to, the MDB, aluminum honeycomb barrier faces, and instrumentation necessary to collect data from the ATDs, the MDB, and the test vehicle.

7.1 TEST VEHICLES

The Contractor has the responsibility of accepting test vehicles. The Contractor acts on the OCWS's behalf when signing an acceptance of test vehicles. If a vehicle is delivered by a dealer, the Contractor must check to verify the following:

- A. All options listed on the 'window sticker' are present on the test vehicle.
- B. Tires and wheel rims are the same as listed.
- C. There are no dents or other interior or exterior flaws.
- D. The vehicle has been properly prepared and is in running condition.
- E. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
- F. Proper fuel filler cap is supplied on the test vehicle.
- G. Spare tire, jack, lug wrench and tool kit (if applicable) is located in the vehicle cargo area.
- H. The vehicle's odometer confirms that fewer than 200 miles have been driven.
- I. The vehicle is equipped as specified by the COTR.

The Contractor must check for any damage which may have occurred during transit. The COTR is to be notified of any damage prior to preparation of the vehicle for testing.

A "Report of Vehicle Condition" form (refer to **APPENDIX E**) shall be completed by the Contractor and submitted to the COTR as part of the QCPackage.zip file. The upper half of the form is used to describe the vehicle as initially accepted. The lower half of the form provides space for a detailed description of the post-test condition of the vehicle.

7.2 ANTHROPOMORPHIC TESTING DEVICES

An adequate number of fully-instrumented Part 572 Subpart V 5th percentile female small side impact test dummies (SID-IIs) and Part 572 Subpart U 50th percentile male EuroSID2 side impact dummies with rib extensions (ES-2re) will be furnished to the contract laboratory by the OCWS. The dummies shall be stored in an upright, seated position with the weight supported by the internal structure of the pelvis. The dummy's head shall be held upright without supporting the weight of the dummy by using an eye bolt that can be secured in the top of the head. These dummies shall be allowed to soak for 24 hours in an environment that is maintained between **18.9° C and 25.5° C (66° F and 78° F)** and at any relative humidity from 10% to 70% prior to placement in the test vehicle. The Contractor will check the dummy components for damage when performing the calibrations and complete a dummy damage checklist.

The Contractor shall report to the COTR the condition of the dummies in order that replacement parts can be provided or refurbishment can be scheduled.

The Contractor shall keep a detailed record for each test dummy, describing parts replaced and the results of calibration tests.

8. CALIBRATION AND TEST INSTRUMENTATION

8.1 GENERAL REQUIREMENTS

Before the Contractor initiates the OCWS 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, at a minimum:

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions. This ensures 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 **6 months for accelerometers and 12 months for load cells (dummy qualification shall be performed after every test)**. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

Accelerometers must be calibrated prior to 6 months if a vehicle fails to meet the FMVSS 214 MDB test performance requirements or after any indication from calibration checks that there may be a problem with a particular accelerometer. In such cases, only those accelerometers directly related to channels that exceeded the 214 MDB test requirements, or those indicating problems during calibration checks, must be recalibrated prior to 6 months.

- C. All measuring and test equipment and measuring standards will 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 which 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 will need the approval of the COTR before testing commences.
- G. The contractor-furnished data acquisition and processing system for recording signals from test dummies and vehicle sensors in vehicle tests shall be qualified prior to each test. Furthermore, a polarity check should be conducted for all ATD and vehicle sensors to ensure that all data is accurately recorded and reported. All checks shall be recorded by the test technician(s).
- H. Test equipment shall receive a system functional check using a known test input immediately before and after the test. This check shall be recorded by the test technician(s).
- I. Anthropomorphic test devices shall be calibrated before and after each crash test. The post-test calibration data obtained after a side MDB crash test can be used as the pre-test calibration data for a subsequent side MDB crash test as long as the dummy is used in a side MDB test within 8 weeks of the post-test calibration.
- The calibration data for the test device shall be submitted as part of the Quality Control Package, the Draft Test Report, and Final Test Report (see Deliverables) Calibration data must also be available electronically (in UDS format with a .ev5 header) if requested by the COTR. Electronic data collected for all dummy calibrations must be retained by the Contractor for at least five years from the test date.
- J. The Contractor may be directed by NHTSA to evaluate its data acquisition system.

NOTE: *In the event of a test failure (i.e. failure to meet FMVSS No. 214 performance requirements) or data anomaly, that region on the ATD must be recalibrated. 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 will be performed without additional cost.*

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."

8.2 ANTHROPOMORPHIC TESTING DEVICES

The full-vehicle test concept requires the use of human surrogates to determine the injury levels listed above. The Part 572 Subpart V SID-IIs and the Part 572 Subpart U ES-2re have been

chosen as appropriate ATDs. The SID-IIs and ES-2re are generally configured for lateral, left-side impacts.

A. The Part 572 Subpart U ES-2re shall be instrumented with the following:

- (1) Primary and redundant tri-axial head accelerometers
- (2) Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
- (3) Abdomen forward, middle, and rear y-axis load cells
- (4) Lower spine (T12) tri-axial accelerometers
- (5) Pubic symphysis y-axis load cell

The Part 572 Subpart V SID-IIs shall be instrumented with the following:

- (1) Primary and redundant tri-axial head accelerometers
- (2) Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
- (3) Abdomen upper rib and lower rib y-axis displacement potentiometers
- (4) Lower spine (T12) tri-axial accelerometers
- (5) Acetabulum and iliac wing y-axis load cells

Record the actual number of channels used for both driver and passenger dummies on Data Sheet No. 5. Also record the serial numbers, manufacturer, and calibration date of each accelerometer, potentiometer, and load cell for incorporation into Appendix D of the Final Report (See **APPENDIX E**, Section 1.9).

B. All ATDs shall be calibrated (pre and post-test) by the Contractor ON-SITE. **APPENDIX A** contains calibration procedures for GFE Part 572 U (ES-2re) ATDs. Calibration procedures for Part 572 Subpart V (SID-IIs) ATDs can be found in **APPENDIX B**. If additional clarification for either dummy type is required, contact the COTR.

All calibration data shall be recorded and submitted as part of the Quality Control Package, the Draft Test Report, and Final Test Report (see **Deliverables**).

C. The ATDS shall be clothed. The ES-2re dummy shall wear a short-sleeved form-fitting top and midcalf-length pants, both made of 100% cotton stretch material, during the calibration test and Side NCAP test. Each foot of the Part 572 U (ES-2re) dummy shall have a size 11XW shoe that meets the configuration and size specification of MIL-S-13192. The SID-IIs dummy shall wear a short-sleeved form-fitting top and knee-length pants, both made of 100% cotton stretch material, during the calibration test and Side NCAP test. Each foot of the Part 572 V (SID-IIs) dummy shall have a size 7.5W shoe that meets the configuration and size specification of MIL-S-21711E or its equivalent. All articles of clothing must be clean prior to testing and should not exhibit evidence of extreme wear. Shoes should not show separation(s) at the seams, and clothing should not be ripped.

D. Prior to positioning, ES-2re and SID-IIs dummy limb joints shall be set at between 1 and 2 g. Adjust leg joints with the torso in the supine position.

9. PHOTOGRAPHIC DOCUMENTATION

9.1 CAMERAS

A. HIGH-SPEED DIGITAL CAMERAS

Each side impact test shall be documented in color by high-speed digital cameras that operate at a minimum speed of 1000 frames per second (fps). The cameras shall be positioned as indicated in **Figure 3**. These cameras must operate for at least 50 ms

before the MDB contacts the vehicle and for at least 300 ms after the MBD contacts the vehicle. The minimum resolution for these cameras must be 1024 x 1024 pixels.

The Contractor shall report the locations of Cameras 1 through 6 as well as camera speeds and lens focal lengths for all cameras on the appropriate Data Sheet in the Final Test Report. Camera lens locations shall be noted in reference to the impact point in the X and Y directions. The ground shall be referenced when noting camera lens locations in the Z direction. The coordinate system shall be aligned with the test vehicle's struck side.

A time-zero ($t(0)$) mark must be registered in a frame to indicate when contact with the MDB occurs. This may be accomplished by placing strobe lights or flash bulbs that illuminate at $t(0)$ in each field-of-view. The strobes are wired to contact switch plates tapes to the test vehicle or MDB impact face.

Each video frame shall contain the camera speed and the frame number, beginning with the time zero frame labeled as "Frame 0". The frame numbers prior to time zero shall be negative numbers.

The impact area must be equipped with sufficient lighting to provide the proper exposure without producing excess glare or shadows. The vehicle interior may require auxiliary on-board lighting to facilitate video analysis.

Post-test, the Contractor shall verify that all high-speed cameras operated at or above 1000 fps and produced video at or above the minimum resolution specification of 1024 x 1024 pixels. The Contractor shall also verify that the real-time cameras operated within specification. If any camera view was not captured, or if a camera did not operate within specifications, the camera number and the reason why it did not operate as intended should be indicated on the appropriate Data Sheet.

A digital file for each camera shall be uploaded to the established FTP site in .avi, .wmv, or .mpeg format with a standard or generally available 'codec'. Other types of files can be used if prior approval is granted by the COTR. The standard resolution of the digital video files is 1024 x 1024 pixels. However, a duplicate impact video for the NHTSA website shall also be included. This duplicate video file should have a resolution that results in a file size of 300-400 kb and should be in .wmv format. Any other resolution level for these test videos must be approved by the COTR.

NOTE: *The test laboratory's name or logo shall not appear in any high-speed videos.*

B. REAL TIME CAMERA

The Contractor shall use two "real time" color digital video cameras that operate at 24 - 30 frames per second. They shall be used to document the views indicated below for Cameras 10 and 11. The video footage shall be uploaded to the established FTP site as part of the QCPackage.zip file and transferred as .avi, .mpeg, or .wmv files with a standard or generally available 'codec'.

NOTE: *The test laboratory's name shall only appear in the documentary real-time video as part of the title frame.*

C. CAMERA LOCATIONS

Figure 3 provides a schematic that should be referenced when determining camera locations.

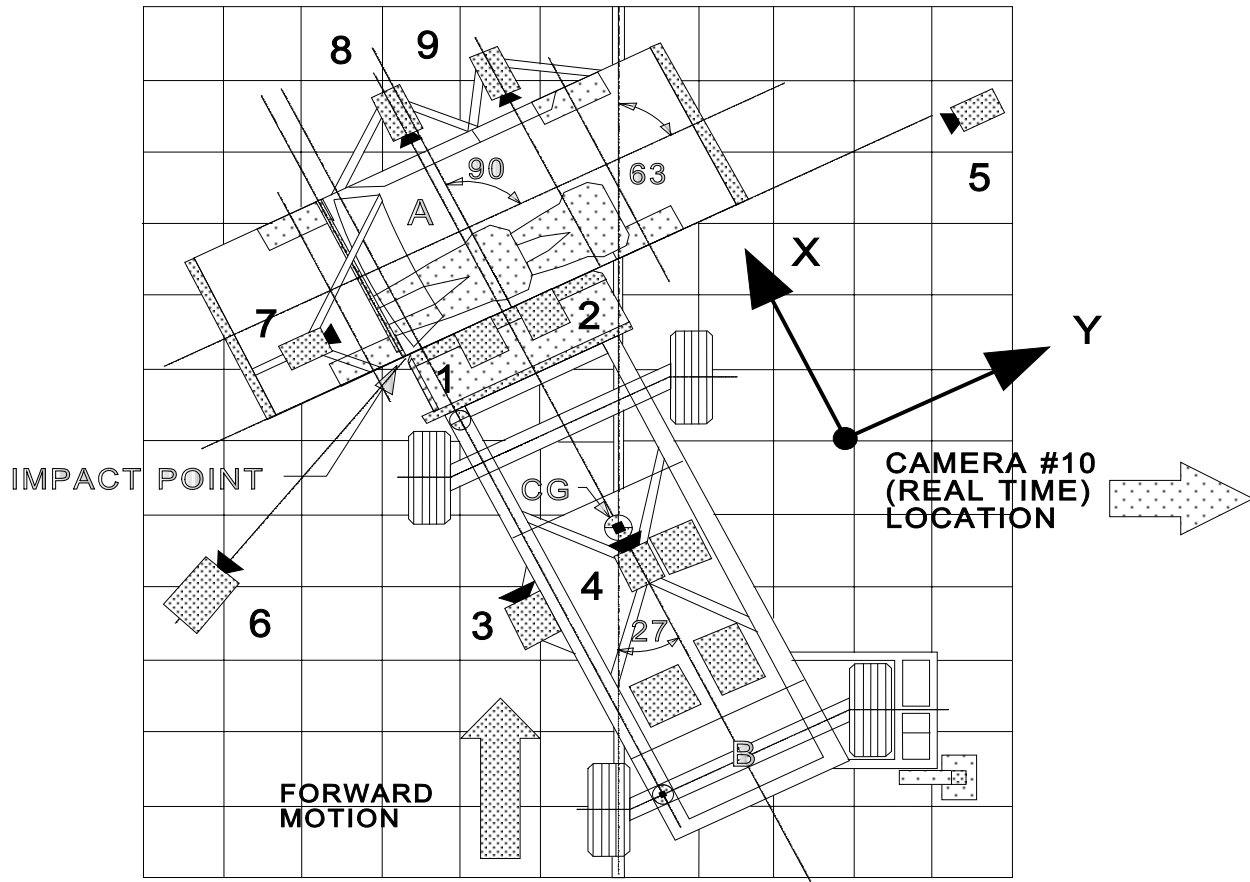


Figure 3 - Camera Locations

- | | |
|----------|--|
| Camera 1 | High-speed overhead camera to view target vehicle dynamics and positioned directly above the impact plane between the target vehicle and the MDB. |
| Camera 2 | High-speed overhead camera to provide close-up view of the impact plane (should include view of photograph targets on centerline of test vehicle and photograph targets on top of MDB barrier face) and positioned adjacent to Camera No. 1. |
| Camera 3 | High-speed camera positioned along the impactor's face left vertical edge to cover target vehicle impact point during side impact event. |
| Camera 4 | High-speed camera positioned on MDB's centerline to view struck side of test vehicle during the side impact event. |
| Camera 5 | High-speed right side view camera to cover both the MDB and the target vehicle during the side impact event. |
| Camera 6 | High-speed left side view camera to cover the motion of the target vehicle after impact. |
| Camera 7 | High-speed camera to provide front view of the front dummy through the vehicle's windshield from above the engine compartment. (Should be sufficiently raised above the hood structure and positioned such that it |

shows not only curtain air bag deployment in relation to the dummy's head, but also torso air bag deployment in relation to the dummy's chest, if applicable.)

- | | |
|-----------|--|
| Camera 8 | High-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the front dummy during and after side impact. |
| Camera 9 | High-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the rear dummy during and after side impact. |
| Camera 10 | Real-time (24-30 fps) camera to provide a left rear view of the MDB impacting the target vehicle. |
| Camera 11 | Real-time (24-30 fps) camera to provide the following pre-test, test, and post-test coverage: <ol style="list-style-type: none"> (1) side panned view of the moving deformable barrier traveling down the track and impacting the test vehicle (2) impact side, front, non-impact side and rear of test vehicle, and condition of the moving deformable barrier prior to impact (3) pre-test position of dummies (including, but not limited to the placement of lap and shoulder belt on the dummies) (4) cycling of air bag indicator light (5) door closings (including any rear hatchback or tailgate) (6) lab technician installing fuel filler cap onto the filler neck and the rotation of the cap to the installed position (7) speed traps, post-test (8) front, front oblique view of impact side, impact side, rear oblique view of impact side, rear, and non-impact side of test vehicle, and condition of the pole after impact (9) post-test position of dummies (10) chalk markings on air bag(s) (11) static rollover (12) other vehicle failures or anomalies, including door openings and any fluid spillage (along with its collection after impact) |

The exact camera coordinates and specifications shall be noted on Data Sheet No. 5. (See Section 2 of **APPENDIX E**.)

9.2 *COLORING REQUIREMENTS FOR PHOTOGRAPHIC PURPOSES*

- A. Vehicle interior surfaces such as the A, B, C-pillars and trim panels, impacted interior door trim panels, etc. shall be painted with flat white paint unless otherwise noted in the manufacturer's submission of test setup information (Form 1). The air bag indicator light on the dash shall **NOT** be painted so as to be visible prior to testing.

- B. Body parts of the driver and passenger ATDs shall be coated with colored face paint to show contact points with the vehicle's door and interior components. The paint shall be applied after final dummy positioning. In the event that the paint is partially covered by a latched seat belt, the coloring shall be applied to the seat belt as well to ensure any interior contact is evident post-test. If necessary, a colored chalk/water solution may be used, but face paint is preferred.

PAINT COLORS TO BE USED ON TEST DUMMIES

DUMMY PART	COLOR
Face	Blue
Top of Head (<i>stop painting at skull cap</i>)	Yellow
Left Side of Head	Green
Back of Head (<i>skull cap</i>)	Red
Left Shoulder	Orange
Upper Torso	Blue
Lower Torso	Yellow
Left Hip	Red
Left Knee	Green

9.3 IMPACT EVENT MARKERS

Time zero indicated on the side impact high-speed video must be synchronized to the event time zero point. Additionally, strobes or flash bulbs with diffused light shall be placed in the field-of-view of all nine high-speed cameras to mark the time zero point. The Contractor shall use pressure switches attached to the test vehicle or moving deformable barrier impact face in order to trigger the time zero indicators.

9.4 PHOTOGRAPHIC TARGETS AND TAPE FOR TEST VEHICLE AND BARRIER

A. VERTICAL IMPACT REFERENCE LINE AND CENTERLINE OF IMPACT FACE

Place 25 mm (1 inch) wide yellow/black checkerboard tape along the vertical impact reference line, as shown in **Figure 4** and as determined by (1) or (2) below.

(1) For passenger vehicles:

Test Vehicle Wheelbase Length	Vertical Impact Reference Line Location
Less than or equal to 2,896 mm	940 mm +/- 5 mm forward of wheelbase centerline
Greater than 2,896 mm	508 mm +/- 5 mm rearward of front axle centerline

(2) For multipurpose vehicles, sport utility vehicles, light trucks, and vans:

Test Vehicle Wheelbase Length	Vertical Impact Reference Line Location
Less than or equal to 2,489 mm	305 mm +/- 5 mm rearward of front axle centerline
Greater than 2,489 mm but less than 2,896 mm	940 mm +/- 5 mm forward of wheelbase centerline
Greater than 2,896 mm	508 mm +/- 5 mm rearward wheelbase centerline

NOTE: For different wheelbase versions of the same model vehicle, the vertical impact reference line may be determined (at the manufacturer's option) by the following procedure (refer to 49CFR571.214 §8.11.2):

- (1) Select the shortest wheelbase version of the same model and locate the vertical impact reference line as described above.

(2) Measure the distance between the SgRP and the vertical impact reference line.

(3) Maintain the same distance between the seating reference point and the vertical impact reference line for the version being tested as that distance between the seating reference point and vertical impact reference line for the shortest wheelbase version.

Also, 25 mm (1 inch) wide yellow/black checkerboard tape shall be placed on the vehicle such that when the barrier is properly aligned with the test for impact, the tape coincides with the vertical centerline of the barrier's impact face. See **Figure 4** and **Figure 5**. The tape should be extended across the roof of the vehicle (90° angle to the test vehicle longitudinal centerline) to provide a reference for the overhead camera coverage.

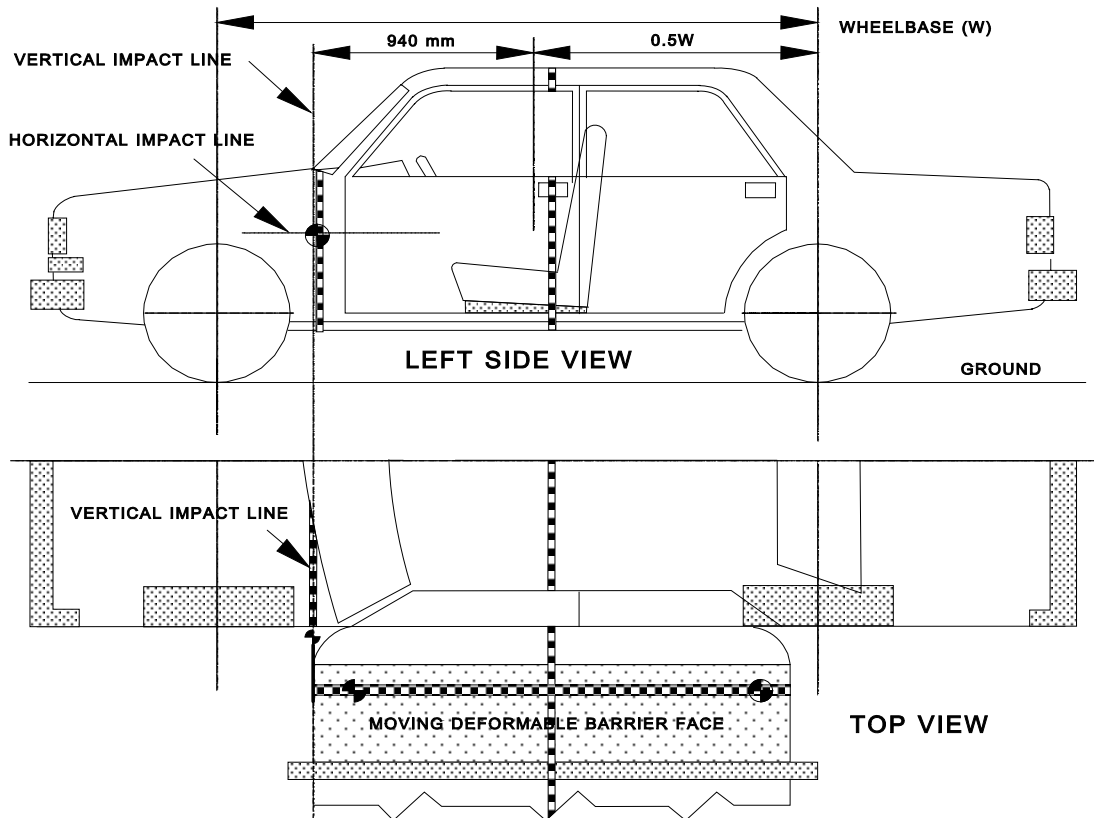


Figure 4 - Vertical Impact Lines

B. HORIZONTAL IMPACT REFERENCE LINES AND IMPACT POINT TARGET

As shown in **Figure 5**, place 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at the following five levels above the ground surface and record the height of each level at the vertical impact reference line.

- (1) LEVEL 1 – Top of side sill: Affix tape along the door sill from the front to the rear wheel-wells.
- (2) LEVEL 2 -- Driver Hip Point: Project the location of the hip point determined by the driver dummy laterally through the door to its exterior panel. Affix tape to the side body panels so that the tape intersects the hip point.

- (3) LEVEL 3 -- Mid-door: Measure the height of the front door body panel at two different locations that are at least 600 mm apart. Take the average of the two measurements. Mark this point on the exterior door panel. Affix tape to the side body panels so that the tape intersects this point.
- (4) LEVEL 4 -- Window sill: Affix tape just below the front door window sill.
- (5) LEVEL 5 -- Top of window: Affix tape just above the top of the front door window.

A 51 mm (2 inch) diameter target shall be positioned on the vehicle at mid-door height (see **note** below) and along the left edge of the vertical impact reference line. The tip of the welding rod in **Section 9.4C** will be located in the center of the target (see **Figure 6**).

NOTE: *It is suggested that this height be at mid-door level; however, this is not required as long as whatever height is used is clearly marked on the target vehicle (such as by using a 51 mm (2 inch) diameter photograph target) so that a post-test measurement of relative vertical impact height can be determined.*

C. OTHER VEHICLE TARGETS

Affix targets, labeled appropriately (if applicable), on the test vehicle as follows:

- (1) along LEVEL 4, window sill tape line, at every 300 mm (see **Figure 5**). Use 51 mm (2 inch) diameter targets.
- (2) the front door or side panel to denote the hip pivot centers of the driver and rear passenger test dummies (See **Figure 5**). Use a 100 mm (4 inch) diameter target and label each target with "HP".
- (3) the front door and the roof to denote the vehicle CG location, as determined in the "As Tested" condition. (See **Figure 5**). Use 100 mm (4 inch) diameter targets and label each with "CG".

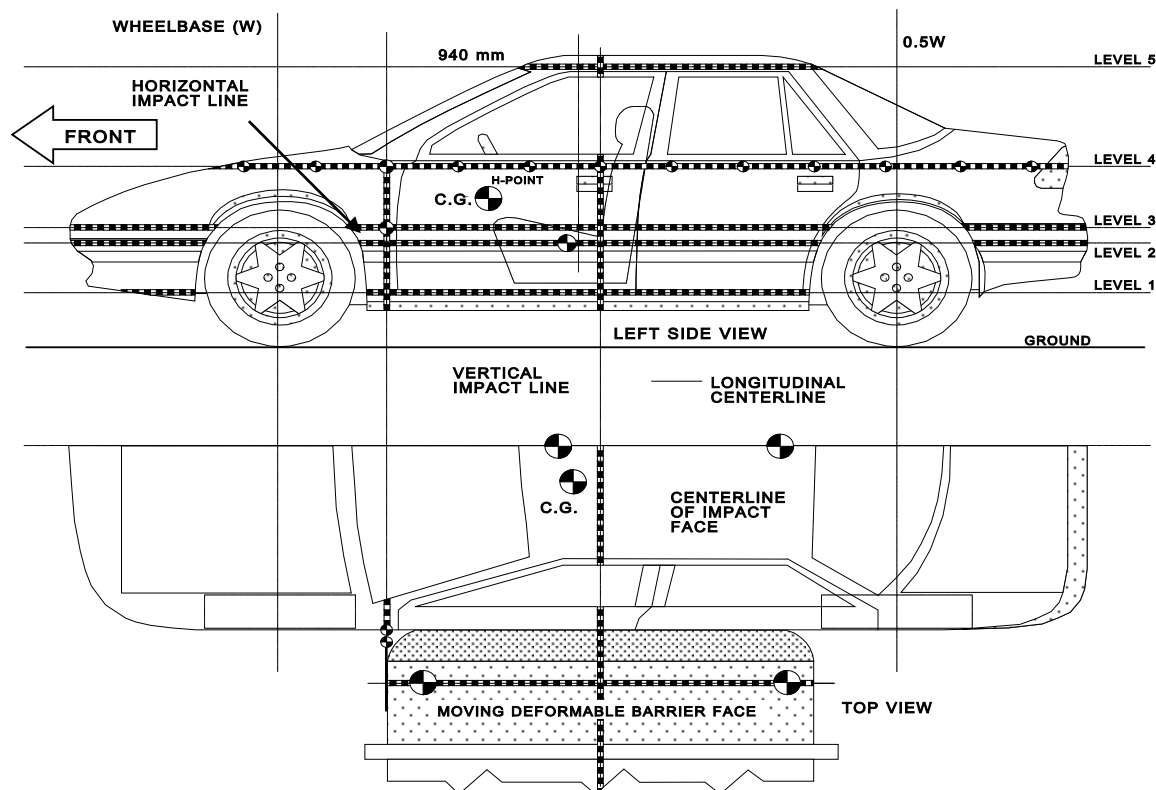


Figure 5 - Photographic Tape Location for the Test Vehicle

D. BARRIER PHOTOGRAPHIC TARGETS, TAPE, AND WELDING ROD ALIGNMENT

Tape shall be placed on the barrier face as shown in **Figure 6**. Place 25 mm (1 inch) wide yellow/black checkerboard tape along the top and front of the honeycomb barrier face centerline and along the top and front of the left edge of the honeycomb barrier face, to align with the vertical impact reference line of the test vehicle. Two [102 mm diameter (4")] targets will be placed on top of the barrier face 400 mm from the barrier centerline.

Additionally, the CG marker and other known location markers shall be visible and labeled on the MDB in the overhead view, and photographic targets [102 mm diameter (4")] shall be placed on the MDB at the rear cross member accelerometer location on the left side of the frame.

A welding rod sharpened to a point on one end will be attached along the left side vertical surface of the honeycomb barrier in the horizontal plane level with the mid-door of the test vehicle as shown in **Figure 6 and Figure 7**. Also, see **note** regarding impact point height, **Section 9.4B**. The sharpened tip of the welding rod shall be positioned and attached with duct tape so as to contact the test vehicle body sheet metal during pre-test setup when the MDB is positioned against the side of the test vehicle. The tip should be located in the center of the target described in **Section 9.4B**. During the impact event, the point of the welding rod will provide a permanent indication on the test vehicle impact line. For redundancy, the initial contact between the tip of the welding rod and test vehicle shall be recorded by Camera No. 3.

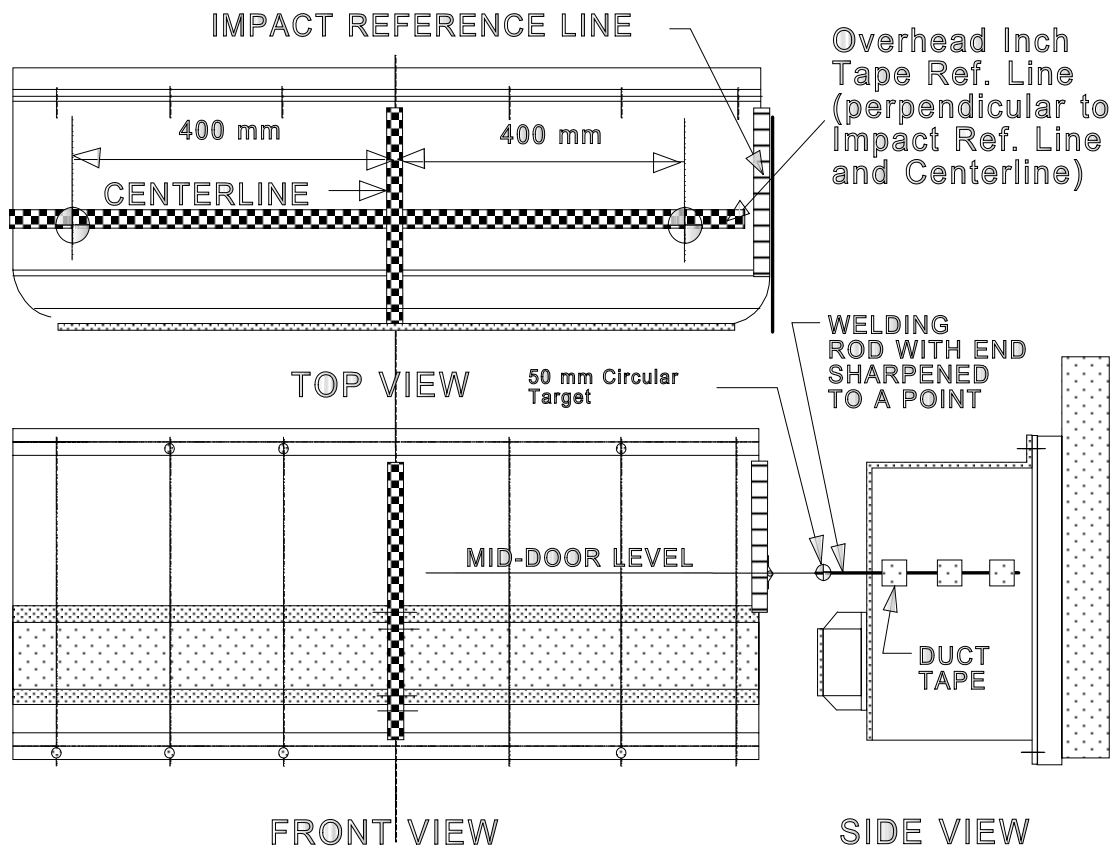


Figure 6 - Photographic Tape Location for the Moving Deformable Barrier

SIDE IMPACT POINT ALIGNMENT

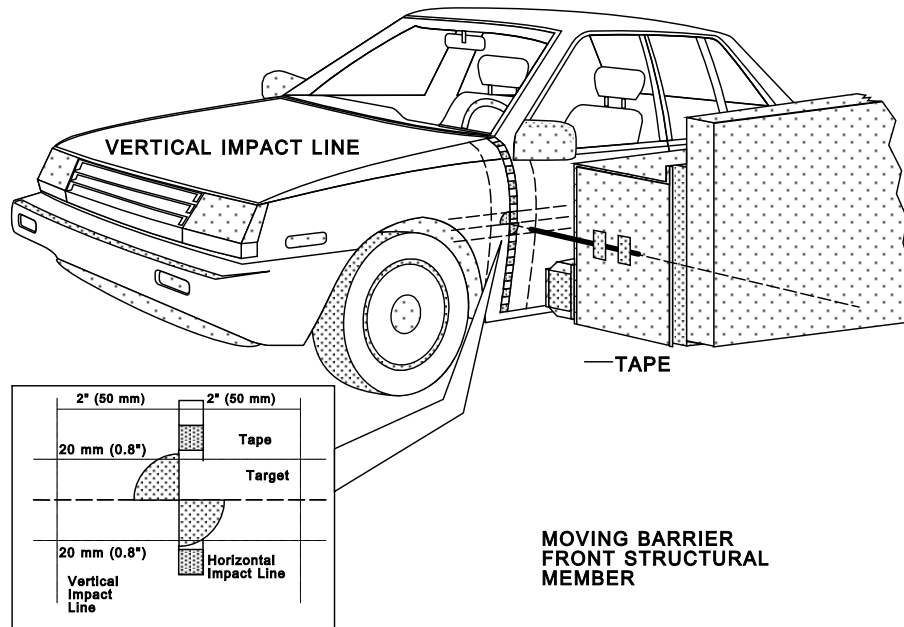


Figure 7 - Side Impact Point Alignment

E. ANGLE OF BARRIER AT IMPACT

When the MDB is properly positioned such that it is contacting the vehicle at the initial point of contact along struck side of the vehicle, strike a plane perpendicular to the ground that is coincident with the MDB impact face and is parallel to the vehicle's longitudinal centerline. Accordingly, this plane should form an angle of 63 degrees (± 0.5 degrees) with the direction of forward motion of the MDB. Paint or mark a line on the floor at this location. This line should extend past the front and rear of the vehicle when it is properly positioned.

F. DUMMY TARGETS

Place a 100 mm (4 inch) diameter target on the head of the anthropomorphic test devices at the CG location (as determined in the "As Tested" condition) on the struck side.

Place 25 mm (1 inch) diameter targets on the anthropomorphic test devices as follows:

- (1) on the front of the dummies' heads/faces and at the head CG locations
- (2) on the dummy's chest, at the positions determined when taking the CS, CD, and CB measurements in Section 11.2 of this laboratory test procedure.

9.5 TARGET VEHICLE INFORMATION PLACARDS

Test vehicle identification placards shall be positioned so that at least one placard will be visible and legible in each of the cameras' field of view. The following information shall be shown:

- A. Target vehicle's NHTSA number
- B. The words "55/28 km/h 90° NCAP MDB Side Impact"
- C. Date of the side impact test
- D. Vehicle year, make and model

NOTE: *The test laboratory's name or logo shall not appear on vehicle information placards.*

9.6 CRASH VIDEO TITLE HEADING AND SEQUENCE

The Contractor shall upload the color videos for each crash test to the established FTP website as part of the QCPackage.zip file (see **Section 13**) within **five (5)** days after completion of the test. The master copy for each of the crash test movies shall be retained by the Contractor and will be made available to the OCWS upon request.

A separate video shall be created from the footage recorded by each high-speed camera, for a total of nine high-speed videos. These videos should appear in numerical order in both the QCPackage.zip file and the FinalDeliverables.zip file and should be labeled as follows:

- Camera No. 1 – Overhead Wide View
- Camera No. 2 – Overhead Close-Up View
- Camera No. 3 – Impact Point
- Camera No. 4 – Struck-Side View at Impact
- Camera No. 5 – Rear Impact View of Struck Side
- Camera No. 6 – Front Oblique Impact View of Struck Side
- Camera No. 7 – Driver Dummy Front View (Onboard)
- Camera No. 8 – Driver Dummy Side View (Onboard)
- Camera No. 9 – Rear Passenger Dummy Side View (Onboard)
- Camera No. 10 – Real-Time Rear View of Impact
- Camera No. 11 – Real-Time Pan View of Impact

The test laboratory shall also make a separate movie of the impact event that is acceptable for inclusion on the NHTSA's website. This movie file shall be labeled as "<Model Year><Make & Model><Number of Doors><Body> MDB IMPACT FOR WEB", have an approximate size of 300-400 kb, and shall be in .wmv format.

9.7 REAL-TIME DOCUMENTATION VIDEO EDITING

A test documentation video file shall also be made to include all real-time video footage and must only be submitted as part of the FinalDeliverables.zip file. The real-time documentation video shall be edited in the following sequence:

- A. Title, to include the following title frames:
 - (1) The following NCAP Side Impact Test was conducted under contract with the National Highway Traffic Safety Administration by (laboratory name, city, and state).
 - (2) 55/28 km/h 90° NCAP SIDE IMPACT (MOVING DEFORMABLE BARRIER)
Test Vehicle Model Year, Make and Model
NHTSA No. MXXXXX
Date of Impact Event
Contract No.: DTNH22-0X-X-XXXXX
- B. Pre-Test Coverage (real-time)
 - (1) Vehicle
 - i. View of front of vehicle
 - ii. Front $\frac{3}{4}$ view of struck-side of vehicle
 - iii. View of struck-side of vehicle
 - iv. Rear $\frac{3}{4}$ view of struck-side of vehicle
 - iii. View of rear of vehicle
 - iv. View of non-struck-side of vehicle

- (2) Test Dummies
 - i. Left side view of ES-2re in front seat (struck-side door open)
 - ii. Left side view of SID-IIs in rear seat (struck-side door open)
 - iii. Left side view of ES-2re in front seat (struck-side door closed)
 - iv. Left side view of SID-IIs in rear seat (struck-side door closed)
 - v. Right side view of ES-2re in front seat (non-struck-side door open)
 - vi. Right side view of SID-IIs in rear seat (non-struck-side door open)
 - vii. Right side view of ES-2re in front seat (non-struck-side door closed)
 - viii. Right side view of SID-IIs in rear seat (non-struck-side door closed)
- (3) MDB
 - i. View of left side of MDB
 - ii. View of front of MDB
 - iii. View of right side of MDB
 - iv. Overhead view of MDB
- (4) Gas cap being attached to filler pipe
- (5) Cycling of air bag indicator light (to include full view of instrument panel)
- (6) Door closings (including all passenger doors, trunk or rear hatch (if applicable))
- C. Real-Time Pan Coverage of Impact Event
- D. Post-Test Coverage (real-time)
 - (1) Test Speed
 - i. View of primary and redundant speed traps (include NHTSA No. placard)
 - (2) Vehicle
 - i. View of front of vehicle
 - ii. Front $\frac{3}{4}$ view of struck-side of vehicle
 - iii. View of struck-side of vehicle
 - iv. View of impact point – close-up
 - v. Rear $\frac{3}{4}$ view of struck-side of vehicle
 - vi. View of rear of vehicle
 - vii. View of non-struck-side of vehicle
 - (2) Test Dummies
 - i. View of front ES-2re – parallel to impact door
 - ii. View of rear SID-IIs – parallel to impact door
 - iii. View of front ES-2re – through opposite window
 - iv. View of rear SID-IIs – through opposite window
 - (3) Air bags
 - i. View of struck-side of vehicle (dummy removed)
 - ii. View of inside front door showing chalk marks on air bag(s) (dummy removed)
 - iii. View of inside rear door showing chalk marks on air bag(s) (dummy removed)
 - (4) MDB
 - i. View of left side of MDB
 - ii. View of front of MDB
 - iii. View of right side of MDB
 - iv. Overhead view of MDB and vehicle
 - (5) Static Rollover
 - i. View of static rollover - 0 degrees
 - ii. View of static rollover – 90 degrees
 - iii. View of static rollover – 180 degrees
 - iv. View of static rollover – 270 degrees
 - v. View of static rollover – 360 degrees
- E. Any vehicle failures or anomalies (show tape measure from latch to door if door opening)
- F. The final frame shall state “The End”

9.8 STILL PHOTOGRAPHS

Clear and properly focused digital, color still photographs shall be taken to document the test. Information placards for the target vehicle and/or deformable barrier, which identify the test vehicle model as well as the barrier, NHTSA number, and test date, along with an indication of whether the photograph was taken pre-test or post-test, shall appear in each photograph and be legible. **All pre-test photographs should be taken immediately prior to impact (i.e., within the hour preceding impact after the manufacturer has been given an opportunity to review the test set-up) and all post-test photographs should be taken immediately following impact (within the hour following impact before the manufacturer has been given the opportunity to examine the crashed vehicle).** Photographs that are approximately 4 in. x 6 in. (at a minimum) shall be included in Appendix A of the Final Test Report. Two photographs shall be provided on each page and each photograph shall be labeled as to subject matter in accordance with the list below. See also Section 1.2 of **APPENDIX E**. All digital still photographs shall also be properly labeled, should include a time/date stamp, and should be posted to the established FTP site in the order specified below as part of the QCPackage.zip and FinalDeliverables.zip files (See Section 13). As a minimum, the following photographs, labeled as follows, shall be included as part of the QCPackage.ZIP file (**only these photographs (which must be both numbered and labeled) should be included in the FinalDeliverables.zip file, unless the OCWS requests that additional photos be included**):

- No. 001 – As-Delivered Right Front 3-4 View of Test Vehicle
- No. 002 – As-Delivered Left Rear 3-4 View of Test Vehicle
- No. 003 – Pre-Test Frontal View of Test Vehicle
- No. 004 – Post-Test Frontal View of Test Vehicle
- No. 005 – Pre-Test Left Front 3-4 View of Test Vehicle
- No. 006 – Post-Test Left Front 3-4 View of Test Vehicle
- No. 007 – Pre-Test Left Side View of Test Vehicle
- No. 008 – Post-Test Left Side View of Test Vehicle
- No. 009 – Pre-Test Left Rear 3-4 View of Test Vehicle
- No. 010 – Post-Test Left Rear 3-4 View of Test Vehicle
- No. 011 – Pre-Test Rear View of Test Vehicle
- No. 012 – Post-Test Rear View of Test Vehicle
- No. 013 – Pre-Test Right Side View of Test Vehicle
- No. 014 – Post-Test Right Side View of Test Vehicle
- No. 015 – Pre-Test Overhead View of Test Area (*The MDB should be positioned against the test vehicle at the ideal impact point, if possible.*)
- No. 016 – Post-Test Overhead View of Test Area (*This view should include test vehicle and MDB, if possible.*)
- No. 017 – Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle (*The MDB should be positioned at the ideal impact point.*)
- No. 018 – Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle (*The MDB should be positioned at the ideal impact point.*)
- No. 019 – Pre-Test Close-Up View of Impact Point Target
- No. 020 – Post-Test Close-Up View of Impact Point Target (*This photograph should show the impact point location with an arrow or finger calling attention to the impact point.*)
- No. 021 – Pre-Test Left Front Door Latch Close-Up (*The driver door should be closed.*)
- No. 022 – Post-Test Left Front Door Latch Close-Up (*The driver door should be closed.*)
- No. 023 – Pre-Test Left Rear Door Latch Close-Up (*The rear passenger door should be closed.*)
- No. 024 – Post-Test Left Rear Door Latch Close-Up (*The rear passenger door should be closed.*)
- No. 025 – Pre-Test Front Close-Up View of Driver Dummy (*This photograph is taken through front window.*)
- No. 026 – Post-Test Front Close-Up View of Driver Dummy (*This photograph is taken through front window.*)
- No. 027 – Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking (*The driver door should be open.*)

- No. 028 – Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View (*The driver door should be closed.*)
- No. 029 – Post-Test Left Side View of Driver Dummy Shoulder and Door Top View (*The driver door should be closed.*)
- No. 030 – Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning (*The head restraint should be included in the photograph, along with a visible centerline that is drawn on the seat back and head restraint.*)
- No. 031 – Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint
- No. 032 – Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning (*This photograph should show a visible centerline that is drawn onto the seat cushion.*)
- No. 033 – Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan (*This photograph should show the centerline on the seat pan between the dummy's legs, if possible.*)
- No. 034 – Pre-Test Placement of Driver Dummy's Feet
- No. 035 – Pre-Test View of Belt Anchorage for Driver Dummy (*This photograph should show the position of the upper belt anchorage. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 036 – Pre-Test Left Side View of Steering Wheel (*This photograph should show the test position of the steering wheel. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 037 – View of Disengaged Parking Brake (*This photograph should be taken at the same time as As-Delivered photos*)
- No. 038 – Pre-Test View of Parking Brake (*This photograph should be taken at the same angle as the previous photo.*)
- No. 039 – Pre-Test Close-Up Left Side View of Driver Seat Track (*This photograph should show the test position of the seat track. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 040 – Pre-test Close-Up Left Side View of Driver Seat Back (*This photograph should show the test position of the seat back. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 041 – Pre-Test Close-Up View of Driver Seat Back or Head Restraint (*This photograph should show the test position and should include a level, placed at the manufacturer's designated location, to show the angle of the test position.*)
- No. 042 – Pre-Test Driver Dummy and Door Clearance View (*This photograph should be taken from above, looking down into the vehicle with the driver door closed. It should depict the clearance between the driver dummy and the door interior.*)
- No. 043 – Post-Test Driver Dummy and Door Clearance View (*This photograph should be taken as similarly to the pre-test photo as is feasible.*)
- No. 044 – Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment (*This photograph should be taken through the vehicle with the right front passenger door open.*)
- No. 045 – Post-Test Right Side View of Driver Dummy and Front Seat Occupant Compartment (*This photograph should be taken through the vehicle with the right front passenger door open.*)
- No. 046 – Pre-Test Driver Inner Door Panel View (*This photograph should be taken through the vehicle with the right front passenger door open. The seat back should be adjusted such that it is close to the anticipated test position.*)
- No. 047 – Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations (*This photograph should be taken through the vehicle with the right front passenger door open. It should be taken after the dummy is removed but prior to the airbags being handled or rearranged.*)
- No. 048 – Post-Test Driver Dummy Close-Up Head Contact with Vehicle View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 049 – Post-Test Driver Dummy Close-Up Head Contact with Side Air Bag View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic. The airbag should be arranged to show contact marks.*)

- No. 050 – Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 051 – Post-Test Driver Dummy Close-Up Torso Contact with Side Air Bag View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic. The airbag should be arranged to show contact marks.*)
- No. 052 – Post-Test Driver Dummy Close-Up Pelvis Contact View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 053 – Post-Test Driver Dummy Close-Up Pelvis Contact with Side Air Bag View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic. The airbag should be arranged to show contact marks.*)
- No. 054 – Post-Test Driver Dummy Close-Up Knee Contact View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 055 – Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking (*The rear left passenger door should be open.*)
- No. 056 – Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View (*The rear left passenger door should be closed.*)
- No. 057 – Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View (*The rear left passenger door should be closed.*)
- No. 058 – Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning (*The head restraint should be included in the photograph, along with a visible centerline that is drawn on the seat back and head restraint.*)
- No. 059 – Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint
- No. 060 – Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning (*This photograph should show a visible centerline that is drawn onto the seat pan.*)
- No. 061 – Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan (*This photograph should show the centerline on the seat cushion between the dummy's legs, if possible.*)
- No. 062 – Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket
- No. 063 – Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level (*A level should be shown in this photograph.*)
- No. 064 – Pre-Test Placement of Rear Passenger Dummy's Feet
- No. 065 – Pre-Test View of Belt Anchorage for Rear Passenger Dummy (*This photograph should show the position of the upper belt anchorage. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 066 – Pre-Test Close-Up Left Side View of Rear Passenger Seat Track (*This photograph should show the test position of the seat track. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 067 – Pre-Test Close-Up Left Side View of Rear Passenger Seat Back (*This photograph should show the test position of the seat back. Detent or millimeter markings should be shown and labeled, if applicable.*)
- No. 068 – Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint (*This photograph should show the test position and should include a level, placed at the manufacturer's designated location, to show the angle of the test position.*)
- No. 069 – Pre-Test Rear Passenger Dummy and Door Clearance View (*This photograph should be taken from above, looking down into the vehicle with the rear passenger door closed. It should depict the clearance between the rear passenger dummy and the door interior.*)
- No. 070 – Post-Test Rear Passenger Dummy and Door Clearance View (*This photograph should be taken as similarly to the pre-test photo as is feasible.*)
- No. 071 – Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment (*This photograph should be taken through the vehicle with the right rear passenger door open.*)

- No. 072 – Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment (*This photograph should be taken through the vehicle with the right rear passenger door open.*)
- No. 073 – Pre-Test Rear Passenger Inner Door Panel View (*This photograph should be taken through the vehicle with the right rear passenger door open. The seat back should be adjusted such that it is close to the anticipated test position.*)
- No. 074 – Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations (*This photograph should be taken after the dummy is removed but prior to the airbags being handled or rearranged.*)
- No. 075 – Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 076 – Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Air Bag View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic. The airbag should be arranged to show contact marks.*)
- No. 077 – Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View, (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 078 – Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Air Bag View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic. The airbag should be arranged to show contact marks.*)
- No. 079 – Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 080 – Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Air bag View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic. The airbag should be arranged to show contact marks.*)
- No. 081 – Post-Test Rear Passenger Dummy Close-Up Knee Contact View (*This photograph should only be taken if it is applicable. Otherwise, use a placeholder graphic.*)
- No. 082 – Pre-Test View of Fuel Filler Cap or Fuel Filler Neck
- No. 083 – Post-Test View of Fuel Filler Cap or Fuel Filler Neck
- No. 084 – Pre-Test Front View of MDB Impactor Face
- No. 085 – Post-Test Front View of MDB Impactor Face
- No. 086 – Pre-Test Top View of MDB Impactor Face
- No. 087 – Post-Test Top View of MDB Impactor Face
- No. 088 – Pre-Test Left Side View of MDB Impactor Face
- No. 089 – Post-Test Left Side View of MDB Impactor Face
- No. 090 – Pre-Test Right Side View of MDB Impactor Face
- No. 091 – Post-Test Right Side View of MDB Impactor Face
- No. 092 – Close-Up View of Vehicle's Certification Label (photograph of certification label, include a photograph of the reduced load carrying capacity as No. 092a, if applicable)
- No. 093 – Close-Up View of Vehicle's Tire Information Placard or Label
- No. 094 – Pre-Test Ballast View
- No. 095 – Post-Test Primary and Redundant Speed Trap Read-Out (*Primary and redundant speed should be labeled in this photograph and it should always include a placard that displays the NHTSA No.*)
- No. 096 – FMVSS No. 301 Static Rollover 0 Degrees
- No. 097 – FMVSS No. 301 Static Rollover 90 Degrees
- No. 098 – FMVSS No. 301 Static Rollover 180 Degrees
- No. 099 – FMVSS No. 301 Static Rollover 270 Degrees
- No. 100 – FMVSS No. 301 Static Rollover 360 Degrees
- No. 101 – Impact Event (*This photograph should be taken from the impact side of the vehicle.*)
- No. 102 – Monroney Label
- No. 103 – Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual
- No. 104 – Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

NOTE: *The numbering convention shown above must be maintained. It is deliberate and intended to keep the photographs in a specific order when sorting photographs electronically. For the Quality Control Package file, photographs should be labeled with a minimum of the numbering convention shown here; when the final deliverables are submitted, however, the photographs should also be labeled with the text descriptions provided.*

NOTE: *The test laboratory's name or logo shall not appear in any photographs.*

Additional photographs which further describe what is visible in Photograph Nos. 1 – 104 should be labeled with the most relevant photograph number followed by a, b, c, etc. Any additional photographs taken for documentation of vehicle anomalies, safety concerns, test details, etc. which **do not** fit under the photograph descriptions above should be appropriately labeled and shall follow the list of preceding required photographs in numerical order.

Photograph No. 100 shall be additionally formatted to be 222 x 127 pixels in size and be approximately 100 kb in size. This formatted photograph shall be labeled as "<Model Year><Make & Model><Number of Doors><Body> MDB Impact FOR WEB", and should be included separately as part of the QCPackage.zip and FinalDeliverables.zip files on the FTP site.

10. DEFINITIONS

DESIGNATED SEATING CAPACITY (DSC)

The number of designated seating positions provided as found on the tire information placard (required by FMVSS 110). This number must be consistent with the number of restraints in the vehicle.

DESIGNATED SEATING POSITION (DSP)

Any plain-view location capable of accommodating a person at least as large as a 5th percentile adult female, if the overall seat configuration and design and vehicle design is such that the position is likely to be used as a seating position while the vehicle is in motion, except for auxiliary seating accommodations such as temporary or folding jump seats.

DOUBLE SIDE DOORS

A pair of hinged doors with the lock and latch mechanisms located where the door lips overlap.

FULLY LOADED ATTITUDE

The vehicle attitude when the vehicle is loaded to its unloaded vehicle weight plus its rated luggage and cargo capacity (placed along the longitudinal centerline of the vehicle in the luggage compartment), plus the two fully instrumented (with shoes) test dummies placed in the test configuration.

Note: *Even if the rear seat is exempt from performance criteria, the rear test dummy must be placed in vehicle when determining fully loaded attitude.*

H-POINT

The mechanically-hinged hip point of a manikin which simulates the actual pivot center of the human torso and thigh, described in SAE Recommended Practice J826, "Manikin for Use in Defining Vehicle Seating Accommodations," May 1987. See **APPENDIX F**, "Determining the H-Point Location".

HIP POINT

The actual pivot center of the dummy's torso and thigh. For the ES-2re, this point is not coincident with the H-point determined by the H-point machine (see **APPENDIX C**).

HORIZONTAL IMPACT LINE

A reference line along the struck side of the test vehicle that is perpendicular to the vertical impact reference line and intersects the point at which the welding rod contacts the vehicle. See **Figure 5** and **Section 9.4B**.

LONGITUDINAL OR LONGITUDINALLY

Parallel to the vehicle's longitudinal centerline.

MIDSAGITTAL PLANE

The vertical plane that separates the dummy into equal left and right halves.

SEAT CUSHION REFERENCE POINT (SCRCP)

A point placed on the outboard side of the seat cushion at a horizontal distance between 150 mm (5.9 in.) and 250 mm (9.8 in.) from the front edge of the seat used as a guide in positioning the seat.

SEAT CUSHION REFERENCE LINE (SCRL)

A line on the side of the seat cushion, passing through the seat cushion reference point, whose projection in the vehicle vertical longitudinal plane is straight and has a known angle with respect to the horizontal.

UNLOADED VEHICLE WEIGHT (UVW)

The weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, WITHOUT cargo or occupants.

VERTICAL IMPACT REFERENCE LINE

The vertical line, as determined in **Section 9.4A**, which aids in proper barrier fore-aft alignment pre-test and serves as evidence of barrier impact position post-test.

11. TEST EXECUTION**11.1 TEST VEHICLE AND MOVING DEFORMABLE BARRIER PREPARATION****A. SIDE AIR BAGS**

All side air bags on the non-struck side of the test vehicle should be disabled by the vehicle manufacturer prior to the test.

B. TEST VEHICLE INFORMATION AND OPTIONS

Using the owner's manual, certification labels, information provided by the COTR and/or vehicle manufacturer, and any other data available, determine the following vehicle information and record:

- (1) NHTSA Number (supplied by COTR)
- (2) Vehicle model year, make, model and body style
- (3) VIN
- (4) Body color
- (5) Current odometer reading (in km and mi)
- (6) Engine data, to include displacement (CID, liters or cc), type and number of cylinders, and placement (longitudinal or lateral)
- (7) Transmission data, to include type (manual or automatic), number of speeds, and whether the vehicle is equipped with overdrive
- (8) Final drive (rear, front or four-wheel-drive)
- (9) All major options (indicate "Yes" if the vehicle is equipped with an option and "No" if it is not)
- (10) All available occupant safety restraints (indicate "Yes" if the vehicle is equipped and "No" if it is not)
- (11) Instructions to turn off ADLs

C. DATA FROM CERTIFICATION LABEL

Record the following information from the vehicle's certification label:

- (1) Manufacturer
- (2) Build date (or month and year of manufacture)
- (3) Vehicle type
- (4) Gross Vehicle Weight Rating (GVWR)
- (5) Gross Axle Weight Rating (GAWR) for the front and rear of the vehicle

D. TIRE DATA RECORDED FROM FMVSS NO. 110 VEHICLE TIRE PLACARD OR OPTIONAL TIRE INFLATION PRESSURE LABEL

- (1) Designated Seating Capacity (DSC)
- (2) Vehicle Capacity Weight (VCW)
- (3) Rated Cargo and Luggage Weight (RCLW)

NOTE: Account for reduced load capacity, if applicable.

E. VEHICLE SEAT TYPE

Record the following information from the manufacturer's submitted Form No. 1 (see sample of Form No. 1 in Section 3 of **APPENDIX D**) data. Visually inspect the seat to verify seat type:

- (1) Type of front seat pan (bucket, bench, or split bench)
- (2) Type of front seat back (fixed or adjustable w/lever or knob)
- (3) Type of rear or second row seat pan (bucket, bench, split bench, or contoured)
- (4) Type of rear or second row seat back (fixed or adjustable w/lever or knob)
- (5) Type of third row seat pan (bucket, bench, split bench, or contoured)
- (6) Type of third row seat back (fixed or adjustable w/lever or knob)

F. DATA RECORDED FROM TIRE PLACARD AND SIDEWALLS

Record the following information:

- (1) Recommended cold tire pressure for both the front and rear tires
- (2) Recommended tire size for both the front and rear tires.

- (3) Tire pressure for maximum load carrying capacity (Verify that this pressure exceeds or is equal to the recommended cold tire pressure listed on the vehicle placard.)
- (4) Size of tires (Verify that the tire size(s) meet the manufacturer's specifications as listed on the vehicle placard or optional tire label.)
- (5) Tire manufacturer
- (6) Tire name
- (7) Tire type and width
- (8) Aspect ratio, radial, and wheel diameter
- (9) Load index and speed symbol
- (10) Treadwear, traction grade, and temperature grade
- (11) Tire material

G. "AS DELIVERED" VEHICLE WEIGHT CONDITION

- (1) If the vehicle is equipped with running boards, remove them from both sides of the vehicle.
- (2) Fill the transmission with transmission fluid to full capacity.
- (3) Drain the fuel from the fuel tank. Run the engine until all fuel remaining in the fuel delivery system is used and the engine stops. Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck on Data Sheet No. 2.
- (4) Record the usable fuel tank capacity of both standard and optional (if applicable) fuel tanks as supplied on Form 1.
- (5) Record the fuel tank capacity of both standard and optional (if applicable) fuel tanks as supplied in the owner's manual.
- (6) Calculate 1/3 of the usable capacity of the fuel tank(s) (as provided on Form 1) and record the calculated value on Data Sheet No. 2. Also calculate 93% of the usable capacity of the fuel tank(s) and record the calculated value on Data Sheet No. 2.
- (7) Using purple dyed Stoddard solvent having the physical and chemical properties of Type 1 solvent or cleaning fluid, Table 1, ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents," fill the fuel tank to 100% usable capacity as supplied on Form 1. Record the amount of solvent added for the "As Delivered" weight condition on Data Sheet No. 2.

NOTE: *Stoddard solvent shall be free of debris. It is considered debris-free only if, upon filtering with a 10 micron filter, no solid debris is retained on the filter media or in any conduit, container or vessel upstream from the filter paper (e.g. debris is not allowed to be present in the funnel, pump, or container.). The solvent used for NHTSA testing must be designated for NHTSA testing only.*

- (8) Crank the engine to fill the fuel delivery system with Stoddard solvent.
- (9) Fill the coolant system to capacity.
- (10) Fill the engine with motor oil to the maximum mark on the dip stick.
- (11) Fill the brake reservoir with brake fluid to its normal level.
- (12) Fill the windshield washer reservoir to capacity.
- (13) Record the "As Delivered" tire pressure for each tire on Data Sheet No. 1. Inflate the tires to the cold tire pressure indicated on the tire placard. If no tire placard is available, inflate the tires to the recommended pressure in the owner's manual. Record the tire pressure for each tire on Data Sheet No. 1.
- (14) Weigh the vehicle at each wheel and add the weights together to determine the "As Delivered" (or "Unloaded Vehicle") weight condition. Record the weight measurements on Data Sheet No. 1.

H. CALCULATION OF VEHICLE TARGET TEST WEIGHT

- (1) Calculate the Rated Cargo and Luggage Weight (RCLW) as follows and record on Data Sheet No. 1:

$$\text{RCLW} = \text{VCW} - (68.04 \text{ kg} \times \text{DSC})$$

VCW = the Vehicle Capacity Weight from the vehicle placard, also taking into account any reduction in load capacity.

DSC = the Designated Seating Capacity as indicated on the vehicle placard.

FOR TRUCKS, MPV's or BUSES - If the RCLW calculated above is greater than 136 kg, use 136 kg as the RCLW.

- (2) Weigh the fully-instrumented dummies to be used.
 (3) Calculate the Test Vehicle Target Weight (TVTW) by summing the "As Delivered" weight, the RCLW, and the weight of the fully instrumented ES-2re and SID-IIs dummies:

$$\text{TVTW} = \text{As Delivered Weight} + \text{RCLW} + \text{ES-2re weight} + \text{SID-IIs weight}$$

Record the TVTW.

I. "FULLY LOADED" VEHICLE WEIGHT CONDITION

- (1) With the vehicle in the "As Delivered" weight condition, load the vehicle with the ballast equal to the RCLW placed in the luggage or load carrying/cargo area. Center the load over the longitudinal centerline of the vehicle.
 (2) Place the weight of the fully instrumented test dummies (with clothes and shoes) in the appropriate front and rear outboard seating positions.
 (3) Weight the vehicle at each wheel and add the weights together to determine the "Fully Loaded" weight. Record the weight measurements on Data Sheet No. 1.

J. VEHICLE ATTITUDE AND CG MEASUREMENTS – "FULLY LOADED" WEIGHT CONDITION

- (1) Place the vehicle on a flat, level surface in the "Fully Loaded" weight condition.
 (2) If the vehicle has an Auto-Leveling System, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, contact the COTR for further guidance on attitude measurements.
 (3) If the vehicle has been raised off of the ground to make weight measurements, the vehicle should be rolled for at least 10 meters and left to settle for at least 10 minutes prior to moving to step (4).
 (4) "Exercise" the vehicle's suspension system by pushing down and pulling up on each of the four corners of the vehicle at least 5 times in an interval not to exceed 40 seconds each. Allow the vehicle to settle for at least 10 minutes.
 (5) Mark a reference point on the test vehicle's body, directly above each wheel opening.
 (6) For each wheel well, measure the distance between the ground and each of the reference points. Record each measurement on Data Sheet No. 1.
 (7) Measure and record the vehicle CG aft of the front axle and left(+)/right(-) from the longitudinal centerline on Data Sheet No. 1.

K. "AS TESTED" VEHICLE WEIGHT CONDITION

- (1) With the test vehicle in the "Fully Loaded" test weight condition, drain the fuel tank.
- (2) Using purple dyed Stoddard solvent having the physical and chemical properties of Type 1 solvent or cleaning fluid, Table 1, ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents.", fill the tank to 93% ($\pm 1\%$) of usable capacity as supplied on Form 1.
- (3) Drain transmission fluid, engine coolant, motor oil, and windshield washer fluid from the test vehicle.
- (4) Remove ballast (RCLW) from the cargo area.
- (5) Load the vehicle with the necessary onboard test equipment (including all instrumentation boxes, cameras, lighting, etc.) Secure the equipment in the load-carrying area and distribute it as evenly as possible to obtain the proportion of axle weight indicated by the gross axle weight ratings. Center it over the longitudinal centerline of the vehicle.
- (6) Load the appropriate dummies (ES-2re and SID-IIs, with umbilical cords) in the front outboard and rear outboard positions.
- (7) Calculate the actual test weight range as follows and record it on Data Sheet No. 1:

(Test Vehicle Target Weight - 9 kg) \leq As Tested Weight \leq (Test Vehicle Target Weight - 4.5 kg)

- (8) Record the vehicle weight at each axle on Data Sheet No. 1 and add the weights together to determine the "As Tested" weight. Verify that the "As Tested" weight is within the range specified in (7). If necessary, to achieve the "As Tested" weight, adjust the weight of the test vehicle by either adding ballast or removing vehicle components in accordance with the data supplied on Form 1.
- (9) On Data Sheet No. 1, record the weight of the added ballast, if any. Also, record each vehicle component that was removed and its weight.

NOTE: *If the calculated Test Vehicle Target weight is exceeded, the Contractor must notify the COTR to discuss the possible removal of additional vehicle components or instrumentation to decrease the weight. Under no circumstances shall the "As Tested" weight be greater than the Test Vehicle Target weight.*

L. VEHICLE ATTITUDE AND CG MEASUREMENTS – "AS TESTED" WEIGHT CONDITION

- (1) Place the vehicle on a flat, level surface in the "As Tested" weight condition.
- (2) If the vehicle has an Auto-Leveling System, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, contact the COTR for further guidance on attitude measurements.
- (3) "Exercise" the vehicle's suspension system by pushing down and pulling up on each of the four corners of the vehicle at least 5 times in an interval not to exceed 40 seconds each. Allow the vehicle to settle for at least 10 minutes.
- (4) For each wheel well, measure the distance between the ground and the same reference points used in determining the "Fully Loaded" attitude measurement in **Section 11.1J**. Record each measurement on Data Sheet No. 1.
- (5) Measure and record the vehicle CG aft of the front axle and left(+)/right(-) from the longitudinal centerline on Data Sheet No. 1.
- (6) Verify that the "As Tested" vehicle attitude measurements are equal to the "Fully Loaded" vehicle attitude measurements ± 10 mm at each wheel well. If the correct attitude cannot be obtained, the COTR shall be notified to determine whether to proceed with the test.

NOTE: *The “As Tested” vehicle attitude measurements shall be taken within an hour of impact to ensure the proper attitude is met.*

M. VEHICLE INSTRUMENTATION

Place the following accelerometers on the test vehicle (see **Figure 8**) using an attachment method that is considered acceptable by the COTR. It is typically acceptable to use self-tapping screws to affix the accelerometers to a test vehicle, except for those required on the A-pillar and B-pillar. An appropriate adhesive (such as MBond200 glue) can be used to affix all other accelerometers to the test vehicle.

Record the actual number of channels used for the vehicle structure on Data Sheet No. 5. Record the accelerometer coordinates on Data Sheet No. 6. Also record the serial numbers, manufacturer, and calibration date of each accelerometer for incorporation into Appendix D of the Final Report (See **APPENDIX E**, Section 1.9).

- (1) *Vehicle CG* - Triaxial accelerometer mounted on the floor at the vehicle CG (as determined in the “As Tested” condition) to collect Ax, Ay, and Az data.
- (2) *Right Side Sill @ Front Seat* - Triaxial accelerometer mounted on the opposite side to the impacted side sill at the front seat to provide Ax, Ay and Az data.
- (3) *Right Side Sill @ Rear Seat* - Triaxial accelerometer mounted on the opposite side to the impacted side sill at the rear seat to provide Ax, Ay and Az data.
- (4) *Left Side Sill @ Front Seat* - Uniaxial accelerometer mounted on the impacted side sill in line longitudinally with the center of the widest portion of the front door and located under the sill inward of pinch welds to provide Ay data.
- (5) *Left Side Sill @ Rear Seat* - Uniaxial accelerometer mounted on the impacted side sill in line longitudinally with the center of the widest portion of the rear door and located under the sill inward of pinch welds to provide Ay data.
- (6) *Left Lower A-Pillar* - Uniaxial accelerometer mounted on the impacted lower A-Pillar (located 1/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.
- (7) *Left Middle A-Pillar* - Uniaxial accelerometer mounted on the impacted middle A-Pillar (located 2/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.

NOTE: *Do not install if disassembly of the dash is required for installation.*

- (8) *Left Lower B-Pillar* - Uniaxial accelerometer mounted on the impacted lower B-Pillar (located 1/3 the distance from the floor to the bottom of the door’s window opening) to provide Ay data.
- (9) *Left Middle B-Pillar* - Uniaxial accelerometer mounted on the impacted middle B-Pillar (located 2/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.
- (10) *Front Seat Track* - Uniaxial accelerometer mounted on the front seat track nearest the impacted door and approximately aligned with the driver hip point to provide Ay data.
- (11) *Rear Seat Structure* - Uniaxial accelerometer mounted on the rear seat structure (if easily accessible) nearest the impacted door and approximately aligned with the dummy’s hip pivot point to provide Ay data
- (12) *Right Rear Occupant Compartment* - Uniaxial accelerometer mounted in the rear occupant compartment to provide Ay data.
- (13) *Engine Block* - Biaxial accelerometer mounted on the top of the engine to measure accelerations in the x and y directions.
- (14) *Rear Floor Pan Above Axle* - Triaxial accelerometer mounted on the rear floor pan above the axle to provide Ax, Ay and Az data.

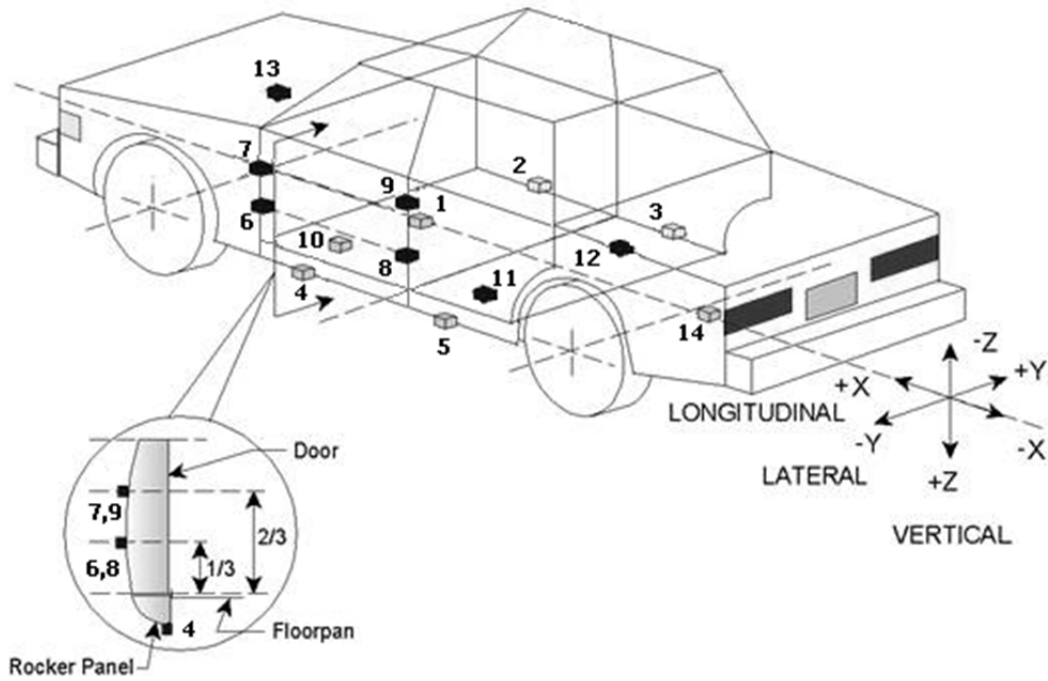


Figure 8 - Test Vehicle Instrumentation

N. MOVING DEFORMABLE BARRIER INSTRUMENTATION

The moving deformable barrier shall be instrumented as shown in **Figure 9**.

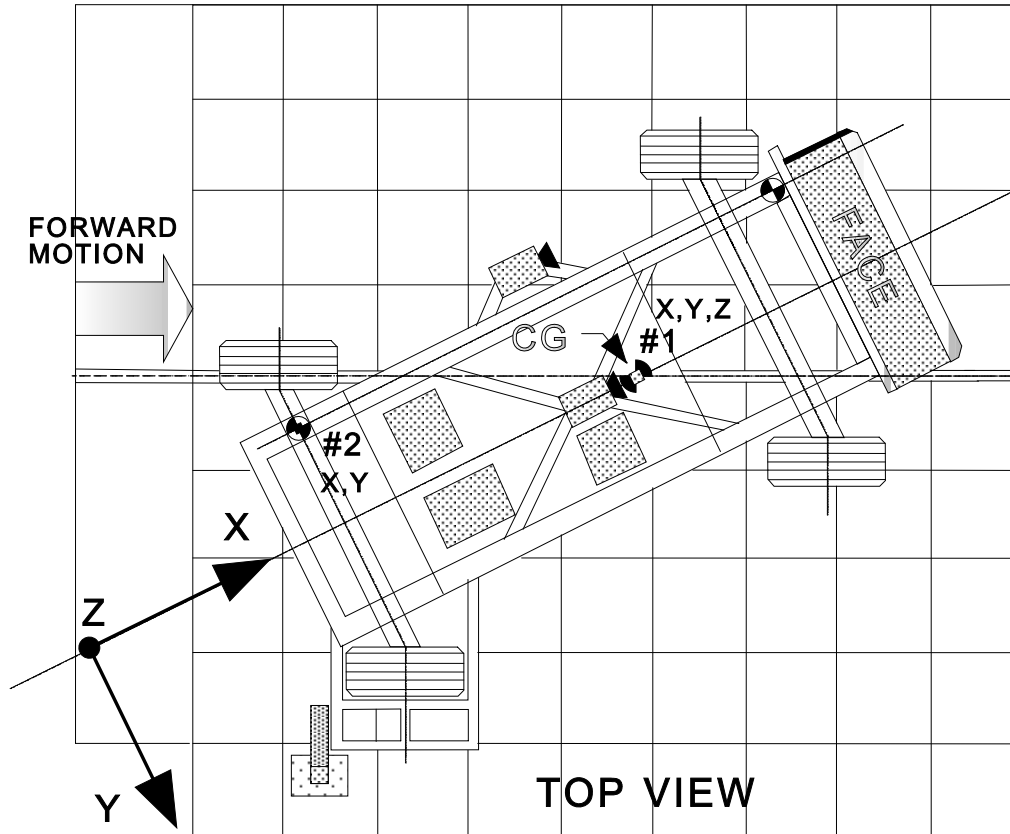


Figure 9 - Moving Deformable Barrier Instrumentation

Record the actual number of channels used for the MDB on Data Sheet No. 5. Record the accelerometer coordinates on Data Sheet No. 7. Also record the serial numbers, manufacturer, and calibration date of each accelerometer for incorporation into Appendix D of the Final Report (See **APPENDIX E**, Section 1.9)

- (1) A triaxial accelerometer shall be mounted at the MDB's center of gravity to provide A_x , A_y and A_z data -- refer to **Figure 9**.
- (2) A biaxial accelerometer shall be mounted on the left side of the frame member along the rear axle centerline to provide A_x and A_y data.
- (3) Contact switches shall be installed on the right and left side of the MDB honeycomb bumper. Note that these two switches are in addition to the one installed on the test vehicle.

O. ADJUSTABLE SUPPORTS

Position the seat's adjustable lumbar supports so that they are in the lowest, retracted or deflated adjustment positions. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. Place any adjustable leg support system in its rearmost position.

P. ADJUSTABLE HEAD RESTRAINTS

- (1) **50th Percentile Male Dummy** - Use any adjustment of the head restraint to position it at its highest and most full forward position. If it rotates, rotate it such that the head restraint extends as far forward as possible. Mark the head restraint at its fully retracted and full forward positions to demonstrate range of motion. Measure the most forward position of the front edge of the head restraint from a fixed point on the seat back along a horizontal plane parallel to the longitudinal centerline of the test vehicle. **Mark** the point on the seat back where the measurement was taken for future reference, and note the head restraint position on Data Sheet No. 2.
- (2) **5th Percentile Female Dummy** - Use any adjustment of the head restraint to position it at its lowest and most full forward position. If it is possible to achieve a position lower than the effective detent range, the head restraint should be set to its lowest possible position. Only positions intended for occupant use as defined by FMVSS No. 202a should be considered. Any non-use position is excluded from being considered as the lowest possible position. This information should also be included in the manufacturer-supplied data found in Form 1. If the head restraint rotates, rotate it such that the head restraint extends as far forward as possible. Mark the head restraint at its fully retracted and full forward positions to demonstrate range of motion. Measure the lowest position of the bottom edge of the head restraint from a fixed point on the seat back along a vertical plane perpendicular to the longitudinal centerline of the test vehicle. **Mark** the point on the seat back where the measurement was taken for future reference, and note the head restraint position on Data Sheet No. 2.

Q. VEHICLE SEAT CENTERLINE

For the driver's seat, if adjustable, place the seat back in its most vertical (upright) position. For bucket seats, draw a line along the intersection of a vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface, seat back, and head restraint. For bench seats, draw a line along the intersection of a vertical longitudinal plane that passes through the centerline of the steering wheel and the seat cushion upper surface, seat back, and head restraint.

In either case, this line shall be visible in video footage from Camera No. 7.

For the rear passenger's seat, for both bucket seats and bench seats, draw a line along the intersection of a vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface, seat back, and head restraint.

R. SEAT ADJUSTMENT REFERENCE MARKS

NOTE: *Before marking, move each seat through its full range of motion using all available controls. Separately, operate each control to determine whether it moves the seat and/or seat cushion primarily in the fore-aft or up-down directions. Draw arrows on these controls to demonstrate how each one operates.*

Driver, Front Center, and Front Passenger Seats

Prior to placing the dummy in the driver seating position as specified by the COTR, mark for reference the seat adjustment as follows:

- (1) With the seat's adjustable lumbar supports in the lowest, retracted or deflated adjustment positions, and any adjustable parts of the seat that provide additional support in the lowest or most open adjustment position, **mark** a point (seat cushion reference point - **SCRCP**) on the side of the seat cushion that is between 150 mm and 250 mm from the front outermost edge of the seat cushion. For seat cushions that move up and down independently from the seat housing, **mark** the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.
- (2) Draw a horizontal line (seat cushion reference line - **SCRL**) through the seat cushion reference point.
- (3) Using only the controls that primarily move the seat in the fore-aft direction, move the **SCRCP** to the rearmost position.
- (4) If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the **SCRCP** to the rearmost position.
- (5) Using any part of any control, other than the parts just used for fore-aft positioning, determine and record the range of angles of the **SCRL** and set the **SCRL** at the mid-angle. Record the mid-angle.
- (6) If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the **SCRCP** in its lowest position with the **SCRL** line angle at the mid-angle found in (5).
- (7) Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.
- (8) Using only the controls that primarily move the seat in the fore-aft direction, **mark** for future reference the fore-aft seat positions. **Mark** each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and **mark** each detent. For power seats (no detents), move the seat forward 10 mm at a time and mark each increment. Then label the rearmost, middle, and foremost positions as: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost. Record the total fore-aft seat movement in millimeters and detents, if applicable, on the applicable Data Sheet.
- (9) Use only the controls that primarily move the **SCRCP** in the fore-aft direction to place the seat in the rearmost position.
- (10) Using any controls, other than the controls that primarily move the seat and/or seat cushion in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle heights of the **SCRCP** with the **SCRL** at the mid-angle determined in (5) by measuring from the **SCRCP** to a reference point on the floor pan or sill. Record the maximum, minimum, and middle heights on the applicable Data Sheet.
- (11) Using only the controls that primarily move the seat and/or seat cushion in the fore-aft direction, place the **SCRCP** in the mid-fore-aft position.
- (12) Using any controls, other than the controls that primarily move the seat and/or seat cushion in the fore-aft direction, find and visually **mark** for future reference the maximum, minimum, and middle heights of the **SCRCP** with the **SCRL** at the mid-angle determined in (5) by measuring from the **SCRCP** to a reference point on the floor pan or sill. Record the maximum, minimum, and middle heights on the applicable Data Sheet.
- (13) Using only the controls that primarily move the seat in the fore-aft direction, place the **SCRCP** in the foremost position.
- (14) Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the **SCRCP** with the **SCRL** at the mid-angle determined in (5) by measuring from the **SCRCP** to a reference point on the floor

pan or sill. Record the maximum, minimum, and middle heights on the applicable Data Sheet.

- (15) For adjustable seat backs, position the seat back at the foremost stop. **Mark** each position of adjustment from the foremost to rearmost stops so that there is a visual indication when the seat back is at a particular position. For manually adjustable seat backs (with detents), move the seat back rearward one detent at a time and **mark** each detent. Label the rearmost, middle, and foremost positions with the measured detent. If no middle detent exists, label the next most-rearward detent to the middle position. For power seat backs (no detents), move the seat back rearward one degree at a time and **mark** each angle. Angles should be measured at the location on the seat (head restraint, seat back, plastic trim, etc.) as indicated by the manufacturer on Form No. 1 (see sample in **APPENDIX E**). Label the rearmost, middle, and foremost positions with the measured angle. Record the range of angles in degrees and detents on Data Sheet No. 2. Visually **mark** and label for future reference the seat back angle, if adjustable, at the manufacturer's nominal design riding position for the dummy in the manner specified by the manufacturer on Form No. 1. If the position is not specified, set the seat back at the first detent rearward of 25° from the vertical.

Repeat steps 1 through 15 of this section to determine the reference marks for the front outboard passenger seat as well unless the front outboard passenger seat does not adjust independently of the driver's seat. Also, repeat steps 1 through 15 of this section to determine the reference marks for the front center seat if the front center seat adjusts independently of the front passenger seat.

NOTE: *If the front outboard passenger seat does not adjust independently of the driver's seat, the driver's seat shall control the final fore-aft position of the passenger seat and there is no need to repeat steps 1 through 15 of this section for the front outboard passenger seat. If the front center seat does not adjust independently of the front passenger's seat, the front passenger's seat shall control the final position of the front center seat and there is no need to repeat steps 1 through 15 of this section for the front center seat.*

Rear Center and Rear Outboard Passenger Seats

Prior to placing the dummy in the rear passenger seating position as specified by the COTR, mark for reference the seat adjustment as follows:

- (1) With the seat's adjustable lumbar supports in the lowest, retracted or deflated adjustment positions, and any adjustable parts of the seat that provide additional support in the lowest or most open adjustment position, **mark** a point (seat cushion reference point - **SCR**P) on the side of the seat cushion that is between 150 mm and 250 mm from the front outermost edge of the seat cushion. For seat cushions that move up and down independently from the seat housing, **mark** the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.
- (2) Draw a horizontal line (seat cushion reference line - **SCR**L) through the **SCR**P.
- (3) If possible, using only the controls that primarily move the seat in the fore-aft direction, move the **SCR**P to the rearmost position.
- (6) If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the **SCR**P to the rearmost position.
- (5) Using any part of any control, other than the parts just used for fore-aft positioning, determine and record the range of angles of the **SCR**L and set the **SCR**L at the mid-angle. Record the mid-angle.

- (6) If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the **SCRIP** in its lowest position with the **SCRL** line angle at the mid-angle found in (5).
- (7) Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.
- (8) Using only the controls that primarily move the seat in the fore-aft direction, **mark** for future reference the fore-aft seat positions. **Mark** each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and **mark** each detent. For power seats (no detents), move the seat forward 10 mm at a time and mark each increment. Then label the rearmost, middle, and foremost positions as: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost. Record the total fore-aft seat movement in millimeters and detents, if applicable, on the applicable Data Sheet.
- (9) Use only the controls that primarily move the **SCRIP** in the fore-aft direction to place the seat in the rearmost position.
- (10) Using any controls, other than the controls that primarily move the seat and/or seat cushion in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle heights of the **SCRIP** with the **SCRL** at the mid-angle determined in (5) by measuring from the **SCRIP** to a reference point on the floor pan or sill. Record the maximum, minimum, and middle heights on the applicable Data Sheet.
- (11) For adjustable seat backs, position the seat back at the foremost stop. **Mark** each position of adjustment from the foremost to rearmost stops so that there is a visual indication when the seat back is at a particular position. For manually adjustable seat backs (with detents), move the seat back rearward one detent at a time and **mark** each detent. Label the rearmost, middle, and foremost positions with the measured detent. If no middle detent exists, label the next most-rearward detent to the middle position. For power seat backs (no detents), move the seat back rearward one degree at a time and **mark** each angle. Angles should be measured at the location on the seat (head restraint, seat back, plastic trim, etc.) as indicated by the manufacturer on Form No. 1 (see sample in **APPENDIX E**). Label the rearmost, middle, and foremost positions with the measured angle. Record the range of angles in degrees and detents on Data Sheet No. 2. Visually **mark** and label for future reference the seat back angle, if adjustable, at the manufacturer's nominal design riding position for the dummy in the manner specified by the manufacturer on Form No. 1. If the position is not specified, set the seat back at the first detent rearward of 25° from the vertical.

Repeat steps (1) through (11) of this section to determine the reference marks for the adjacent rear outboard passenger seat as well unless the outboard rear passenger seats do not adjust independently of one another. Also, repeat steps (1) through (11) of this section to determine the reference marks for the rear center seat if the rear center seat adjusts independently of the rear outboard non-struck side passenger seat.

NOTE: *If the rear outboard passenger seats do not adjust independently of one another, the struck-side rear passenger seat shall control the final fore-aft position of the non-struck-side rear passenger seat and there is no need to repeat steps (1) through (11) of this section for the non-struck-side rear passenger seat. If the rear center seat does not adjust independently of the rear non-struck side passenger's seat, the rear non-struck side passenger's seat shall control the final position of the rear center seat and there is no need to repeat steps (1) through (11) of this section for the rear center seat.*

S. SETTING THE SEATS

NOTE: *Position the rear seat occupant (SID-IIs 5th percentile female), if applicable, prior to positioning the driver seat occupant (ES-2re 50th percentile male).*

For the 50th Percentile Male dummy positioned in the driver's seat

Using the reference marks determined in **Section 11.1R**, set the seat accordingly:

- (1) If adjustable, set the seat back angle at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 25 degrees from the vertical.
- (2) Using only the control that primarily moves the seat and seat cushion fore and aft, move the **SCR**P to the mid-travel position. If an adjustment position does not exist midway between the forward most and rearmost positions, set the seat in the closest adjustment position to the rear of the midpoint. Record the fore-aft test position with respect to the forwardmost position on Data Sheet No. 2.
- (3) If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft, set the height of the **SCR**P to the minimum height, with the **SCR**L set as closely as possible to the mid-angle determined in **Section 11.1R**. Record the "As-Tested" **SCR**L angle and **SCR**P height on Data Sheet No. 2.
- (4) **After** positioning the dummy in the seat (see **Section 11.2**), record the test position seat back angle on Data Sheet No. 2 with respect to the most upright position. Also describe how the seat back was positioned.

NOTE: *If the center front seat and/or the non-struck-side seat adjacent to the struck-side seat **does not** adjust independently of the struck-side seat, the struck-side seat controls the final positions of the center front seat and the non-struck-side seat. The seat back angle for the driver's seat shall control the seat back angle for the center front seat and the front passenger seat. If the center front seat and/or the non-struck-side seat **does** adjust independently of the struck side seat, repeat steps 1-4 of this section to set the center front seat and the non-struck-side seat, disregarding the dummy positioning step.*

For the 5th Percentile Female dummy positioned in the left rear seat

Using the reference marks determined in **Section 11.1R**, set the seat accordingly:

- (1) Using only the control that primarily moves the seat and seat cushion fore and aft, move the **SCR**P to the full rearward position. Record the fore-aft test position with respect to the forwardmost position on Data Sheet No. 2.
- (2) If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft, set the height of the **SCR**P to the minimum height, with the **SCR**L set as closely as possible to the mid-angle determined in **Section 11.1R**. Record the "As-Tested" **SCR**L angle and **SCR**P height on Data Sheet No. 2.
- (3) Set the seat back angle or adjust the lower neck bracket according to the instructions given in **APPENDIX C**.
- (4) **After** positioning the dummy in the seat (see **Section 11.2**), record the test position seat back angle on Data Sheet No. 2 with respect to the most upright position. Also describe how the seat back was positioned.

NOTE: *If the center rear seat and/or the non-struck-side seats adjacent to the struck-side seat **does not** adjust independently of the struck-side seat, the struck-side*

*seat controls the final positions of the center rear seat and the non-struck-side seat. The seat back angle for the struck-side rear passenger seat shall control the seat back angle for the center rear seat and the non-struck-side seat. If the center rear seat and/or non-struck-side seats **do** adjust independently of the struck side seat, repeat steps 1-4 of this section to set the center rear seat and the non-struck-side seat, disregarding the dummy positioning step.*

T. STEERING WHEEL ADJUSTMENT

Complete the following steps to set the final steering wheel location.

- (1) Determine each up and down position. **Label** three of the positions with the following: H for highest, M for mid-position (if there is no mid-position, label the next lowest adjustment position), and L for lowest. Record the tilt angle of each position on the applicable Data Sheet.
- (2) Determine each in and out position. **Label** three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the next rearmost adjustment position), and R for rearmost. Record the fore/aft measurement of each position on the applicable Data Sheet.
- (3) Place the steering wheel in the mid up/down and mid in/out position. If no up-and-down mid-position exists, place the steering wheel in the next lowest adjustment position to the mid-position. If no in-and-out mid-position exists, place the steering wheel in the next rearmost adjustment position to the mid-position. Record the fore/aft measurement and tilt angle of the test position on the appropriate Data Sheet in **APPENDIX E**. Also describe how the measurement was attained.

U. ADJUSTABLE SEAT BELT ANCHORAGES

- (1) **50th Percentile Male Dummy-** Place adjustable seat belt anchorages in the nominal adjustment position in accordance with the manufacturer-supplied data found in Form 1. **Mark** and label each position with the following: H for highest, M"X" for mid-positions (where "X" stands for 1, 2, 3, etc. and 1 is used for the highest mid-position), and L for lowest.
- (2) **5th Percentile Female Dummy-** Place adjustable seat belt anchorages in the nominal adjustment position in accordance with the manufacturer-supplied data in Form 1. **Mark** and label each position with the following: H for highest, M"X" for mid-positions (where "X" stands for 1, 2, 3, etc. and 1 is used for the highest mid-position), and L for lowest.

Record this information in the appropriate Data Sheet in **APPENDIX E**.

V. SEAT BELT GUIDES

Usage of seat belt guides should be in accords with instructions included in the vehicle owner's manual or in Form No. 1 (see sample of Form No. 1 in Section 3 of **APPENDIX E**).

W. ADJUSTABLE ARMRESTS AND CONSOLES

Place any adjustable armrest and/or console in the retracted position.

X. DOORS

Place all doors (including hatchback or tailgate) in the fully closed and latched position. Check instrument panel telltales just prior to the test to ensure that all doors and hatches

are closed. If the test vehicle comes equipped with standard Automatic Door Locks (ADLs) and the vehicle owner's manual does not provide instructions on how to disable this feature, the struck-side doors should be locked pre-test. If the vehicle owner's manual provides instructions on how to disable this feature, the struck-side doors should NOT be locked pre-test. If the test vehicle is not equipped with ADLs or if ADLs are considered optional equipment, the struck-side doors should NOT be locked pre-test. In all instances, non-struck-side doors should be unlocked pre-test.

Y. TRANSMISSION ENGAGEMENT

- (1) **Manual Transmission** - Place manual transmissions in 2nd gear.
- (2) **Automatic Transmission** - Place automatic transmissions in neutral.

Z. PARKING BRAKE ENGAGEMENT

Engage the parking brake.

AA. IGNITION SWITCH

The key shall be in the ignition and switched to the "ON" position. If the ignition switch operates without entry of a key, assure the ignition is in the "power on" position.

AB. WINDOWS

Place any movable windows and vents located on the struck side of the vehicle in the fully closed position

AC. SUNROOF

Place sunroof(s) in the fully closed position.

AD. CONVERTIBLE TOPS

Place convertible tops in the closed passenger compartment configuration

AE. FLOOR MATS

If the vehicle was received with floor mats, place them in their proper locations prior to testing.

11.2 DUMMY PREPARATION AND POSITIONING

Place properly clothed and calibrated ES-2re and SID-IIs dummies in the driver and passenger seats, respectively, in accordance with **APPENDIX C**.

***Place test dummies in the test vehicle the day of the test.
Do not place the dummies in the vehicle the day before testing for
overnight storage. Test dummies shall remain in the test vehicle for a time
not to exceed twelve (12) hours.***

Ensure that all cables from the dummies are routed in accords with Section 10.0 of the *Procedures for Assembly, Disassembly, and Inspection (PADI) of the EuroSID-2re 50th Percentile Adult Male Side Impact Crash Test Dummy, February 2008* for the ES-2re and with Section 7.0 of the *Procedures for Assembly, Disassembly, and Inspection (PADI) of the SID-IIsD Side Impact Crash Test Dummy, September 2006* for the SID-IIs. Also ensure that all required strain relief is used. Cables from the upper and lower torso should be combined as shown in each PADI. This

combined cable bundle should be routed exterior to the dummy from the dummy's pelvis. The laboratory should take precautions to ensure that this cable bundle is routed over the front seat armrest/console such that it allows sufficient slack and does not preclude or restrict the dummy movement during impact. Duct tape may be used to secure the cable bundle to the front seat armrest/console to prevent cable damage and to permanently set the necessary amount of slack.

Once the dummies are properly positioned and the seat belts have been fastened over the dummies' chests, align a 150 mm (6 inch) segment of yellow/red checkerboard tape with the outboard edge of a shoulder belt portion of the seat belt such that it will be visible in Camera View No. 7 for the driver dummy and No. 9 for the rear passenger dummy. Place a second 150 mm (6 inch) segment of yellow/red checkerboard tape on the dummies' chests such that it is aligned with the first segment of tape placed along the outboard edge of the shoulder belt. The two checkerboard tape segments should be cut and positioned such that the colors for each square-inch section alternate on either side of the edge of the shoulder belt. Do not allow the tape segments to stick to one another.

The final positions of the driver and passenger dummies seated in the test vehicle shall be recorded on the applicable Data Sheet in **APPENDIX E** by taking the following measurements shown in **Figure 10** and **Figure 11** (accurate to within ± 3 mm):

NOTE: *When a level is to be used, it is to ensure that the line containing the two points described is either parallel or perpendicular to the ground. If a measurement to be made is less than 250 mm, ignore the directions to use a level and approximate a level measurement. Also, when a measurement is to be taken to or from the center of a bolt on the dummy, take the measurement from the center of the bolt hole if the bolt is recessed.*

* **Measurement** used in Data Tape Reference Guide

A. DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

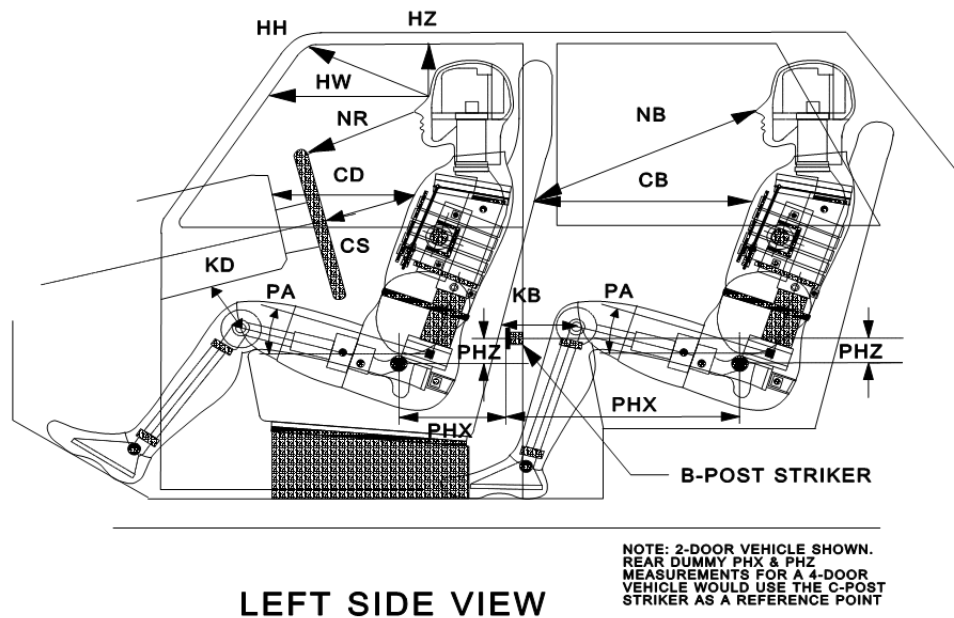


Figure 10 - Dummy Longitudinal Clearance Dimensions

- *HH *Head to Header* - Measure the distance from the point where the driver dummy's nose meets the forehead (between the eyes) to the furthest point forward on the header.
- *HW *Head to Windshield* - Measure the distance from the point where the driver dummy's nose meets the forehead (between the eyes) to a point on the windshield directly in front of it. Use a level or plumb-bob.
- HZ *Head to Roof Liner* - Measure the distance from the point where the driver or passenger dummy's nose meets the forehead (between the eyes) to the point on the roof directly above it. Use a level or plumb-bob.
- *CS *Chest to Steering Wheel* - Measure from the center of the steering wheel hub to the driver dummy's chest. Use a level. Mark this location on the dummy's chest with a 25 mm (1 inch) diameter target.
- *CD *Chest to Dashboard* - Place a tape measure on the tip of the driver dummy's chin and rotate 125mm of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Mark this point with a 25 mm (1 inch) diameter target. Then, measure the distance from this point to the closest point on the dashboard either between the upper part of the steering wheel between the hub and the rim, or measure to the dashboard placing the tape measure above the rim, whichever is a shorter measurement.
- CB *Chest to Seat Back* - Place a tape measure on the tip of the passenger dummy's chin and rotate 125 mm of it downward toward the dummy to the point of contact on the transverse center of the passenger dummy's chest. Mark this point with a 25 mm (1 inch) diameter target. Then measure the distance from this point to the closest point on the seat back directly forward of the rear outboard passenger seating position. Mark point on seat back for later NB measurement.

- NR *Nose to Rim* - Measure the distance from the tip of the driver dummy's nose to the closest point on the top of the steering wheel rim.
- NB *Nose to Seat Back* - Measure the distance from the tip of the passenger dummy's nose to the **same** point on the seat back located in *CB* measurement.
- KD(L)/ *Left and Right Knees to Dashboard* - Measure the distance from the center of the driver dummy's knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard.
- KD(R)
- KDA(L)/ *Left and Right Knees to Dashboard Angle* - Using the line representing the length KDA(R) measurement of the driver dummy's knees to the dashboard (KD(L) and KD(R)), measure the angle between that line and the horizontal.
- KB(L)/ *Left and Right Knees to Seat Back* - Measure the distance from the center of the passenger dummy's knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the seat back.
- KB(R)
- KBA(L)/ *Left and Right Knees to Seat Back Angle* - Using the line representing the length KBA(R) measurement of the passenger dummy's knees to the seat back (KB(L) and KB(R)), measure the angle between that line and the horizontal.
- KB(R))
- PHX *Hip Point to Striker(X)* - Locate a point on the striker. Project this point (preferably, with a level) vertically downward. Measure the distance horizontally from the pivot center of the dummy's torso and thigh to the point it intersects with the level.
- PHZ *Hip Point to Striker(Z)* - Locate a point on the striker. Project this point (preferably, with a level) horizontally toward the pivot center of the driver or passenger dummy's torso and thigh. Measure the distance vertically from the pivot center of the driver or passenger dummy's torso and thigh to the point it intersects with the level.
- PAX *Pelvic Tilt Angle (X)* – For ES-2re, use the pelvic tilt sensor or another method approved by the COTR. For SID-IIs, insert the pelvic angle gauge into the hip pivot point gauging hole on the dummy and measure this angle with respect to the horizontal, or record the pelvic tilt angle X measured by tilt sensors in the test dummy, if so equipped.
- PAY *Pelvic Tilt Angle (Y)* - For SID-IIs only, insert the pelvic angle gauge into the hip pivot point gauging hole on the dummy and measure this angle with respect to the vertical, or record the pelvic tilt angle Y measured by tilt sensors in the test dummy, if so equipped.

NOTE: *When testing 2-door vehicles, the B-pillar striker will be used as the reference point for PHX & PHZ measurements. When testing 4-door vehicles, the B-pillar striker will serve as the reference point for the front seat occupant, while the C-pillar striker will be used for the rear seat occupant.*

B. DUMMY LATERAL CLEARANCE DIMENSIONS

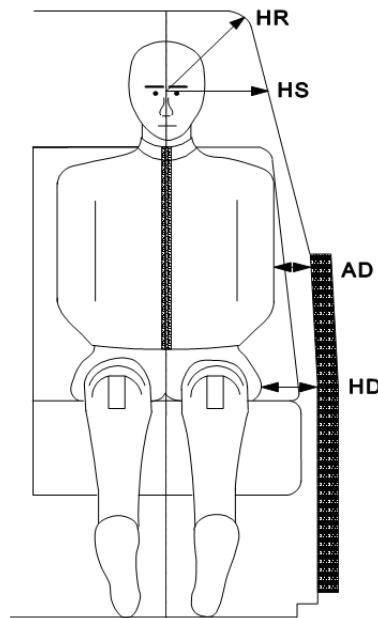


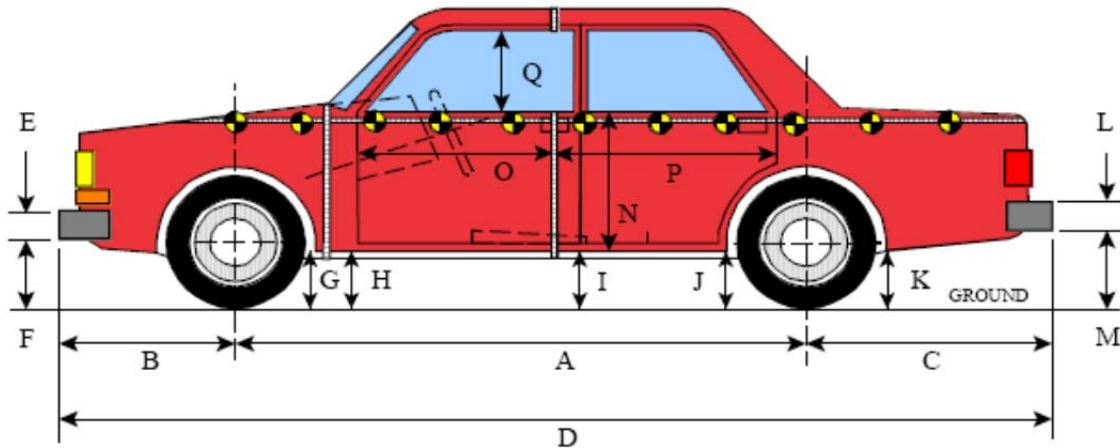
Figure 11- Dummy Lateral Clearance Dimensions

- *HR *Head to Side Header* - Measure the shortest distance from the point where the driver or passenger dummy's nose meets the forehead (between the eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.
- *HS *Head to Side Window* - Measure the distance from the point where the driver or passenger dummy's nose meets the forehead (between the eyes) horizontally to the outside of the side window. In order to make this measurement, roll the window down to the exact height which allows a level measurement. Use a level.
- *AD *Arm to Door* - Measure the distance from the center of the bottom of the outboard arm segment where it meets the driver or passenger dummy's torso to the closest point on the door.
- *HD *Hip Point to Door* - Project a point horizontally from the pivot center of the dummy's torso and thigh, outward to the edge of the pelvis skin (for ES-2re) or pelvis plug (for SID-IIs). Measure the distance horizontally from this point to the closest point on the door panel.

11.3 TEST VEHICLE AND MOVING DEFORMABLE BARRIER MEASUREMENTS

A. TEST VEHICLE PROFILE MEASUREMENTS (IMPACT SIDE ONLY)

Using **Figure 12** as a guide, take the following measurements listed below prior to impact with the vehicle in the "As Tested" condition resting on a level surface and post-test, at the same points, with the vehicle's tires inflated and resting on a level surface. Compute the difference between the pre-test and post-test measurements and record all measurements on the applicable Data Sheet.



LEFT SIDE VIEW

All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3 mm

Figure 12 - Impact Side View

- A Wheelbase - Front axle centerline to rear axle centerline
- B Front Axle to FSOV - The longitudinal distance between the front axle centerline and the front bumper
- C Rear Axle to FSOV - The longitudinal distance between the rear axle centerline and the rear bumper
- D Total Length at Centerline - Overall length at the vehicle's longitudinal centerline
- E Front Bumper Thickness - Vertical height of the front bumper fascia
- F Front Bumper Bottom to Ground - Vertical distance from ground to the bottom of the front bumper fascia
- G Sill Height at Front Wheel Well - Vertical distance from ground to the sill at the front wheel well opening
- H Sill Height at Front Door Leading Edge - Vertical distance from ground to the sill at the front door seam
- I Sill Height at B-Pillar - Vertical distance from ground to the sill in line with the front door striker or B-pillar if no striker exists
- J1 Sill Height at Rear Wheel Well - Vertical distance from ground to the sill at the rear wheel well opening
- J2 Pinch Weld Height at Rear Wheel Well - Vertical distance from ground to the pinch weld at the rear wheel well opening
- K Sill Height Aft of Rear Wheel Well - Vertical distance from ground to the vehicle sheet body at the rear of the rear tire's wheel well
- L Rear Bumper Thickness - Vertical height of rear bumper fascia
- M Rear Bumper Bottom to Ground - Vertical distance from the ground to the bottom of the rear bumper
- N Sill Height to Bottom of Front Window Sill - Vertical distance from the bottom of the door to the bottom of the front window sill
- O Front Door Leading Edge to Impact Reference Line - Longitudinal distance from the vertical impact reference line to the front door seam
- P Rear Door Trailing Edge to Impact Reference Line - Longitudinal distance from the vertical impact reference line to the rear door seam
- Q Front Window Opening - Vertical distance that measures the front window opening on the impact side
- R. Right Side Length - Longitudinal distance of the right side of the vehicle measured along a plane parallel to its longitudinal centerline

- S. *Left Side Length* – Longitudinal distance of the left side of the vehicle measured along a plane parallel to its longitudinal centerline
- T. *Maximum Vehicle Width* – Width of the vehicle measured laterally across the vehicle at the location of maximum width

B. TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

- (1) Pre-test, with the vehicle resting on a flat level surface in the “As Tested” configuration, establish a fixed reference plane that is parallel to the vehicle’s longitudinal centerline.
- (2) Measure from the fixed reference plane to the exterior vehicle body across the entire length of the impact side at all five levels (as determined in **Section 9.7**). Take measurements at 150 mm intervals forward and rearward of the impact reference line. Mark the location where each measurement is taken for future reference.
- (3) Post-test, place the test vehicle on a flat, level surface. Inflate the test vehicle’s tires to the maximum cold pressure.
- (4) Using the same reference locations established in step (2) above, begin taking static crush measurements at the first 150mm interval forward of the forward-most point of the induced body damage and end at the first 150 mm interval past the rearward-most point of induced body damage. Record all measurements on the applicable Data Sheet.
- (5) Compute the difference between the pre-test and post-test measurements (static crush) at each interval.
- (6) For each level 1 through 5, record the vertical height above the ground. Compute the maximum static crush at each level and record this value and the distance from the vertical impact reference line on the applicable Data Sheet.
- (7) For each level 1 through 5, Plot the distance from impact in 150 mm intervals (X-axis) versus the static crush measurement (Y-axis), and include the plot on the applicable Data Sheet. See **Figure 13**.

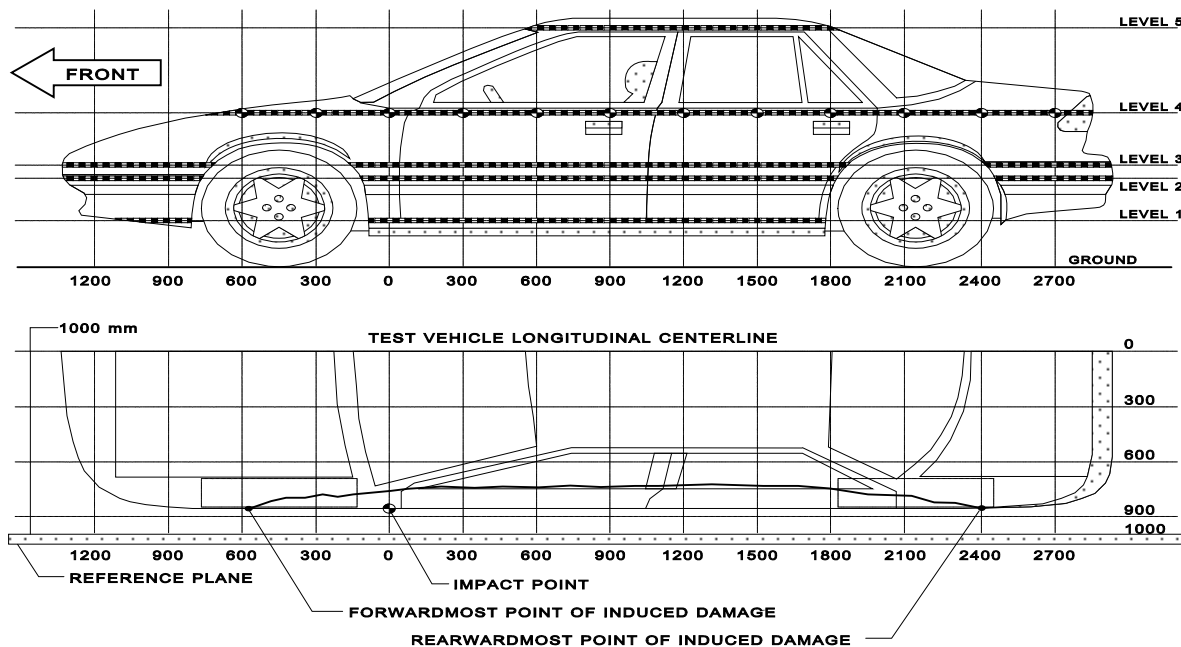


Figure 13 - Exterior Crush Measurement for Test Vehicle

C. MOVING DEFORMABLE BARRIER IMPACT FACE CRUSH MEASUREMENTS

The maximum static crush of the MDB's honeycomb face shall be measured pre-test and post-test in the longitudinal direction at the following vertical locations (see **Figure 14**):

- (1) Center of Bumper Level = 432 mm above ground level
- (2) Top of Bumper Level = 533 mm above ground level
- (3) Mid Level = 686 mm above ground level
- (4) Top-Stack Level = 813 mm above ground level

The crush data shall be recorded on Data Sheet No. 14, "Exterior Static Crush for Impactor Face" (see **APPENDIX E**). Pre- and post-test measurements are taken (from a reference plane perpendicular to and 1,000 mm from the MDB's longitudinal centerline) across the barrier face at 100 mm intervals at each of the four levels specified above.

NOTE: The MDB crush measurement procedure is similar to the procedure used for vehicle crush measurements.

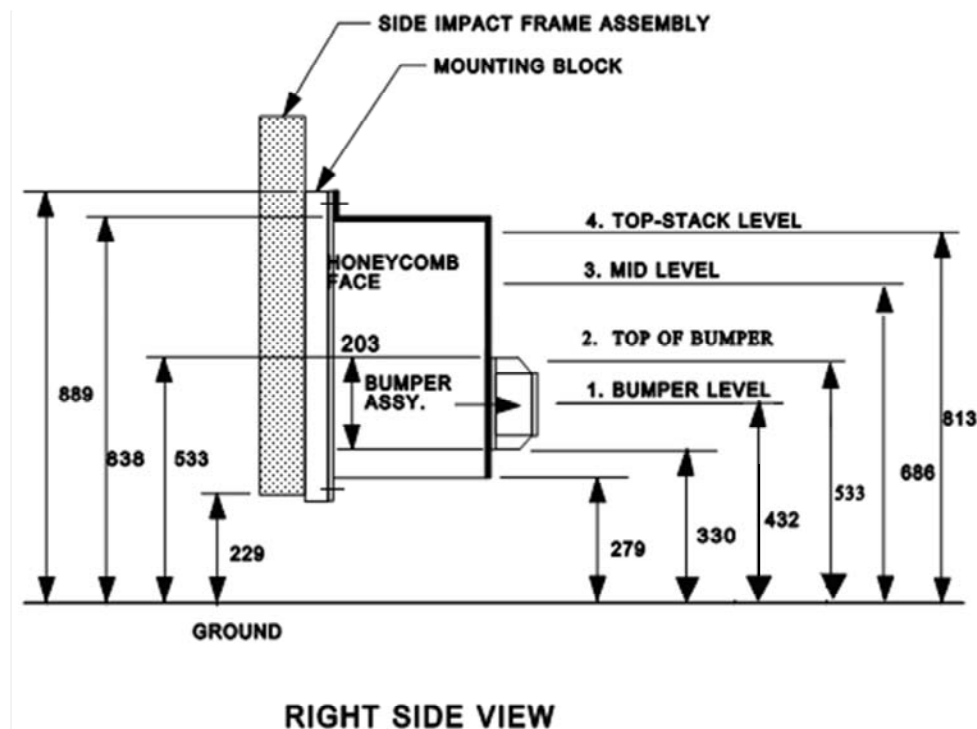


Figure 14- Moving Deformable Barrier Face Crush Measurement Locations - Right Side View

NOTE: All measurements are in millimeters and have a tolerance of ± 3 mm.

11.4 SIDE IMPACT TEST CONDITION

In **Figure 15**, the target vehicle and the MDB are shown in the side impact test condition at $t = 0$. The following conditions must be met.

- A. The MDB shall weigh $1,361 \pm 4.5$ kg.
- B. The line of forward motion of the MDB shall form an angle of $63^\circ \pm 0.5^\circ$ with the centerline of the test vehicle.

- C. The centerline of the MDB shall be perpendicular $90^\circ \pm 1.5^\circ$ to the centerline of the test vehicle at the time of impact.
- D. The MDB shall be crabbed at an angle of $27^\circ \pm 1^\circ$ to the line of forward motion. This crabbed impactor position simulates a moving vehicle-to-vehicle collision.
- E. The MDB's impact speed shall be 61.90 ± 0.80 km/h.
- F. The longitudinal impact tolerance is ± 51 mm (between MDB and test vehicle).
- G. The vertical impact tolerance is ± 20 mm.
- H. The MDB brakes shall be applied 1,000 to 1,500 milliseconds (1- 1.5 seconds) after the side impact (duration of MDB/vehicle contact is approximately 150 milliseconds).

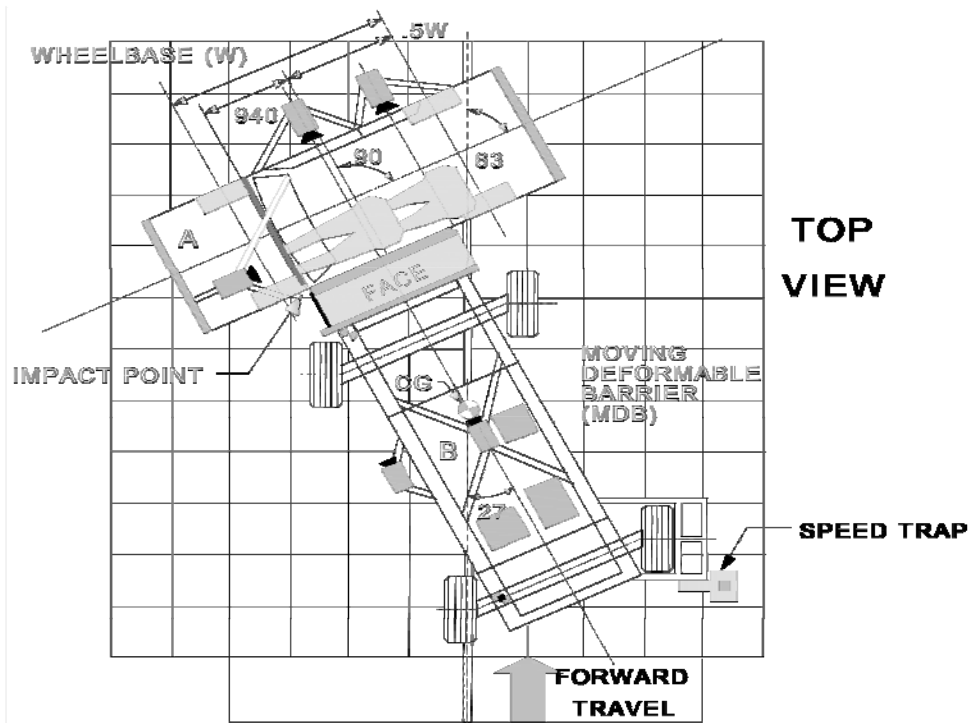


Figure 15- Side Impact Test Condition

12. POST-TEST MEASUREMENTS AND OBSERVATIONS

After the test, the information specified in the following sections shall be recorded on the applicable Data Sheets (see **APPENDIX E**).

Record the following information post-test on the applicable Data Sheets in **APPENDIX E**.

12.1 TEST SPEED AND RELEVANT ANGLES

Record the test speed (km/h) recorded by the primary and redundant speed traps. Also record the angles between the following:

- A. MDB Centerline to Target Vehicle Centerline
- B. MDB Forward Line of Motion to Target Vehicle Centerline
- C. MDB Crabbed Angle to MDB Forward Line of Motion

12.2 *TEMPERATURE AND HUMIDITY STABILIZATION*

Record the dummy/vehicle temperature and humidity stabilization data.

12.3 *DUMMY CONTACT POINTS*

Prior to removing the test dummy from the vehicle, observe where dummy body parts made contact with the vehicle's door interior components, other body parts, the rigid pole, and air bags, as indicated by chalk markings transferred to the contacted surfaces. Where applicable, confirm contact locations by using high speed video analysis. Record observations on Data Sheet No. 8. If no contact occurred for a particular body region, indicate as "No contact".

12.4 *IMPACT POINT*

Measure the horizontal distance from the center of the actual impact point (caused by the welding rod that was affixed to the barrier pre-test) to the center of the target that was placed along the vertical impact reference line in Section 9.4B of this test procedure to denote the point of initial contact. Also, measure the vertical distance from the center of the impact point to the center of the target that was placed along the vertical impact reference line. Record these distances on Data Sheet No. 8.

12.5 *VEHICLE DOORS, SEAT MOVEMENT, RESTRAINT SYSTEMS, AND PROFILE MEASUREMENTS*

A. DOORS

The Contractor shall note the status of all doors post-test. In particular, for each door, it should be noted whether: the door remained closed and operational, the door totally separated from the vehicle at the hinges or latches, the door disengaged from the latched position, the latch separated from the striker, the hinge components separated from each other, the latch or hinge systems pulled out of their anchorages, or the door was jammed shut. All applicable conditions should be noted on Data Sheet No. 8. Video analysis should also be used to verify whether any door, including the rear hatch, opened during the impact event. If the door is open at the striker post-test, the Contractor should take a measurement (mm) of the door opening at this location. Record this information on Data Sheet No. 8. Indicate door or door component failure, or door opening, on the QuickLook Report (see section 13.5,B).

B. SEAT MOVEMENT AND OTHER STRUCTURAL OBSERVATIONS

Note any seat or seat back movement or disengagement on Data Sheet No. 8. Also, note any structural observations pertaining to the pillars, sill, window, and windshield on Data Sheet No. 8. In particular, the Contractor should describe the amount of deformation to the struck-side pillars and struck-side sill. The Contractor should also note whether there was damage to the front windshield area and, if so, where the damage occurred. A similar assessment should be made for the side windows. Any other notable effects from the impact should also be indicated.

C. SUPPLEMENTAL RESTRAINT SYSTEMS

Note whether the vehicle was equipped with the supplemental restraint systems listed in Data Sheet No. 8. Also indicate the deployment status of each restraint system. The

Contractor should also verify that the restraint systems for the driver occupant deployed within 20 ms of impact using high speed video analysis, and should provide descriptive comments for any air bag that failed to deploy, deployed late, or appeared not to have inflated to full volume during impact.

D. PROFILE MEASUREMENTS

After photos have been taken to document the position of the test dummy and condition of the vehicle post-test, and post-test observations related to dummy contact have been recorded, collect the post-test vehicle profile measurements.

12.6 REMOVAL OF ANTHROPOMORPHIC TESTING DEVICES

Once all post-test vehicle profile measurements have been taken, remove the anthropomorphic testing devices from the test vehicle and take the remaining post-test photographs of the vehicle interior. Vehicle doors should not be removed to facilitate the removal of dummies unless all other available options have been exhausted (i.e., removal of the dummy's legs, removal of the shift knob, non-struck-side seat movement, steering wheel movement, etc.). The test dummies should incur no additional damage during removal from the test vehicle, and care should be taken to avoid introducing new contact chalk marks to the vehicle interior. Record any additional post-test observations related to dummy contact.

12.7 FMVSS NO. 301/305 STATIC ROLLOVER

After removal of the ATDs, and within 2 hours after impact (unless otherwise instructed by the COTR), perform an FMVSS No. 301 static rollover fuel system integrity test and an FMVSS No. 305 propulsion battery integrity test (electrolyte spillage and electrical isolation), if applicable, on the test vehicle.

NOTE: *The Contractor must keep the test vehicle under constant observation for Stoddard or propulsion battery electrolyte leakage during the transition between impact and static rollover testing.*

NOTE: *The static rollover test WILL NOT BE CONDUCTED unless instructed by the COTR if any of the following occur: There is an indication of a test anomaly or door opening; If the vehicle exceeds any of the injury criteria stipulated by FMVSS No. 214 during the side impact barrier test; If the vehicle exceeds maximum allowable solvent requirements in accords with FMVSS No. 301 post-impact; If the vehicle exceeds electrolyte spillage requirements in accord with FMVSS No. 305 post-impact; If the vehicle does not meet battery retention or electrical isolation requirements in accords with FMVSS No. 305 immediately post-impact.*

To avoid damage to the underbody of the test vehicle when moving the vehicle to the rollover device, ensure that the forklift is only permitted to make contact with the body sills of the vehicle. Accordingly, it may be necessary to place a stabilizer block made of rubber, wood, or polypropylene between the body sills and the forks of the forklift. This is particularly important for electric vehicles in order to avoid electric shock. Record the details from the FMVSS No. 301 test on the applicable Data Sheets. Details of the FMVSS No. 305 test, if conducted, should be recorded in a supplemental test report to be submitted along with the test report for this side NCAP MDB test.

12.8 POST-TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

After the FMVSS No. 301/305 rollover test is completed and properly documented, collect and record the post-test vehicle exterior crush measurements.

12.9 *REMOVAL OF TEST INSTRUMENTATION AND EVENT DATA RECORDER*

Immediately following the collection of the post-test crush measurements, the Contractor shall remove all test-related instrumentation from the test vehicle and shall also remove the vehicle's Event Data Recorder (EDR) using the information supplied on Form 1 by the vehicle manufacturer. The EDR shall be handled with care and labeled. It shall also be protected from the elements and retained by the test contractor until requested by the COTR.

12.10 *PREPARATION FOR STORAGE*

After removal of all test instrumentation and the vehicle's EDR, the test vehicle should be prepared for storage. Raise all windows on the test vehicle, if possible, close any hatches, if applicable, and close and latch all doors to the extent permitted by the vehicle crush. Exposed window openings should be covered with a covering that will protect the test vehicle from the elements for a period of one year (example: self-adhesive polyethylene plastic film).

13. **TEST DATA DISPOSITION**

The Contractor shall provide a QuickLook Report, which includes Form No. 5 (see **APPENDIX E**) and a copy of preliminary test data/computer-generated plots to the NHTSA representative within two hours after the test. If there is no NHTSA representative at the test, the Contractor shall send this preliminary information to the COTR via e-mail or fax within one (1) day of the test. Additionally, the Contractor shall analyze the preliminary test results as directed by the COTR. The test data tape shall be submitted within three (3) days of the test via e-mail.

13.1 *TEST DATA LOSS*

A. **INVALID TEST DESCRIPTION**

The Part 572 U and Part 572 V test dummies and the test vehicle are instrumented in order to obtain data needed for the New Car Assessment Program (NCAP). The dummy data from 61.90 km/h moving deformable barrier impact tests for evaluation against FMVSS No. 214D injury criteria and the visual record of dummy kinematics are essential to NCAP. An invalid NCAP test is one which does not conform precisely to all requirements/specifications of the NCAP 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 Side Impact NCAP Laboratory Test Procedure and Statement of Work applicable to the test by telephone within 24 hours of the test. Written notice must be sent to the COTR within 48 hours of 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 a retest, should a retest be required. 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 there is a test anomaly or door opening, if the vehicle exceeds any of the injury criteria as stipulated by FMVSS No. 214, if the vehicle exceeds maximum allowable solvent spillage requirements in accords with FMVSS No. 301 or does not comply with electrolyte spillage, battery retention, or electrical isolation requirements in accords with FMVSS No. 305 (where applicable), or if the test results are deemed questionable. If the retest is deemed valid, the vehicle does not exceed any of the injury criteria, the vehicle does not exceed maximum allowable solvent spillage requirements, and no test anomalies occur, the Contractor may dispose of the retest vehicle upon notification from the COTR that the Final Test Report has been accepted, unless otherwise directed.

RETEST CONDITIONS

FAILURE OF THE CONTRACTOR TO OBTAIN THE SPECIFIED DATA AND TO MAINTAIN ACCEPTABLE LIMITS OF TEST PARAMETERS IN THE MANNER OUTLINED IN THIS TEST PROCEDURE SHALL REQUIRE A RETEST AT THE EXPENSE OF THE CONTRACTOR AND WILL INCLUDE THE COST OF THE VEHICLE REPLACEMENT AND RETEST AT THE CONTRACTOR'S EXPENSE. THE PROVISIONS OF THIS PARAGRAPH APPLY, BUT ARE NOT LIMITED, TO THE CONTRACTOR MAINTAINING PROPER IMPACT ANGLE, VEHICLE SEAT CUSHION AND SEAT BACK POSITIONING, DUMMY POSITIONING, CORRECT LAP AND SHOULDER BELT POSITIONING, AND TEST DATA ACQUISITION, REDUCTION, AND PROCESSING.

THE PROPER SPEED TOLERANCE SHALL BE ATTAINED; ONLY SPEEDS MEASURED IN KILOMETERS PER HOUR (KM/HR), DISPLAYED TO THE HUNDREDTHS, WILL BE ACCEPTED. THE REDUNDANT SPEED WILL ONLY BE ACCEPTED IF THE PRIMARY SPEED IS LOST. ALTERNATIVE METHODS SUCH AS FILM ANALYSIS OR AVERAGING OF THE PRIMARY AND REDUNDANT TEST SPEEDS WILL NOT BE ACCEPTED.

THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR OBTAINING ACCURATE DATA FROM ALL PRIMARY CHANNELS FROM EACH OF THE TWO PART 572 TEST DUMMIES PLACED IN THE FRONT AND REAR LEFT OUTBOARD DESIGNATED SEATING POSITIONS (DSP). FAILURE TO PRODUCE SUCH DATA SHALL ALSO BE AT THE EXPENSE OF THE CONTRACTOR AND SHALL INCLUDE VEHICLE REPLACEMENT AND RETEST UNLESS THE OFFICE OF CRASHWORTHINESS DETERMINES THAT THE DUMMY DATA LOSS OCCURRED THROUGH CONDITIONS BEYOND REASONABLE AND FORESEEABLE CONTROL OF THE CONTRACTOR. SHOULD IT BECOME NECESSARY FOR THE CONTRACTOR TO PROCURE ANOTHER TEST VEHICLE, IT MUST HAVE IDENTICAL EQUIPMENT AND OPTIONS AS THE ORIGINAL VEHICLE. THE ORIGINAL VEHICLE REMAINS THE PROPERTY OF NHTSA. THE RETESTED VEHICLE BECOMES THE PROPERTY OF THE CONTRACTOR. THE RETESTED VEHICLE SHALL BE RETAINED WITHOUT FEE BY THE TESTING FACILITY UNTIL ITS DISPOSAL IS AUTHORIZED BY THE COTR.

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 Final Test Report and other required deliverables for the retest vehicle are required to be submitted to the COTR within three (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. CONDITIONS FOR PARTIAL PAYMENT

The Contractor shall exercise reasonable and foreseeable control to ensure that no data is lost or rendered useless. If some non-critical data (such as camera failure) and critical data (acceleration and load data) are not obtained for the crash test and the test is accepted by the NHTSA, the NHTSA will not pay for the missing or lost data.

13.2 DATA PROCESSING

NOTE: *Parts of the following may not apply to on-board data acquisition systems.*

A. Prior to the vehicle crash test, a null reference and a shunt calibration adjustment are performed to set all analog and direct digitized data devices (including FM magnetic tape recorders, if applicable). Immediately following the crash test, a post impact null reference and shunt calibration check will be performed. The pre and post-test zero and shunt calibration check will be recorded and the data submitted with the report as shown below:

CHANNEL DESCRIPTION	S/N	DLR	UNITS	PRE-ZERO	PRE-CAL	POST-ZERO	POST-CAL
Head x	123abc	106.1	G	0.045	2.202	0.045	2.203
Head y							

B. As a secondary instrumentation check, it is suggested that just prior to vehicle testing, accelerometers and on-board signal conditioning equipment be lightly tapped with a rubber mallet to ensure that sensors are recording, and that instrumentation connections are secure.

C. Prior to initiation of the testing program and periodically thereafter, on-board equipment should be drop-tested and performance checked at G levels expected in the NCAP testing. The equipment should be sufficiently shock-hardened to function in the adverse environment. In addition, it is recommended that on a periodic basis, the instrumentation be energized with the sensors removed from the system. The system should then be subjected to a shock equivalent to that in the crash test event. The output voltages should remain stable confirming system integrity.

D. 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 barrier contact will be incorporated with the time reference signal. An instrumentation

self-checking system that simultaneously monitors all data channels and displays, on a single indicator, will provide the GO/NO-GO status of the sensor system.

- E. Test data should NOT be prefiltered, should be submitted at a Class that is higher than Class 1000, and should be digitized at a minimum rate of 10,000 samples per second. Additionally, the data should be truncated at 300 ms. The data is then placed into permanent storage after the application of appropriate calibration scale factors.
- F. As the data is recalled for integration or plotting, the appropriate filter is applied. These filters are in accordance with SAE Recommended Practice J211 "Instrumentation for Impact Tests." Vehicle acceleration data is plotted after the application of an SAE Class 60 filter, and velocity and displacement data is plotted after the application of an SAE Class 180 filter.
- G. Before plotting, the Contractor shall determine the "time zero", which is verified with the trigger signal. When a velocity or displacement trace is to be plotted, integration for the appropriate acceleration signal is performed digitally.
- H. Time zero bias should be removed prior to submission of the data tape disk to NHTSA.
- I. Reported injury measures in test report should be rounded to one significant decimal place according to accepted rounding practices.

J. ES-2re FILTERING REQUIREMENTS

	Filter Class	Cut-off Frequency
Head Acceleration	1000	1650
Thorax Rib Deflection	180	300
Lower Spine T12 Acceleration	180	300
Abdomen Force	600	1000
Pubic Symphysis Force	600	1000

K. SID-IIs FILTERING REQUIREMENTS

	Filter Class	Cut-off Frequency
Head Acceleration	1000	1650
Thorax Rib Deflection	600	1000
Lower Spine T12 Acceleration	180	300
Abdomen Rib Deflection	600	1000
Acetabulum Force	600	1000
Iliac Force	600	1000

L. VEHICLE FILTERING REQUIREMENTS

	Filter Class	Cut-off Frequency
Vehicle Acceleration	60	100

- M. The Contractor must have the ability to produce deliverables that conform to the latest version of the NHTSA “Data Tape Reference Guide”. This guide can be obtained from:
 U.S. Department of Transportation
 National Highway Traffic Safety Administration
 Office of Crashworthiness
 1200 New Jersey Ave SE
 Washington, DC 20590

For online access to the most recent version, visit <http://www-nrd.nhtsa.dot.gov/> and click on “R&D Software.” Under “NVS Software Applications,” click “NHTSA Test Reference Guides” and select the latest version of Volume I: Vehicle Tests.

- N. A file containing the most recent versions of the algorithms used to calculate various injury parameters, such as HIC, can be obtained from the agency. Any questions pertaining to the algorithms or requests for the algorithms should be directed to the following organization:

U.S. Department of Transportation
 National Highway Traffic Safety Administration
 Office of Vehicle Safety Research
 1200 New Jersey Ave, SE
 Room W46-312
 Washington, DC 20590
 Telephone No.: 202-366-4712 Steve Summers

13.3 *REQUIRED DATA TRACE ORDER*

To increase uniformity in data tape formatting, the following curve order is required:

DRIVER TRACES
Head Acceleration (X) Primary
Head Acceleration (Y) Primary
Head Acceleration (Z) Primary
Head Acceleration (X) Redundant
Head Acceleration (Y) Redundant
Head Acceleration (Z) Redundant
Upper Thorax Rib Deflection (Y)
Middle Thorax Rib Deflection (Y)
Lower Thorax Rib Deflection (Y)
Abdomen Forward Force (Y)
Abdomen Middle Force (Y)
Abdomen Rear Force (Y)
Lower Spine T12 Acceleration (X)
Lower Spine T12 Acceleration (Y)
Lower Spine T12 Acceleration (Z)
Pubic Symphysis Force (Y)

LEFT REAR PASSENGER TRACES
Head Acceleration (X) Primary
Head Acceleration (Y) Primary
Head Acceleration (Z) Primary
Head Acceleration (X) Redundant
Head Acceleration (Y) Redundant
Head Acceleration (Z) Redundant
Upper Thorax Rib Deflection (Y)
Middle Thorax Rib Deflection (Y)
Lower Thorax Rib Deflection (Y)
Abdomen Upper Rib Deflection (Y)
Abdomen Lower Rib Deflection (Y)
Lower Spine T12 Acceleration (X)
Lower Spine T12 Acceleration (Y)
Lower Spine T12 Acceleration (Z)
Iliac Wing Force on Impact Side (Y)
Acetabulum Force on Impact Side (Y)

VEHICLE TRACES
Vehicle Center of Gravity (X)
Vehicle Center of Gravity (Y)
Vehicle Center of Gravity (Z)
Right Side Sill at Front Seat (X)
Right Side Sill at Front Seat (Y)
Right Side Sill at Front Seat (Z)
Right Side Sill at Rear Seat (X)
Right Side Sill at Rear Seat (Y)
Right Side Sill at Rear Seat (Z)
Left Side Sill at Front Seat (Y)
Left Side Sill at Rear Seat (Y)
Lower A-Pillar (Y)
Middle A-Pillar (Y)
Lower B-Pillar (Y)
Middle B-Pillar (Y)
Front Seat Track (Y)
Rear Seat Structure (Y)
Rear Occupant Compartment (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan (X)
Rear Floorpan (Y)
Rear Floorpan (Z)

MOVING DEFORMABLE BARRIER TRACES
Center of Gravity Acceleration (X)
Center of Gravity Acceleration (Y)
Center of Gravity Acceleration (Z)
Left Side Rear Axle Acceleration (X)
Left Side Rear Axle Acceleration (Y)
Left MDB Contact
Right MDB Contact

13.4 NOTIFICATION OF APPARENT TEST FAILURE

The performance requirements are found in **Section 2** (General Requirements) of this test procedure. If the test results indicate that the test vehicle has exceeded any of the injury criteria or has not met a requirement, the Contractor shall notify the COTR in accordance with **APPENDIX E – Deliverable Guidelines**.

13.5 DELIVERABLES

Required deliverables for each test are discussed in this section. A Schedule of Deliverables is also provided at the end of this section.

A. FTP WEBSITE

To expedite data transfer between the Contractor and NHTSA, a File Transfer Protocol (FTP) website will be made available to contractors through an FTP coordinator.

(1) ACCESSING THE FTP SITE

The Point of Contact at each test facility will receive an e-mail with the FTP site address and a unique username and password to access the website. A new password will be issued on the 1st of each month. Any FTP client can be used to access and upload data.

(2) UPLOADING TEST DATA

Associated test documentation (test data, photos, videos, reports, etc.) required for each relevant deliverable must be placed in organized and labeled folders such that each folder's contents are easily recognizable. Once the data is organized, the Contractor shall place all folders into **ONE (1)** .zip file per test via the FTP website. The .zip file should then be uploaded using an FTP client.

To ensure successful transfers, please contact your network administrator and confirm that FTP transfers are permitted. Set your FTP client program to upload in passive (PASV) mode and set the "file exists" action to "skip". For FTP assistance, please contact the COTR.

NOTE: If the Contractor is experiencing difficulty uploading the test data to the FTP site, it is the Contractor's responsibility to alert NHTSA in order to arrange for them to download the data instead.

B. QUICKLOOK REPORT

The QuickLook Report (see Form located in **APPENDIX E**) is a preliminary summary of the test that should be e-mailed to the OCWS **within 24 hours of the impact event**.

The Report should detail all relevant injury criteria, vehicle information, air bag deployment, and evidence of FMVSS 214D, FMVSS 301, and FMVSS 305 (if applicable) compliance, and should include data traces relevant to all injury criteria it contains. Also, anything of interest or out of the ordinary should be included in the QuickLook Report in a comments section.

Form No. 5 of the QuickLook Report should be supplied to the vehicle manufacturer at the conclusion of a test. However, no other test information, including data plots and/or star ratings, should be provided.

The filename for the QuickLook report should be formatted as follows:

<NHTSANO><Model Year><Make & Model><Body><SINCAP>Quicklook.pdf

C. DATA TAPE

Within three (3) business days of the test, the Contractor shall **e-mail** NHTSA the test data (data tape) as a .zip file, formatted as specified in the Office of Crashworthiness Research Data Reference Guide – Volume I: Vehicle Tests. Visit <http://www-nrd.nhtsa.dot.gov/> and click on “R&D Software”. Under “NVS Software Applications”, click “NHTSA Test Reference Guides” and select the latest version of “Volume I: Vehicle Tests”.

Data entry software (ENTRÉE) may also be downloaded from the website and used to generate the specification data files as defined in the guides. Visit <http://www-nrd.nhtsa.dot.gov/> and click on “R&D Software”. Under “NVS Software Applications”, click “ENTRÉE for Windows” and select the latest version of the program.

The filename for the data tape file should be formatted as follows:

<NHTSANO><Model Year><Make & Model><Body><SINCAP>DataTape.zip

D. QUALITY CONTROL PACKAGE

The Quality Control Package is a .zip file that includes all of the information necessary for quality control review. It serves as a summary of the test and includes the data tape, all photographs, all videos (both high-speed and real-time, with the exception of the documentary video, which must only be submitted with the final deliverables), pre- and post-test dummy calibration data (formatted in accordance with the deliverable guidelines outlined in **APPENDIX E** of this laboratory test procedure), and a Report of Vehicle Condition (Form No. 2, found in **APPENDIX E**), as well as a QuickLook Report (including data traces) previously e-mailed to the OCWS. It shall be **uploaded to the FTP site within five (5) business days of the test** for review by the OCWS. Providing this data in a timely manner will ensure that the Contractor and the COTR will be able to discuss the details of both test conduct and report content soon after the test is conducted

The filename for the Quality Control Package should be formatted as follows:

<NHTSANO><Model Year><Make & Model><Body><SINCAP>QCPackage.zip

Photographs included as part of the Quality Control Package should be numbered, at a minimum, and preferably also labeled, and should be arranged such that they are in the same order as they appear in the draft version of the Test Report. See Section 9.8 to determine proper photograph order and labeling requirements. Additional photographs, which may be taken to document a test concern, anomaly, etc, may be included as part of the Quality Control Package, but should appear in order after all required photos.

Videos should be numbered, appropriately labeled, and ordered as specified in Section 9.6 of this laboratory procedure.

The Contractor will also provide website-related material with this data. The Contractor shall provide a .jpg image of the vehicle impact (refer to Section 9.8), which shall be approximately 222 pixels x 127 pixels and approximately 100 kb in file size, as well as a real-time video of the impact itself (refer to Section 9.6) in .wmv format and between 300-400 kb in size.

E. DRAFT TEST REPORT

Contractors are required to submit, via e-mail to the OCWS, the draft version of the Final Test Report (.pdf) **within two (2) weeks of the test**. If the electronic file is larger than 10 MB, it is requested that the Contractor upload the file to the FTP site instead.

<NHTSANO><Model Year><Make & Model><Body><SINCAP>DraftReport.pdf

The Contractor should use **detailed** descriptions of all test events. Any events that are associated with the pass/fail of FMVSS 214D, FMVSS No. 301, or that are of technical interest should also be included. Events associated with the pass/fail of FMVSS No. 305 (if applicable) should be included in a supplemental test report to be submitted along with the draft test report for a side NCAP MDB test.

Contractors are required to review and proofread all test reports before submittal to the COTR. The OCWS 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. The OCWS will alert the Contractor to minimal corrections that should be made prior to submission of the Final Test Report.

F. FINAL TEST REPORT AND DELIVERABLES

The Final Test Report and associated documentation, including test data, **properly labeled and numbered photographs and videos** (both high-speed and real-time, and including those for the web), are relied upon as the chronicle of the NCAP test. For these reasons, each Final Test Report must be a complete document capable of standing by itself. The Contractor should use DETAILED descriptions of all test events. Any events that are not directly associated with the side NCAP MDB test, but that are of technical interest, should also be included. The Contractor should include as much detail as possible in the report.

The Final Test Report and associated deliverables will be released to the public domain after review and acceptance by the COTR. For these reasons, all deliverables must be complete and error-free. Final Test Reports containing errors will be returned to the Contractor for correction and a hold will be placed on invoice payment for the particular test.

Only those photos required in the Final Test Report, as set forth in this procedure, shall be included unless the OCWS requests the inclusion of additional photos to document specific test events or anomalies.

The Final Test Report and associated deliverables shall be uploaded to the FTP website **within two (2) weeks of receiving data tape and Draft Test Report corrections** from the OCWS.

The filename for the Final Test Report and deliverables should be formatted as follows:

<NHTSANO><Model Year><Make & Model><Body><SINCAP>FinalDeliverables.zip

G. OTHER REPORTS

- (1) Monthly Vehicle Status Report

The Contractor shall submit a Monthly Vehicle Status Report (See Form in **APPENDIX E**) to the COTR on the first Friday of every month. The Monthly

Vehicle Status Report form shall be submitted until all vehicles or items of equipment are disposed of.

(2) Laboratory Notice of Test Failure Report

An apparent test failure (i.e., a test vehicle exceeds injury criteria outlined by the applicable FMVSS, No. 214, or fails to meet other requirements stipulated by that Standard) shall be communicated by telephone to the COTR within 24 hours. Written notification shall be mailed within 48 hours (Saturdays and Sundays excluded). A Laboratory Notice of Test Failure (see Form in **APPENDIX E**) with a copy of the related NCAP test Data Sheet(s) and preliminary data plot(s) shall be included. Additionally, in such an event, a post-test calibration check of some of the critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity of calibration shall be at the COTR's discretion and shall be performed without additional costs to the OCWS.

(3) Report of Vehicle Condition

As noted in Section 7.1, a Report of Vehicle Condition form (see Form No. 2 in Section 3 of **APPENDIX C**) shall be completed by the Contractor and submitted to the COTR as part of the QCPackage.zip file.

(4) Dummy Inspection Report

The Contractor shall submit a Dummy Inspection Report to include the following on the first Friday of every month to the COTR: a list of all NCAP-furnished test dummies available for side NCAP MDB testing along with date(s) tested; a list of all dummy parts (including serial numbers); a list of parts inspected post-test (including serial numbers) and any associated comments; a list of parts replaced post-test (including serial numbers) and any associated comments; any other dummy information requested by the COTR.

H. DELIVERABLE SCHEDULE

A summary of the expected deliverables, due dates, and methods of delivery is given below.

Test Deliverable	Procedure Section	File Format & Naming Convention	Time Requirement	Submit Via	Submit To
QuickLook Report	13.5B	.pdf with filename format: <NHTSANO><Model Year><Make & Model><Body><SINCAP>-Quicklook.pdf	One (1) day from test	E-mail	OCWS
Data Tape	13.5C	.zip with filename format: <NHTSANO><Model Year><Make & Model><Body><SINCAP>-DataTape.zip	Three (3) business days from test	E-mail	OCWS
Quality Control Package (QuickLook Report, Report of Vehicle Condition form, data tape, web photo and video, high speed and real time videos, all pre- and post-test photos, and dummy calibration data)	13.5D	.zip with filename format: <NHTSANO><Model Year><Make & Model><Body><SINCAP>-QCPackage.zip	Five (5) business days from test	FTP	FTP
Draft Test Report	13.5E	.pdf with filename format: <NHTSANO><Model Year><Make & Model><Body><SINCAP>-DraftReport.pdf	Two (2) weeks from test date	E-mail/ FTP depending on file size	OCWS/ FTP
Final Test Report, photos, and high speed and real time videos	13.5F	.zip with filename format: <NHTSANO><Model Year><Make & Model><Body><SINCAP>-FinalDeliverables.zip	Two (2) weeks after receiving corrections to preliminary test report	FTP	FTP

13.6 DATA, VEHICLE, AND BARRIER RETENTION BY CONTRACTOR

The Contractor shall retain reproducible copies of all data tapes (analog and digital), high-speed and real-time digital videos, digital photograph files, electronic data collected for all dummy calibrations, and Form No. 1 manufacturer information for at least 5 years from the test date at no cost to the agency.

The tested vehicle and tested honeycomb barrier face, **protected from the elements**, shall be retained by the test contractor for a MINIMUM of 60 days so that OCWS and vehicle manufacturer personnel can be given an inspection opportunity.

13.7 DATA AVAILABILITY TO THE PUBLIC

The Contractor shall provide interested parties with copies of test reports, test datatapes, test videos, and test still photographs, at a reasonable cost to the purchaser, but only after the Office of Crashworthiness Standards representative has advised the Contractor that the results of that particular New Car Assessment Program test have been released to the public by the Agency.

APPENDIX A

ES-2re Calibration Procedure

In addition to the following document, **49 CFR 572 Subpart U** may be referenced.

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
LABORATORY TEST PROCEDURE

FOR

Part 572, SUBPART U
PERFORMANCE CALIBRATION REQUIREMENTS



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

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1. PURPOSE AND APPLICATION

The purpose of this laboratory procedure is to provide dummy users (independent testing laboratories under contract with the Office of Vehicle Safety Compliance) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart U dummy so that repetitive and correlative test results can be obtained. The following tests have been developed to establish a uniform calibration procedure for all users as the means of verifying the performance of the dummy.

- A. EXTERNAL MEASUREMENTS
- B. HEAD DROP TEST (572.182)
- C. NECK FLEXION TEST (572.183)
- D. SHOULDER IMPACT TEST (572.184)
- E. THORAX – RIB DROP TEST (572.185(b))
- F. THORAX – FULL BODY IMPACT TEST (572.185(c))
- G. ABDOMEN IMPACT TEST (572.186)
- H. LUMBAR SPINE FLEXION TEST (572.187)
- I. PELVIS IMPACT TEST (572.188)

2. GENERAL REQUIREMENTS

A properly configured Part 572, Subpart U EuroSID (ES-2re), 50th percentile male side impact dummy must be tested to the calibration requirements stated herein prior to and after being used in a compliance crash test. Contractors may use “passing” post test calibration data to indicate the pre-test condition of a test dummy used in consecutive crash tests occurring less than 90 days apart. Otherwise, a full pretest calibration must be performed.

3. SECURITY

All NHTSA test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as the dummy calibration laboratory. The contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of GFP. Any security problems shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

The contractor is responsible for inspecting and reporting to NHTSA the condition of test dummies. Contractors shall protect and segregate the data that evolves from conducting dummy calibration tests before and after each vehicle crash usage.

No information concerning the dummy calibration data shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Branch or Division Chief.

NOTE: No individuals, other than contractor personnel directly involved in the dummy calibration test program, shall be allowed to witness dummy calibration tests unless specifically authorized by the COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire 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 Part 572, Subpart U dummies are being calibrated as test tools to be used in a vehicle test to determine compliance with the requirements of FMVSS 214. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. Upon request, all testing shall be coordinated to allow monitoring by the COTR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy calibration data available to the COTR for review and analysis as required. Calibration test data for each dummy will be sent to the COTR with each test report in the format indicated in this test procedure.

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

7. GOVERNMENT FURNISHED PROPERTY (GFP)

Part 572 test dummies will be furnished to the contract laboratory by the OVSC. The dummies shall be stored in an upright sitting position with the weight supported by the internal structure of the pelvis. The dummies head shall be held upright without supporting the weight of the dummy by using an eyebolt that can be secured in the top of the head. These dummies shall be stored in a secured room that is kept between 55°F and 85°F. The contractor will check dummy components for damage after each crash test and complete a dummy damage checklist that will be included with the posttest dummy calibration. The COTR will be kept informed of the dummies condition in order that replacement parts can be provided. The contractor shall calibrate the dummies before and verify the calibration after every crash test.

8. CALIBRATION AND TEST INSTRUMENTATION

Before the contractor initiates the dummy performance calibration test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration practices. The calibration system shall be set up and maintained as follows:

- 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 calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

8. CALIBRATION AND TEST INSTRUMENTATION...Continued

- C. All measuring and test equipment and measuring standards shall be labeled with the following information:
- (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment
- D. The contractor shall provide a written calibration procedure that 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 calibrations.
- E. The contractor shall keep records of calibrations for all test instrumentation in a manner that assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the written acceptance of the COTR before testing begins.
- F. Test equipment shall receive a calibration check immediately prior to and after each test. This check shall be recorded by the test technician(s) and submitted with the final report.
- G. Anthropomorphic test devices shall be calibrated before and after each test. These calibrations shall be submitted with the final report.

9. PHOTOGRAPHIC DOCUMENTATION

Provide digital still photographs showing any damage that occurred to the test dummy as a result of the crash test. Provide copies of the photographs in the draft test report.

10. PRETEST REQUIREMENTS

The following equipment and instrumentation are necessary to conduct the calibration tests in accordance with Part 572;

10.1 HEAD DROP TEST FIXTURE (572.182(a) & 572.112(a))

A test fixture configured in accordance with the specifications contained in the figure below shall be used to conduct the head drop tests.

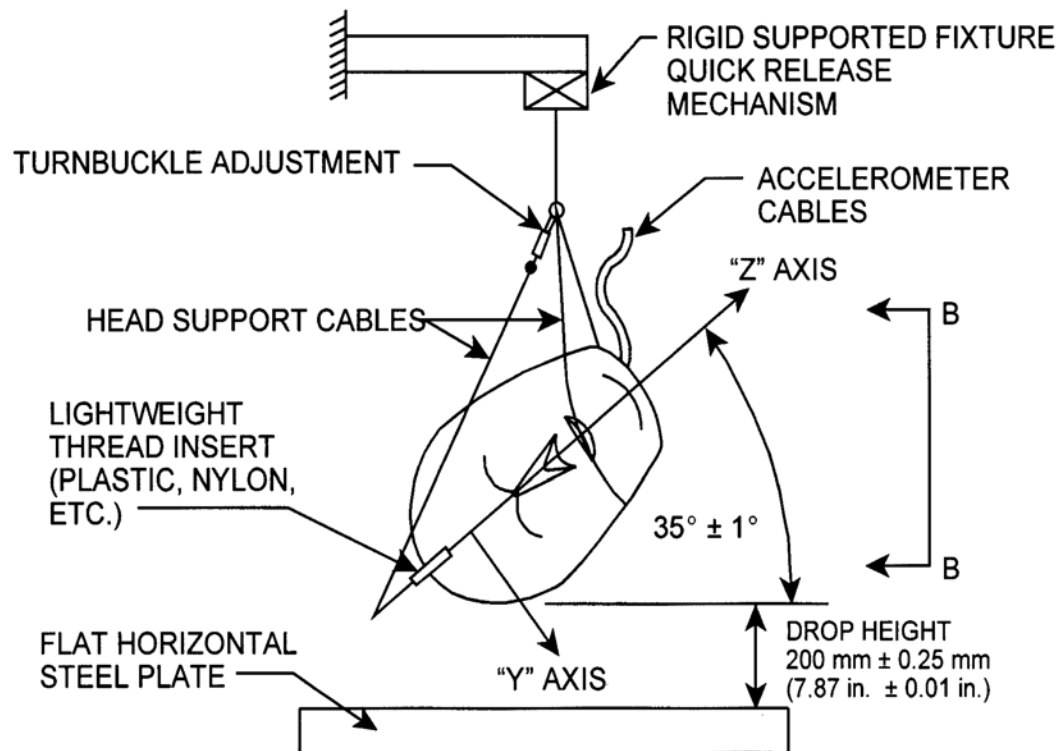
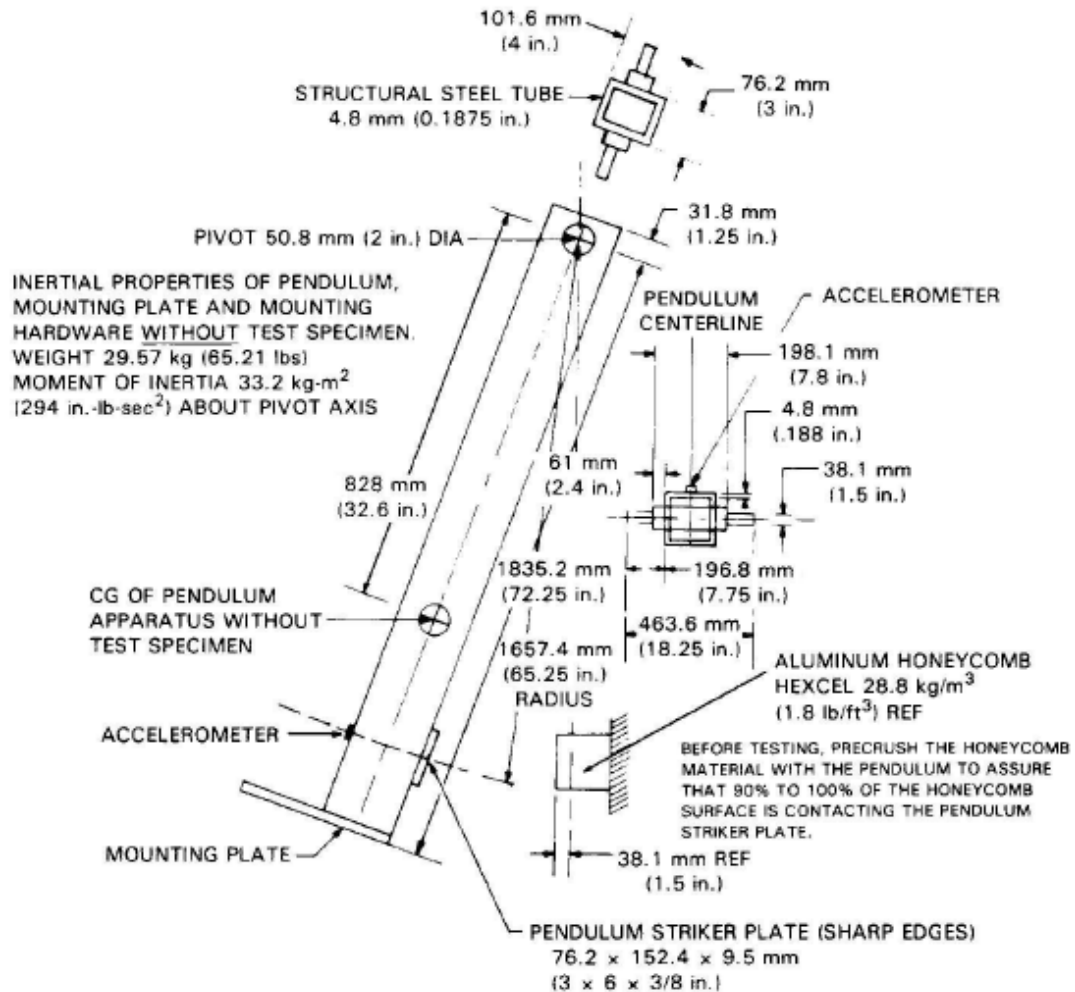


Plate is 51 mm x 610 mm x 610 mm (2 x 24 x 24 in.) with SURFACE FINISH 0.2 microns (8 microinches) to 2.0 microns (80 microinches). IMPACT SURFACE to be clean and dry.

10. PRETEST REQUIREMENTS...Continued

10.2 PART 572 PENDULUM TEST FIXTURE (572.183(2), 572.33)

A pendulum configured in accordance with the specifications contained in the figure below shall be used to conduct the neck and lumbar flexion tests.



10.3 TEST PROBE (572.189(a), 572.36(a))

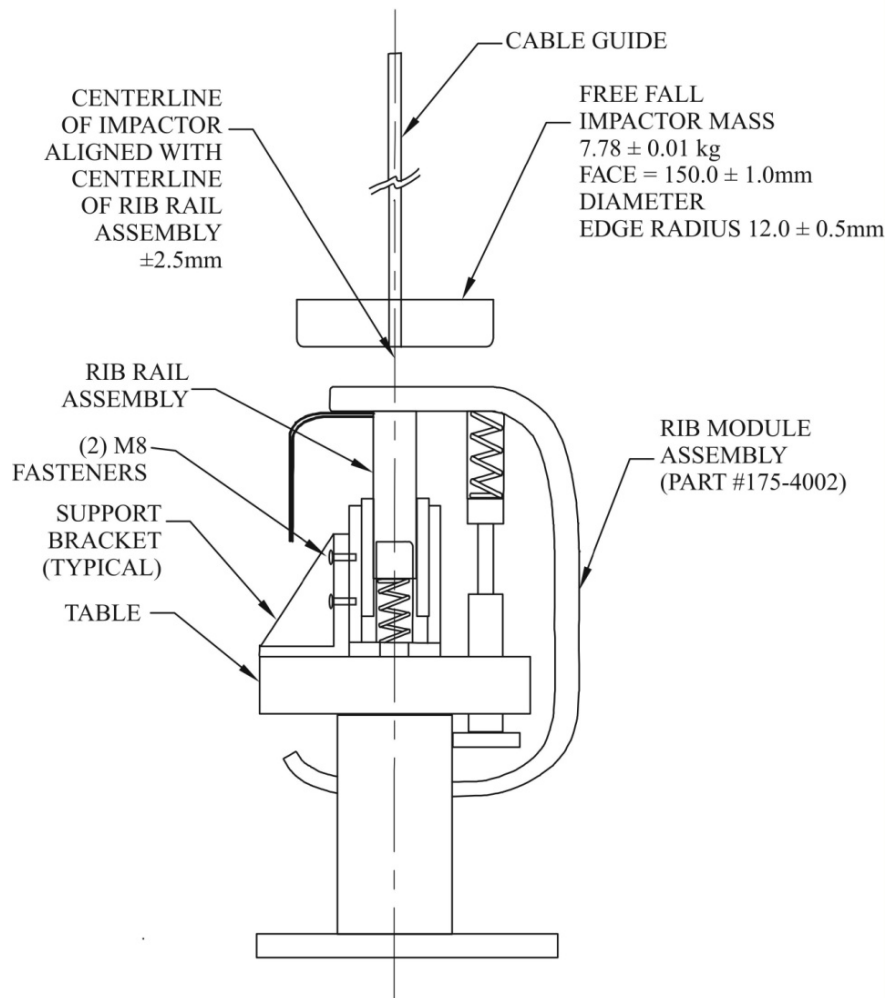
- A. The test probe for the lateral shoulder, thorax without arm, abdomen and pelvis impact tests is a 6 inch diameter cylinder weighing 51.5 pounds. (572.36(a))
- B. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It has an edge radius of 0.5 inches. (572.36(a))
- C. The probe's end opposite to the impact face must have provisions for mounting of an accelerometer with its sensitive axis collinear with the longitudinal centerline of the cylinder. (572.36(a))
- D. The test probe has a minimum mass moment of inertia in yaw of 9,000 kg-cm², a free air resonant frequency not less than 1,000 Hz (572.189(a)).

10. PRETEST REQUIREMENTS...Continued

- E. All hardware attached directly to the impactor and one-third (1/3) of the mass of the suspension cables must be included in the calculations of the total impactor mass. The sum mass of the attachments and 1/3 cable mass must not exceed 5 percent of the total pendulum mass. No suspension hardware, suspension cables, or any other attachments to the test probe, including velocity vane, shall make contact with the dummy during the test (572.189(a)).

10.4 RIB DROP TEST FIXTURE (572.185(b)(1)(iii))

A test fixture configured in accordance with the specifications contained in the figure below shall be used to conduct the rib drop tests.



10. PRETEST REQUIREMENTS....Continued**10.5 TRANSDUCER REQUIREMENTS**

The contractor shall provide and install the following instrumentation;

- A. **ACCELEROMETERS**
Accelerometers for the head, the thoracic spine, and the pelvis conform to specifications of SA572–S4.(572.189(b)).
- B. **ROTARY POTENTIOMETER**
Rotary potentiometers for the neck and lumbar spine certification tests conform to SA572–53. (572.189 (c))

10.6 OTHER TRANSDUCER CONDITIONS

- A. **TRANSDUCER MOUNTS**
The mountings for sensing devices shall have no resonance frequency within range of 3 times the frequency range of the applicable channel class. (572.189(l)).
- B. **TRANSDUCER SIGN CONVENTION**
The sign convention for outputs of transducers mounted within the Hybrid III that measure head and chest accelerations, chest deflection and femur loads are located in Figure 2A. For other transducers see SAE J1733DEC94 (Appendix F). (572.36(j) & (572.31(a)(5))
- C. **TRANSDUCER OUTPUT FILTERING**
The outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified by this part are recorded with individual data channels. Each data channel is comprised of a sensor, signal conditioner, data acquisition device and all interconnecting cables. Instrumentation and sensors conform to the Recommended Practice SAE J–211 (Mar. 1995)—Instrumentation for Impact Test unless noted otherwise.

All instrumented response signal measurements shall be treated to the following specifications:

- (1) Head acceleration—Digitally filtered CFC 1000;
- (2) Neck and lumbar spine rotations—Digitally filtered CFC 180;
- (3) Neck and lumbar spine pendulum accelerations—Digitally filtered CFC 60;
- (4) Pelvis, shoulder, thorax without arm, and abdomen impactor accelerations—Digitally filtered CFC 180;
- (5) Abdominal and pubic symphysis force—Digitally filtered at CFC 600;
- (6) Thorax deflection—Digitally filtered CFC 180.
- (7) Filter the pendulum acceleration data using a SAE J211 CFC 60 filter.

All filter classes should be of the "phaseless" type to be compatible with the "time" dependent test parameters.

- D. **TEST FIXTURE**
The neck pendulum and thorax probe accelerometers shall have the dimensions and characteristics of Endevco Model 7231C. (572.36(g))channels.

11. CALIBRATION TEST EXECUTION

See Check Sheets in Section 14.

12. POST TEST REQUIREMENTS

The contractor shall verify all instrumentation and check data sheets and photographs. Make sure data is recorded in all data blocks on every performance calibration test data sheet.

13. REPORTS**13.1 APPARENT NONCONFORMANCE**

During the post test calibration, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturdays and Sundays excluded). Written notification shall be submitted with a copy of the particular test data sheet(s) and preliminary data plot(s).

In the event of an apparent nonconformance, a post test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

13.2 FINAL PERFORMANCE CALIBRATION REPORTS

The pre-test calibration and post test calibration verification data for each Part 572, Subpart U dummy used in the vehicle compliance test shall be submitted with the FMVSS 214 final test report for the vehicle tested.

14. CHECK SHEETS

CHECK SHEET NO. U1 EXTERNAL MEASUREMENTS

Dummy Serial No. _____
Technician _____

Test Date _____

- __1 Remove the dummy's chest jacket and foam shoulder pad.
__2 Seat the dummy on a flat, rigid, smooth, clean, horizontal surface. The seating surface must be at least 610 mm (24 in.) wide and 406 – 508 mm (16-20 in.) deep, with a vertical section at least 610 mm (24 in.) wide and 914 mm (36 in.) high attached to the rear of the seating surface. The dummy's midsagittal plane should be vertical and centered on the horizontal surface (Figure 1).

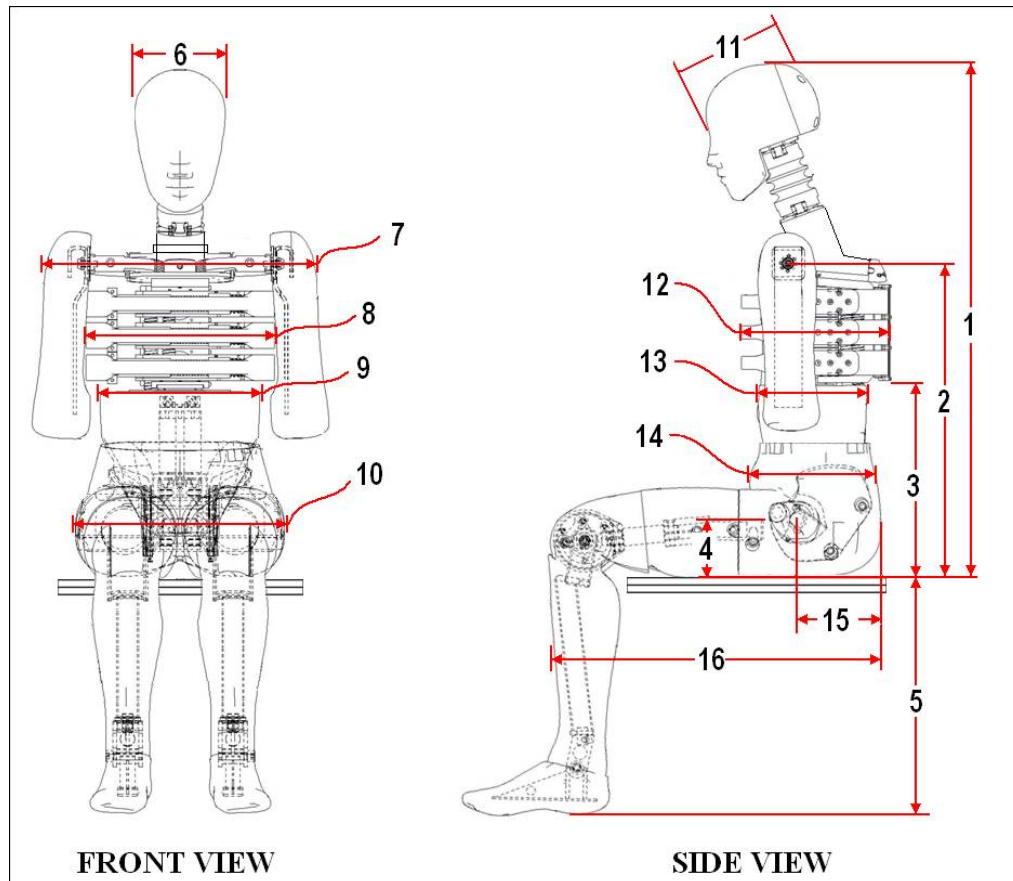


Figure 1. Seated Position of ES-2re for taking external measurements

- __3 Place the dummy's upper torso vertical as measured at the torso back plate by setting the rib extension cover button head screws flush against the vertical measurement surface. The torso back plate and the back of the buttocks are not in the same vertical plane; therefore the buttocks will not be in contact with the vertical measurement surface. A strap or bungee cord may be placed around the neck bracket to secure the dummy in position.
__4 Position the upper and lower legs parallel to the dummy's midsagittal plane. The centerline between the knee pivot and the screw attaching the ankle to the lower tibia shall be vertical.
__5 Position the feet parallel to the dummy's midsagittal plane with the bottoms horizontal and parallel to the seating surface.

CHECK SHEET NO. U1 (Continued)

EXTERNAL MEASUREMENTS

- __6 Before measuring the dummy's sitting height, lift the head to obtain a straight neck, with parallel end plates. This can be checked using a straight edge placed on the neck end plates as shown in Figure 2. A strap or bungee cord may be placed around the head to secure it in this position.



Figure 2. Checking for a straight neck before measuring sitting height

- __7 Threaded cylindrical tools (Figure 3) are used to take measurements in recessed locations at the shoulder and pelvis (see Figure 3). To install the tool at the shoulder, remove the M10 BHCS that fastens the arm to the clavicle and replace the screw with the tool (Figure 4). To install the tool at the pelvis, remove the M6 SHCS from the center of the pelvis back plate and replace the screw with the tool.



Figure 3. Threaded cylindrical tools

CHECK SHEET NO. U1 (Continued)

EXTERNAL MEASUREMENTS



Figure 4. Threaded cylindrical tools installed at the shoulder and pelvis

- __8 Take the following measurements and record on Table U1. Verify that each measurement meets the specification by indicating “Pass” or “Fail” in the far right column.
- __8.1 **Sitting Height (1):** With the head positioned as indicated in step 6, measure the distance from the seat horizontal surface to a level placed on top of the head.
- __8.2 **Seat to Shoulder Joint (2):** seat surface to center of shoulder attachment bolt.
- __8.3 **Seat to the Lower Face of the Thoracic Spine Box (3):** Seat surface to bottom surface on Thoracic spine box.
- __8.4 **Seat to the Hip Joint (4) (center of bolt):** Seat Surface to center of pelvis back plate attachment bolt.
- __8.5 **Sole to Seat, Sitting (5):** Seat surface to bottom of foot
- __8.6 **Head Width (6):** Measure the widest part of the head.
- __8.7 **Shoulder/Arm Width (7):** Outside of arm to outside of arm at the shoulder attachment bolt level.
- __8.8 **Thorax Width (8):** Outside Width of Thorax rib modules.
- __8.9 **Abdomen Width (9):** Outside width of abdomen (black insert)
- __8.10 **Pelvis Lap Width (10):** Outside maximum width of the pelvis flesh measured at the H-Point level.
- __8.11 **Head Depth (11):** Measure from the back of the head to the forehead.
- __8.12 **Thorax Depth (12):** Front of the thorax rib module to the back of the seat surface
- __8.13 **Abdomen Depth (13):** Front side to the back side of the abdomen
- __8.14 **Pelvis Depth (14):** Front side of the pelvis to the rear of the buttocks at the top of the thigh level.
- __8.15 **Back of Buttocks to Hip Joint (15) (center of bolt):** Back of the buttocks to the center of the back plate attachment plate
- __8.16 **Back of Buttocks to Front Knee (16):** Back of the buttocks to the most forward surface of the knee

CHECK SHEET NO. U1 (Continued)
EXTERNAL MEASUREMENTS

Table U1. External Measurements

No.	Description	Spec. (mm)	Result	Pass/ Fail
1	Sitting Height	900 - 918		
2	Seat to Shoulder Joint	558 - 572		
3	Seat to Lower Face of Thoracic Spine Box	346 - 356		
4	Seat to Hip Joint (center of bolt)	97 - 103		
5	Sole to Seat, Sitting	333 - 451		
6	Head Width	152 - 158		
7	Shoulder/Arm Width	461 - 479		
8	Thorax Width	322 - 332		
9	Abdomen Width	273 - 287		
10	Pelvis Lap Width	359 - 373		
11	Head Depth	196 - 206		
12	Thorax Depth	262 - 272		
13	Abdomen Depth	194 - 204		
14	Pelvis Depth	235 - 245		
15	Back of Buttocks to Hip Joint (center of bolt)	150 - 160		
16	Back of Buttocks to Front Knee	597 - 615		

 Signature

 Completion Date

CHECK SHEET NO. U2 HEAD DROP TEST (S572.182)

Dummy Serial No. _____
Technician _____

Test Date _____

- __1 Inspect the head skin for cracks, tears or other damage. Replace the skin if necessary.
- __2 Remove the skull cap by unscrewing the four M6 x 16 SHCS in the back of the head and inspect for defects (Figure 5). If defects are present, repair or replace.

Note: If the damage results from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

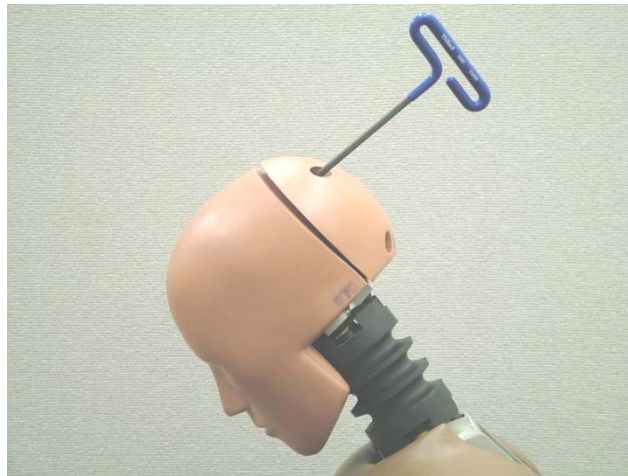


Figure 5. Removal of the skull cap

- __3 Soak the head assembly in a controlled environment at a temperature and relative humidity indicated in Table U2 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U2. Verify that each measurement meets specification by indicating “Pass” or “Fail” in the far right column.
- __4 Unscrew the four M6 x 12 SHCS in the upper neck load cell (or structural replacement) inside the head and separate the head/load cell assembly from the neck. If an accelerometer mount is installed on the upper neck load cell, remove it first for easier access to the four M6 x 12 SHCS (Figure 6).



Figure 6. Removal of head from neck

CHECK SHEET NO. U2 (Continued)
HEAD DROP TEST (S572.182)

- __5 Remove the upper neck load cell (or structural replacement) from the head by unscrewing the four M6 x 22 SHCS in the base of the head. (Figure 7).



Figure 7. Removal of upper neck load cell structural replacement

- __6 Fasten the accelerometers to the accelerometer mount, assuring that all axes are properly oriented using six M1.4 x 3 SHCS.
- __7 Fasten the accelerometer mount to the upper neck load cell (or structural replacement) using two M5 x 10 SHCS and one M5 x 16 SHCS. Attach a self-adhesive cable tie mount to the upper surface at the rear of the upper neck load cell (or structural replacement). Cable tie the accelerometer cables to the cable tie mount to act as a cable strain relief to prevent damage to the accelerometers.

Figure 8. Accelerometer Mount

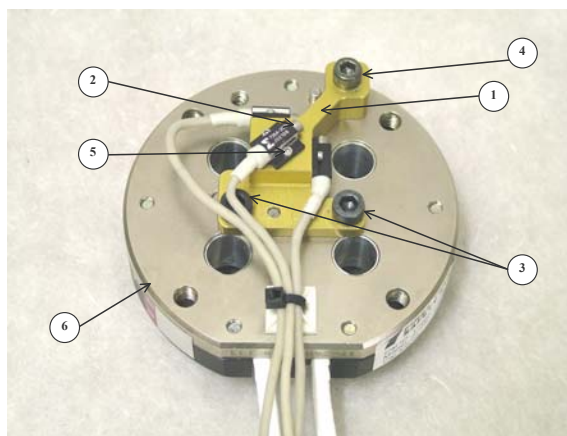


Table I - Head C.G Accelerometer Components

Part Description	Quantity	Part Number	Item No.
Accelerometer Mount, Head C.G.	1	SA572-S81	1
Uniaxial Accelerometer	3	SA572-S4	2
Screw, M5 x .8 x 10 SHCS	2	5000291	3
Screw, M5 x .8 x 16 SHCS	1	5000020	4
Screw, M1.4 x .3 x 3 SHCS	6	5000068	5

CHECK SHEET NO. U2 (Continued)
HEAD DROP TEST (S572.182)

- __8 Re-install the upper neck load (or structural replacement) to the base of the head
- __9 Replace the skullcap. To avoid pinching and damaging transducer cables when installing the skull cap, make sure that any transducer cables exiting the head are carefully located in the cable access cutout located at the base of the skull.
- __10 When replacing the skullcap, use the standard skullcap bolts for all but the bottom left (for left side impacts) or bottom right (for right side impacts) bolts. Instead, insert a threaded 4.2 cm long (1.3 cm of the 4.2 cm is threaded) hex rod so that it protrudes from the skullcap. Tighten the rod into the threaded hole with a wrench. This rod will be used to route the cabling which holds the head assembly for test.
- __11 Clean the headskin with isopropyl alcohol and allow it to dry thoroughly.
- __12 Suspend the head assembly using the head suspension cables (Figure 9). Route the suspension cable around the protruding hex bolt, and between the lips.

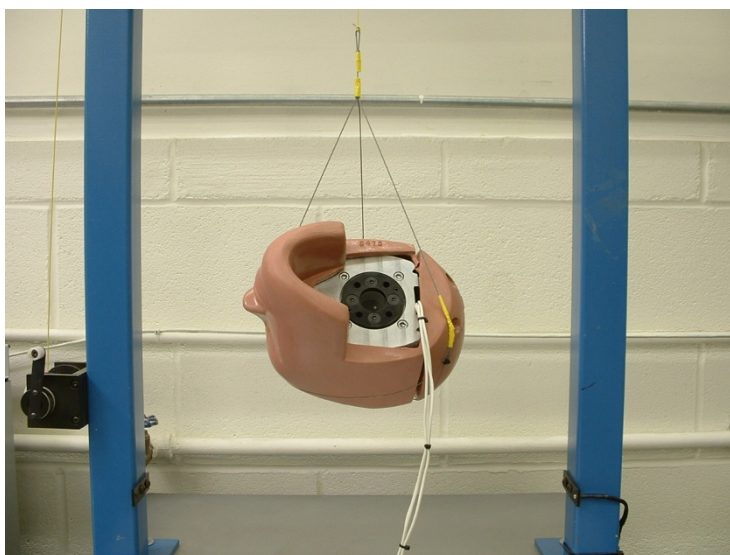


Figure 9. Threaded cylindrical tools

- __13 Adjust the head so that the skull base/D-plane is $35^{\circ} \pm 1^{\circ}$ from the vertical (see Figure 10).

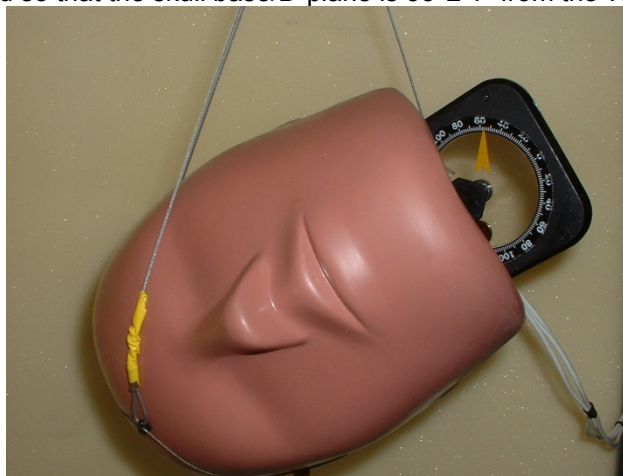


Figure 10. Adjusting the D-plane to $35^{\circ} \pm 1^{\circ}$

CHECK SHEET NO. U2 (Continued)
HEAD DROP TEST (S572.182)

- __14 Level the head so that it is horizontal ($\pm 1^\circ$) in the fore-aft direction (Figure11).

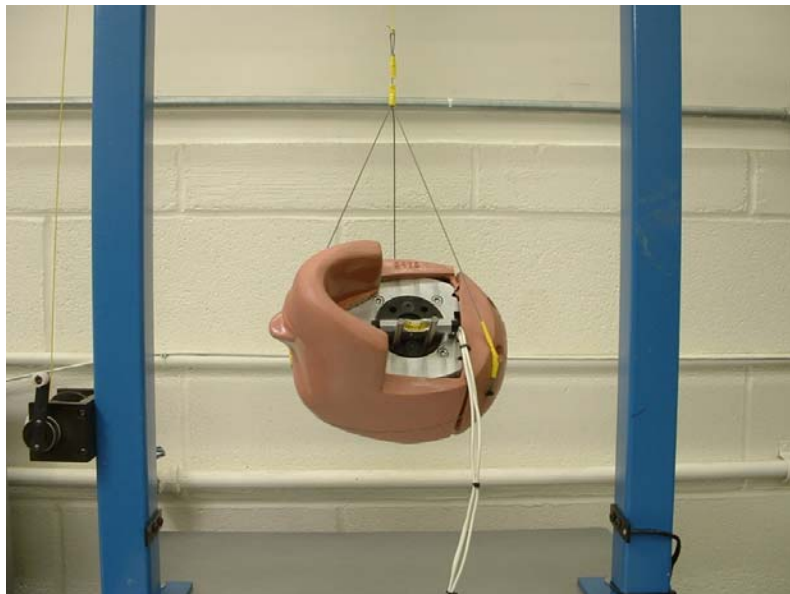


Figure 11. Leveling the Head in the fore-aft direction

- __15 Prepare an impact surface that is constructed of a rigidly supported, flat horizontal steel plate which is 51 (± 2 mm) thick and 610 mm (± 10 mm) square with a micro-finish of 0.2 microns (8 microinches) to 2.0 microns (80 microinches).
- __16 Raise the head assembly so that it is 200 mm (7.87") from the impact point to the lowest point on the head (Figure 12).
- __17 Clean the impact surface with isopropyl alcohol.

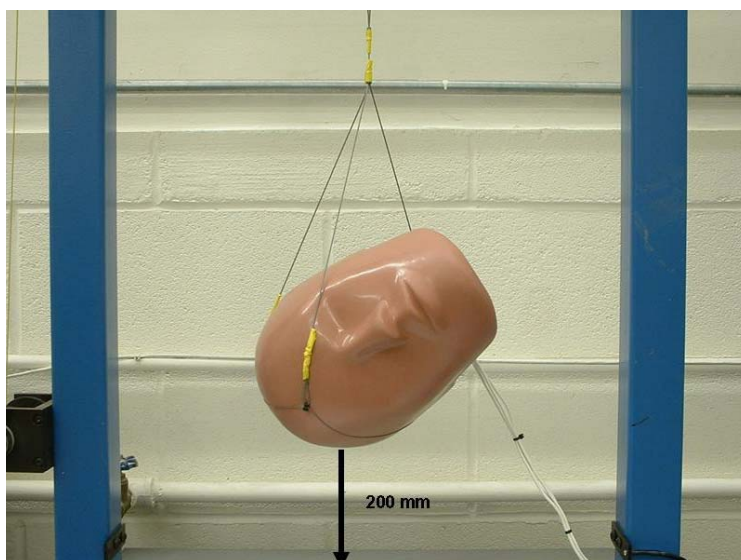


Figure 12. Raise the head to the proper drop height

CHECK SHEET NO. U2 (Continued)
HEAD DROP TEST (S572.182)

- __18 Record the room temperature and humidity on Table U2. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- __19 Release the head assembly so that it falls freely to the impact surface.
- __20 Collect the head acceleration data and filter using a Channel Class 1000 phaseless filter in accordance with SAE J211.
- __21 Time zero is defined as the time of contact between the head and the impact surface. All channels should be at a zero level at this point.
- __22 Plot the x, y, z and resultant acceleration curves.
- __23 Record the peak head resultant acceleration and peak head X acceleration. Verify that these accelerations lie within the specifications indicated in Table U2.
- __24 Calculate 15% of the peak head resultant acceleration.
- __25 Calculate the maximum oscillation that occurs after the peak resultant acceleration. Verify that the maximum oscillation is less than 15% of the peak head resultant acceleration.
- __26 Wait at least 2 hours between successive head certification tests on the same side of the head.

Table U2. Head Drop Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Head Assembly Soak Time		Minutes	≥240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity – During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Peak Head Resultant Acceleration		g's	125 to 155		
Peak Head X Acceleration		g's	<15		
Unimodal (Oscillation)			<15%		

Signature

Completion Date

CHECK SHEET NO. U3 NECK FLEXION TEST (S572.183)

Dummy Serial No. _____

Test Date _____

Technician _____

- ___1 Unscrew the four M6 x 30 SHCS connecting the neck bracket to the shoulder assembly and separate the neck bracket from the shoulder. (Figure 13)
- ___2 Remove the neck assembly (Part No. 175-2000) from the neck bracket by unscrewing the four M6 x 1 x 16 SHCS at the base of the neck assembly. (Figure 14)
- ___3 Visually inspect the neck assembly for deformation, tears or breaks in the rubber or if the neck is permanently bent or twisted.

Note: If the damage results from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.



Figure 13. Removal of the neck bracket from the shoulder assembly



Figure 14. Removal of the neck from neck bracket

Note: When a lower neck load cell is installed, a different neck bracket and different fasteners than shown are required.

CHECK SHEET NO. U3 (Continued)
NECK FLEXION TEST (S572.183)

- ___4 Soak the neck assembly in a controlled environment at a temperature and relative humidity indicated in Table U4 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U4. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___5 Torque the half-spherical screws (175-2004) located at either end of the neck assembly to 88 ± 5 in-lbs. using the neck compression tool (175-9500) or equivalent.
- ___6 Prepare the headform (Part No. 175-9000) for the test (Figure 15).
- ___7 Attach the top of the neck assembly to the headform interface plate (Part No. 175-9029) with four M6x12 SHCS.
- ___8 Attach the base of the neck assembly to the headform interface plate (Part No. 175-9027) with four M6x40 SHCS.
- ___9 Attach the mounting base of the headform onto the pendulum with four M6x12 SHCS. Mount the headform with its rotational potentiometers on the left-hand side (Figure 16).
- ___10 Attach carbon fiber rods (i.e., Arrow Shafts) to each pivot assembly.
- ___11 Carefully insert a carbon fiber rod through the potentiometer assembly that is farthest from the honeycomb impact surface (i.e., Arrow Shaft – Pivot Assembly B).
- ___12 Slide the pivot assembly onto the central carbon fiber rod (i.e., Arrow Shaft). Then, place the spacer onto the central carbon fiber rod.
- ___13 Insert a second carbon fiber rod through the potentiometer assembly housing that is closest to the honeycomb impact surface (i.e., Arrow Shaft – Pivot Assembly A).
- ___14 Lightly tighten the set screw at the base of Pivot Assembly A to firmly attach it to the central carbon fiber rod being careful not to damage the rod.
- ___15 Attach the potentiometers to the neck mounting plate in their correct orientation with Pivot Assembly A closest to the honeycomb.
- ___16 Prepare the pendulum for the test.
Mount a uni-axial accelerometer on the pendulum with its sensitive axis 1657.4 mm from the pendulum pivot in accordance with Standard Part 572 subpart E.

CHECK SHEET NO. U3 (Continued)
NECK FLEXION TEST (S572.183)

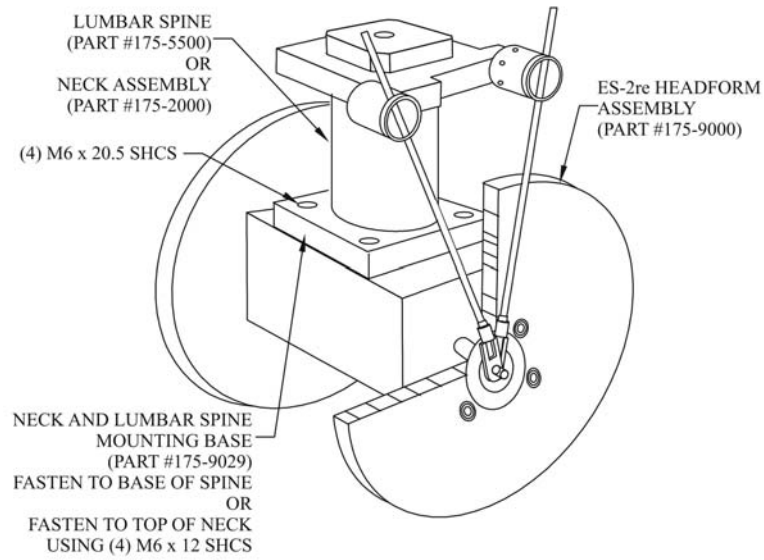


Figure 15. Neck/Lumbar spine attached to the headform

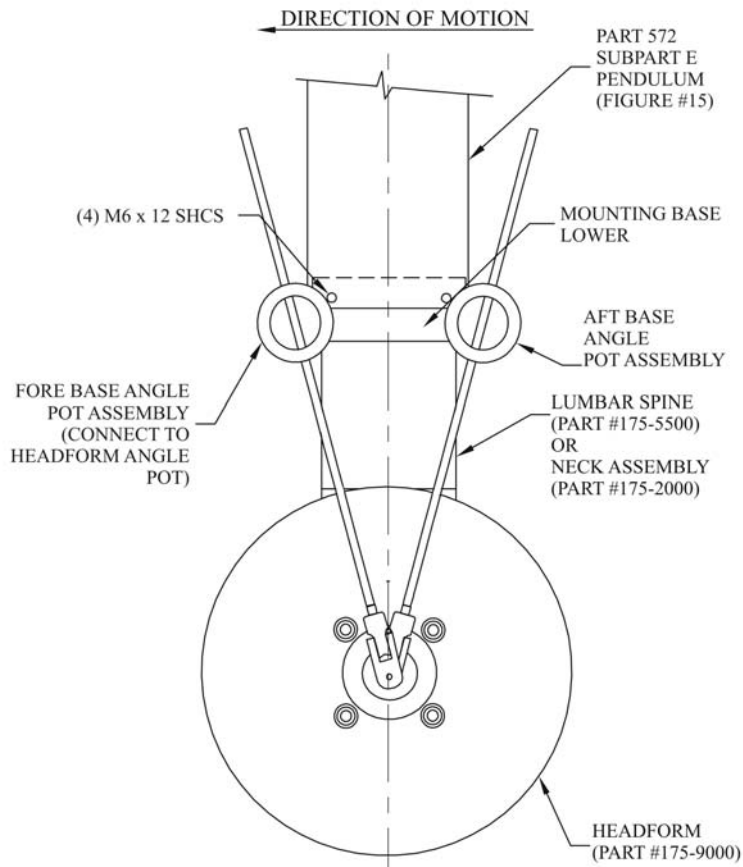
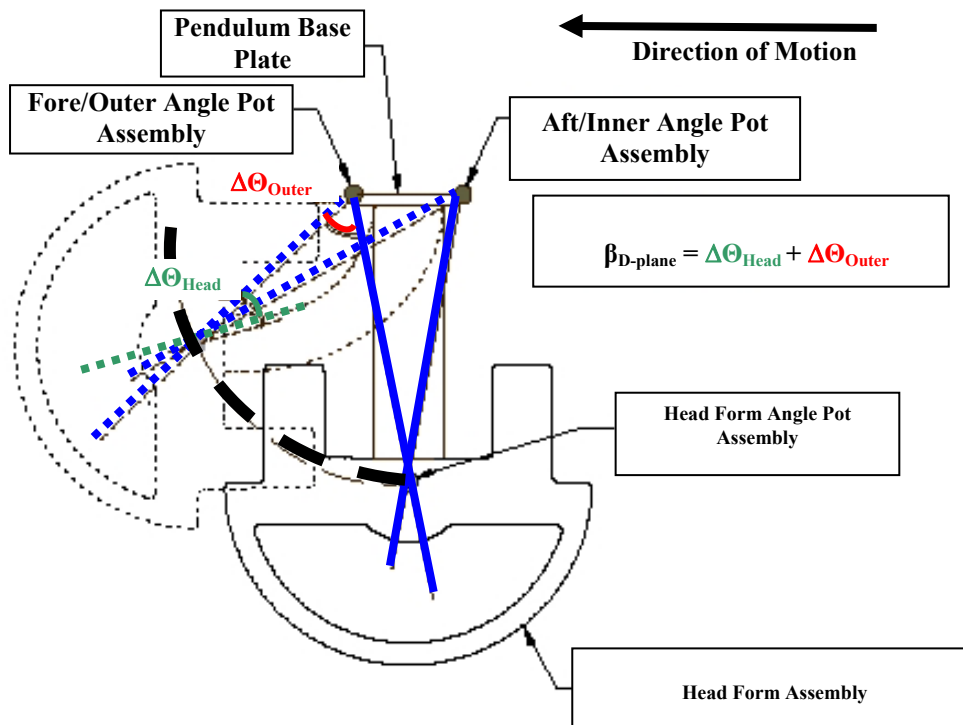


Figure 16. Headform attached to the pendulum

CHECK SHEET NO. U3 (Continued)
NECK FLEXION TEST (S572.183)

- __17 Record the room temperature and humidity in Table U4. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column
- __18 Raise the pendulum and allow it to fall freely such that it achieves an impact velocity of 3.4 ± 0.1 m/s. The pendulum must be vertical $\pm 0.5^\circ$ when its speed is reduced to 0 m/s.
- __19 Allow the neck to flex without the neck-headform assembly making contact with any object.
- __20 Time zero is defined as the time of contact between the pendulum and the honeycomb. All channels should be at zero level at this point.
- __21 Determine the velocity time history by integrating the pendulum acceleration beginning at time zero. Filter the pendulum acceleration using CFC 60.
- __22 Verify that the velocity time history of the pendulum falls within the corridor determined by the upper and lower boundaries specified in Table U3.
- __23 The fore (A), aft (B) and headform (C) angles are directly measured during the test and filtered using CFC180 (Figure 18).
- __24 The maximum headform flexion angle is calculated by summing the fore (A) and headform (C) angles (i.e., $\beta_{max} = \Delta\Theta_{Head} + \Delta\Theta_{Outer}$).
- __25 Verify that the maximum headform flexion angle and the time it occurs meet specifications listed in Table U4.
- __26 Verify that the decaying headform rotation vs. time curve crosses the 0 degree angle with respect to its initial position at time of impact relative to the pendulum centerline between 53 and 88 ms after the time of peak translation rotation value is reached.



where $\Delta\Theta_{Head}$ and $\Delta\Theta_{Outer}$ are the deviations of the angles Θ_{Head} and Θ_{Outer}

Figure 17. Angle measurements with the head form setup

CHECK SHEET NO. U3 (Continued)
NECK FLEXION TEST (S572.183)

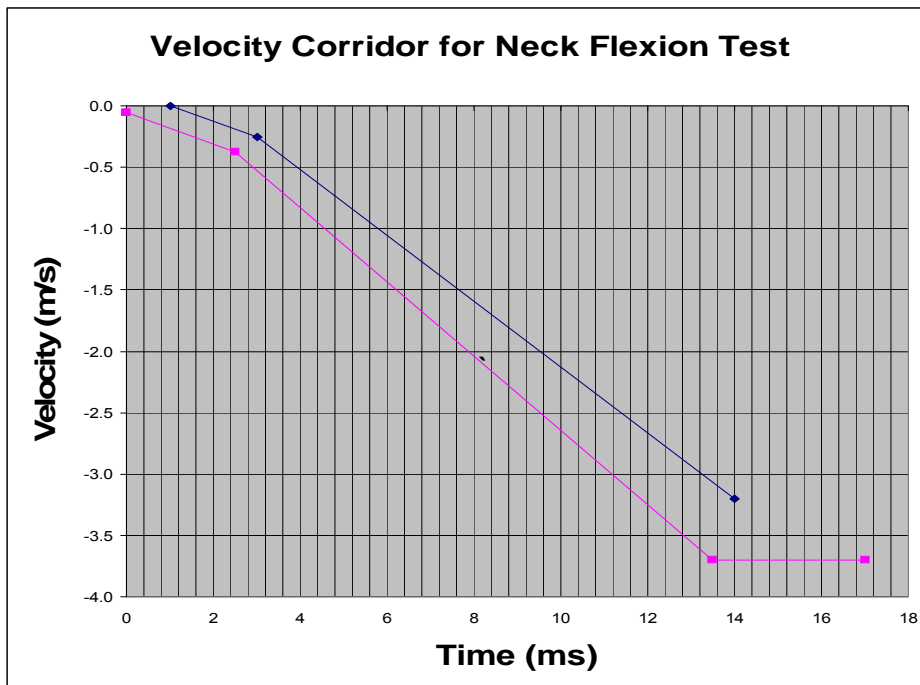


Table U3. Neck Flexion Test Pendulum Velocity Corridors

Upper Boundary		Lower Boundary	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.00	0.00	0	-0.05
3.00	-0.25	2.5	-0.375
14.00	-3.20	13.5	-3.7
		17	-3.7

Table U4. Neck Flexion Test

Tested Parameter		Units	Specification	Result	Pass/Fail
Head Assembly Soak Time		Minutes	≥240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Pendulum Velocity		m/s	3.3 to 3.5		
Maximum headform flexion angle		Deg	49 to 59		
Time at Maximum flexion angle		ms	54 to 66		
Headform Flexion Decay (Peak to zero)		ms	53 to 88		

Signature

Completion Date

CHECK SHEET NO. U4 SHOULDER IMPACT TEST (S572.184)

Dummy Serial No. _____
Technician _____

Test Date _____

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at the temperature and relative humidity shown in Table U5 for at least four hours prior to a test. Record the length of time for the soak and maximum and minimum temperature and humidity in Table U5. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Remove the arm that will be located on the impact side and the M10x30 button head screw in the shoulder cam.
- ___3 Remove the shoulder foam pad.
- ___4 Adjust the elastic bungee cord tension such that the force required to move the shoulder cam forward 1 to 5 mm, when applied at 4 mm (± 1 mm) from the outer edge of the clavicle and applied in the same plane as the clavicle movement is between and including 27.5N and 32.5N. To set the elastic bungee cord tension, the length of the elastic bungee cord is adjusted at the elastic cord holder.
- ___5 After setting the elastic bungee cord tension, check that the clavicles can travel the full range of motion and come to a stop on the cam stop blocks inside the shoulder box. If the shoulder range of motion is limited by the maximum extension of the elastic bungee cord, replace the bungee cord with a new one.
- ___6 Reattach the arm and sit the dummy without jacket on a flat, horizontal, rigid surface without back support covered by two PTFE Teflon sheets 2 mm thick.
- ___7 Set both arms at the middle pivot stop in the shoulder joint. Verify that the arms are set at a position of $50^\circ \pm 2^\circ$ forward with respect to the horizontal, pointing downward.
- ___8 Adjust the dummy such that the anterior-posterior axis of the dummy is perpendicular to the direction of impact.
- ___9 Place the dummy legs horizontal with the distance between the ankles at 100 ± 5 mm.
- ___10 Align the thorax vertically $\pm 2^\circ$ as measured at the rib extension cover. Do not support the dummy to maintain this position (see Figure 18).

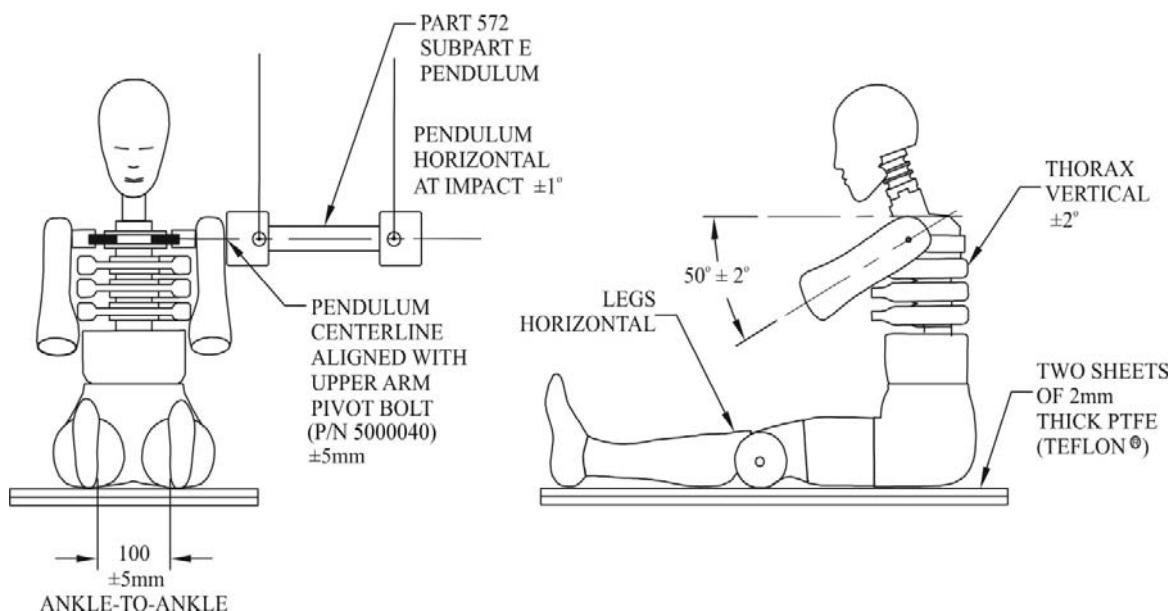


Figure 18. Shoulder Impact Test Condition

CHECK SHEET NO. U4 (Continued)
SHOULDER IMPACT TEST (S572.184)

Conduct Test, Collect Data and Verify Performance

- __11 Record the room temperature and humidity in Table U5. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- __12 The pendulum meets Part 572 subpart E (572.36 (a)) and is equipped with an accelerometer with its sensitive axis collinear with the longitudinal axis of the pendulum.
- __13 Align the pendulum so that at contact with the shoulder, its longitudinal axis is perpendicular $\pm 1^\circ$ to the midsagittal plane of the thorax and centered on the upper arm pivot bolt ± 5 mm (Figure 18).
- __14 Release the pendulum such that it strikes the shoulder with an impact speed of 4.3 ± 0.1 m/s.
- __15 Record the pendulum acceleration and digitally filter at SAE J211 CFC180.
- __16 Verify that the peak impactor acceleration meets specifications in Table U5.

Table U5. Shoulder Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥ 240		
Temperature - During Soak	Max	$^\circ\text{C}$	20.6 to 22.2		
	Min	$^\circ\text{C}$			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		$^\circ\text{C}$	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Pendulum Speed		m/s	4.2 to 4.4		
Peak Impactor Acceleration		G's	7.5 to 10.5		

Note – No suspension hardware, suspension cables, or any other attachments to the probe, including the velocity vane, shall make contact with the dummy during the test.

Signature

Completion Date

CHECK SHEET NO. U5
RIB DROP TEST (S572.185(b))

Dummy Serial No. _____
 Technician _____

Test Date _____

- __1 To release the rib modules, remove the Teflon cover from the back plate by unscrewing the eight M3 x 6 BHCS (Figure 19).

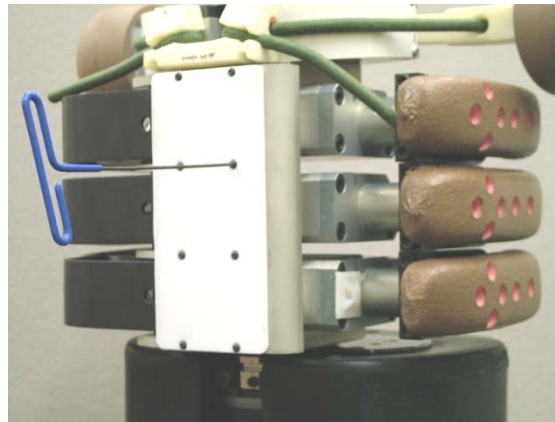


Figure 19. Removal of Teflon back plate cover

- __2 Remove the rib extension guide/back plate load cell (or load cell structural replacement) assembly by unscrewing the six M6 x 22 SHCS that fasten the back plate load cell to the spine box (Figure 20). If further disassembly is desired, the rib extension guide can then be separated from the back plate load cell by unscrewing the five M6 x 18 FHCS (Figure 21).

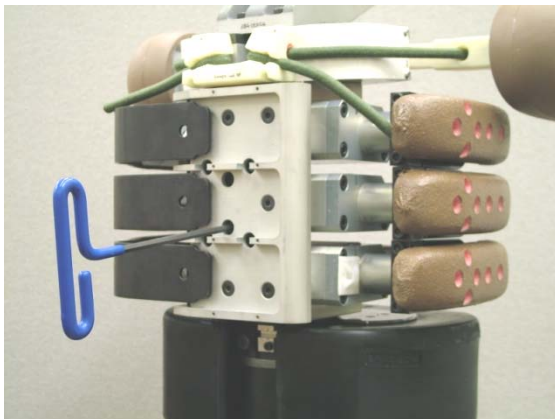


Figure 20. Removal of rib extension guide

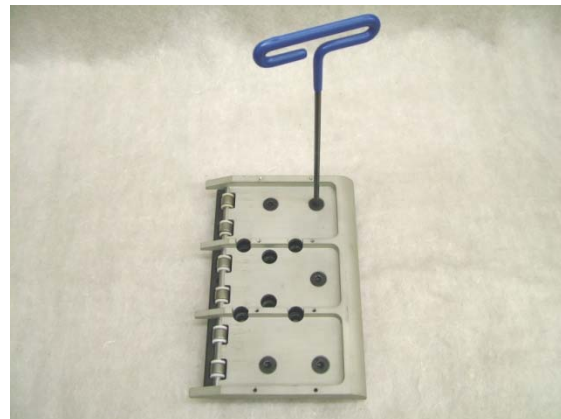


Figure 21. Disassembly of the rib guide

CHECK SHEET NO. A5 (Continued)
THORAX - RIB DROP TEST (S572.185(b))

- __3 Remove each rib module by unscrewing the two M8 x 20 SHCS that fasten each of the three rib modules to the spine box (Figure 22).



Figure 22. Removal of rib module

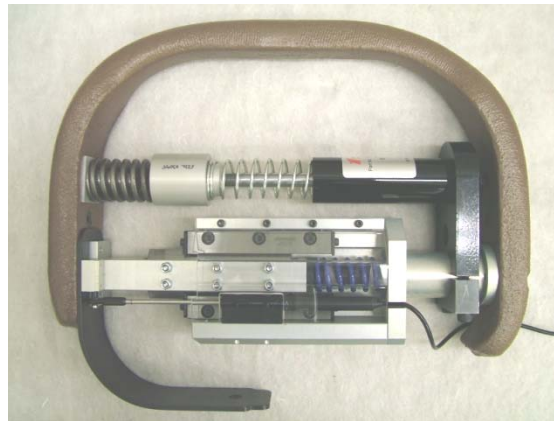


Figure 23. Inspection of the rib module

- __4 Visually inspect the rib modules for damage, play in the linear bearing, non-symmetry in the rib, loss of oil from the damper, etc (Figure 23). Check that the rib easily expands to the rib stop without assistance. Make adjustments or replace as necessary.

Note: If the damage results from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

- __5 Soak the rib modules in a controlled environment at a temperature and relative humidity indicated in Table U6 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U6. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __6 Prepare the drop test fixture and data acquisition system. The guided mass must weigh 7.78 ± 0.01 kg and have a flat impact face 150 ± 1.0 mm in diameter.
- __7 Mount a rib module rigidly in the drop test fixture with the impacted side of the rib facing up.
- __8 Align the rib module and guided mass so that at impact, the center point of the guided mass impact face contacts the centerline of the rib rail guide system within ± 2.5 mm.
- __9 Record the room temperature and humidity in Table U6. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column.
- __10 Release the impact mass from a height of 815 ± 8 mm. Measure and record rib deflection.
- __11 Plot rib deflection v. time. Record the maximum rib deflection on Table U6 and verify that it meets specification by indicating "Pass" or "Fail."
- __12 In a time period not less than 5 minutes, subject the same rib module to second rib drop test with the guided mass released at a height of 459 ± 5 mm.
- __13 Plot rib deflection v. time. Record the maximum rib deflection on Table U6 and verify that it meets specification by indicating "Pass" or "Fail."
- __14 Record the time period between rib drop tests on Table U6.
- __15 If the test results are not within specification, allow a period of not more than 30 minutes, conduct a repeat test.
- __16 Repeat the above sequence for the other rib modules

CHECK SHEET NO. U5 (Continued)
THORAX - RIB DROP TEST (S572.185(b))

Table U6. Thorax - Rib Drop Tests

Tested Parameter		Units	Specification	Result	Pass/ Fail
Upr Rib Drop Module Soak Time		Minutes	≥ 240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
1 st Test - Drop Height 459 ± 5 mm		mm	36 – 40		
2 nd Test - Drop Height 815 ± 8 mm		mm	46 – 51		

Tested Parameter		Units	Specification	Result	Pass/ Fail
Middle Rib Drop Module Soak Time		Minutes	≥ 240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
1 st Test - Drop Height 459 ± 5 mm		mm	36 – 40		
2 nd Test - Drop Height 815 ± 8 mm		mm	46 – 51		

Tested Parameter		Units	Specification	Result	Pass/ Fail
Lower Rib Drop Module Soak Time		Minutes	≥ 240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
1 st Test - Drop Height 459 ± 5 mm		mm	36 – 40		
2 nd Test - Drop Height 815 ± 8 mm		mm	46 – 51		

Signature

Completion Date

CHECK SHEET NO. U6
THORAX – FULL BODY IMPACT TEST (S572.185(c))

Dummy Serial No. _____

Test Date _____

Technician _____

Pretest Preparation

- __1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table U7 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U7. Verify that each measurement meets specification by indicating “Pass” or “Fail” in the far right column.
- __2 Remove the jacket and shoulder foam pad.
- __3 Remove the arm that will be located on the impact side and the M10x30 button head screw in the shoulder cam. Set the other arm in the vertically downward position.
- __4 Sit the dummy on a flat, horizontal, rigid surface without back support covered by two PTFE Teflon sheets 2 mm thick.
- __5 Adjust the dummy such that the anterior-posterior axis of the dummy is perpendicular to the direction of impact.
- __6 Place the dummy legs horizontal with the distance between the ankles at 100 ± 5 mm.
- __7 Align the thorax vertically $\pm 2^\circ$ as measured at the rib extension cover plate. Do not support the dummy to maintain this position (Figure 24).

Conduct Test, Collect Data and Verify Performance

- __8 Record the room temperature and humidity in Table U7. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- __9 The pendulum meets Part 572 Subpart E (572.36 (a)) and is equipped with an accelerometer with its sensitive axis collinear with the longitudinal axis of the pendulum.
- __10 The pendulum is aligned so that at contact with the thorax, its longitudinal axis is within $\pm 0.5^\circ$ (horizontal and perpendicular) to the midsagittal plane of the dummy and centered on the middle rib access hole ± 5 mm (Figures 24 & 25).
- __11 Release the pendulum such that it strikes the dummy’s thorax with an impact speed of 5.5 ± 0.1 m/s.
- __12 Record the pendulum acceleration and digitally filter at SAE J211 CFC180.
- __13 Compute and record the impactor force as the product of the impact probe acceleration and its’ mass.
- __14 Verify that at any time after 6ms from time zero, the peak impactor force lies within the specified force levels in Table U7.
- __15 Verify that upper, middle and lower rib deflections meet specification by indicating “pass” or “Fail” in the far right column of Table U7.
- __16 If the results do not meet specification, wait at least 30 minutes, conduct another test.
- __17 Record results of additional tests in separate tables.

CHECK SHEET NO. U6 (Continued)
THORAX – FULL BODY IMPACT TEST (S572.185(c))

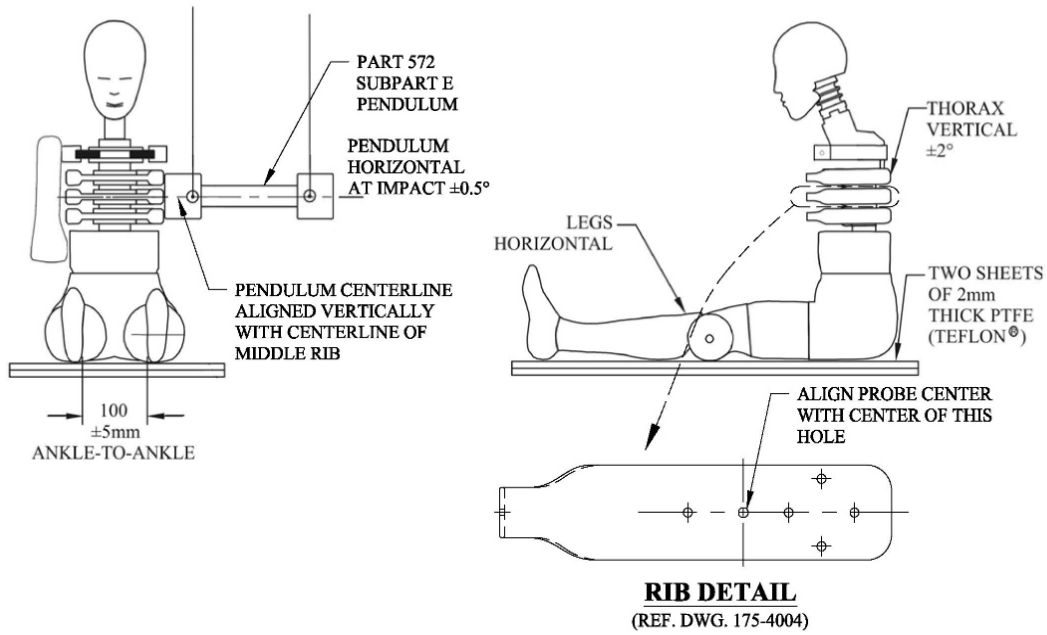


Figure 24. Full Body Thorax Impact Test Condition

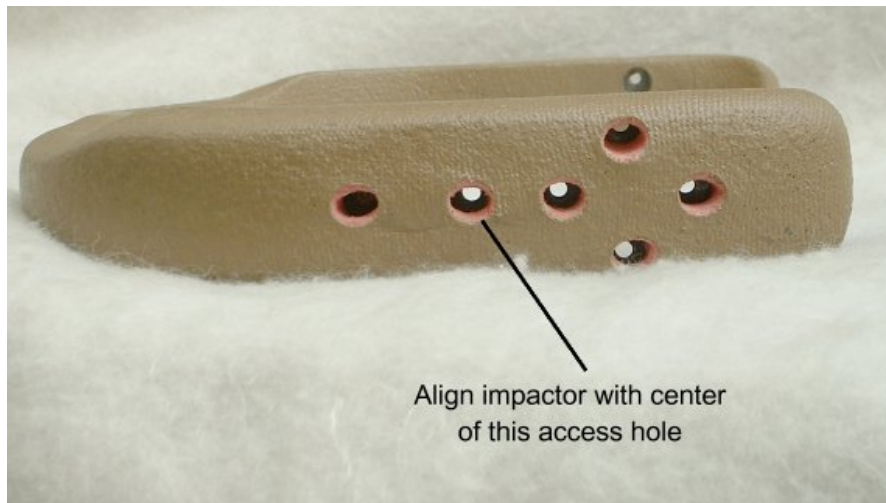


Figure 25. Rib Detail

CHECK SHEET NO. U6 (Continued)
THORAX – FULL BODY IMPACT TEST (S572.185(c))

Table U7. Thorax - Full Body Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Head Assembly Soak Time		Minutes	≥240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Peak Impactor Velocity		m/s	5.4 to 5.6		
Peak Up Rib Deflection		mm	34 to 41		
Peak Middle Rib Deflection		mm	37 to 45		
Peak Lwr Rib Deflection		mm	37 to 44		
Peak Impactor Force (> 6ms)		kN	51 to 62		

 Signature

 Completion Date

CHECK SHEET NO. U7 ABDOMEN IMPACT TEST (S572.186)

Dummy Serial No. _____
Technician _____

Test Date _____

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table U8 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U8. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Remove the jacket and shoulder foam pad.
- ___3 Sit the dummy on a flat, horizontal, rigid surface without back support covered by two PTFE Teflon sheets 2 mm thick.
- ___4 Adjust the dummy such that the anterior-posterior axis of the dummy is perpendicular to the direction of impact.
- ___5 Place the legs horizontal with the distance between the ankles at 100 ± 5 mm.
- ___6 Align the thorax vertically $\pm 2^\circ$ as measured at the torso back plate. Do not support the dummy to maintain this position (Figure 26).

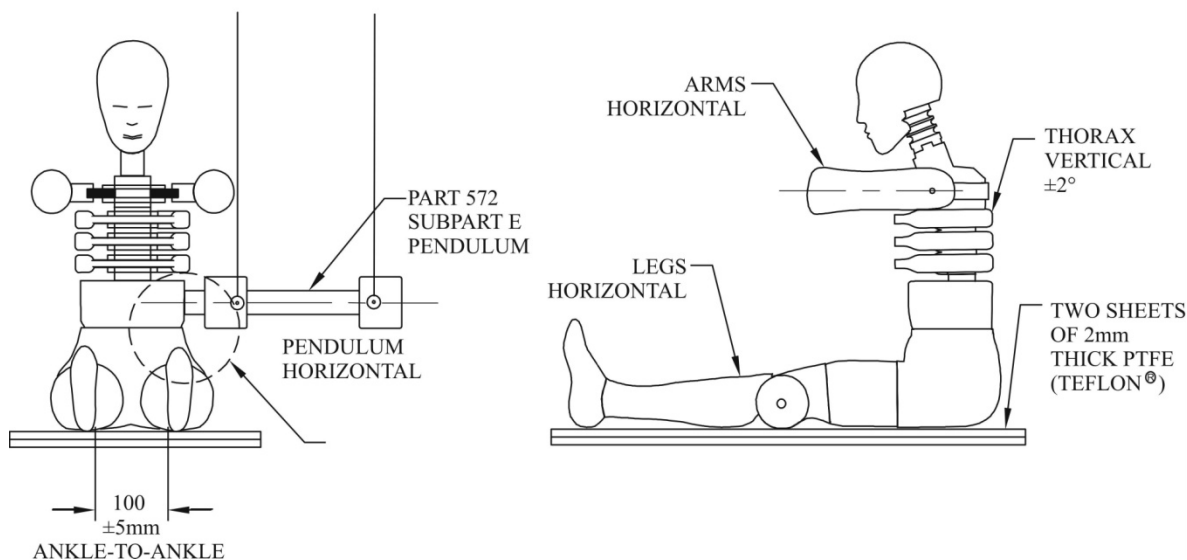


Figure 26. Abdomen impact test condition

- ___7 Affix an abdomen impactor face whose weight is $1.0 \text{ kg} \pm 0.01 \text{ kg}$., height is $70 \text{ mm} \pm 1 \text{ mm}$, width is 150 mm and depth is 60 to 80 mm to the Part 572 Subpart E pendulum (Figure 27).
- ___8 The flat impact surface, with an edge radius of 4 to 5 mm and a minimum Rockwell Hardness of M85, is aligned such that at its widest part is horizontal and centered on the longitudinal axis of the pendulum.
- ___9 Affix an accelerometer with its sensitive axis collinear with the longitudinal axis of the pendulum.

CHECK SHEET NO. U7 (Continued)
ABDOMEN IMPACT TEST (S572.186)

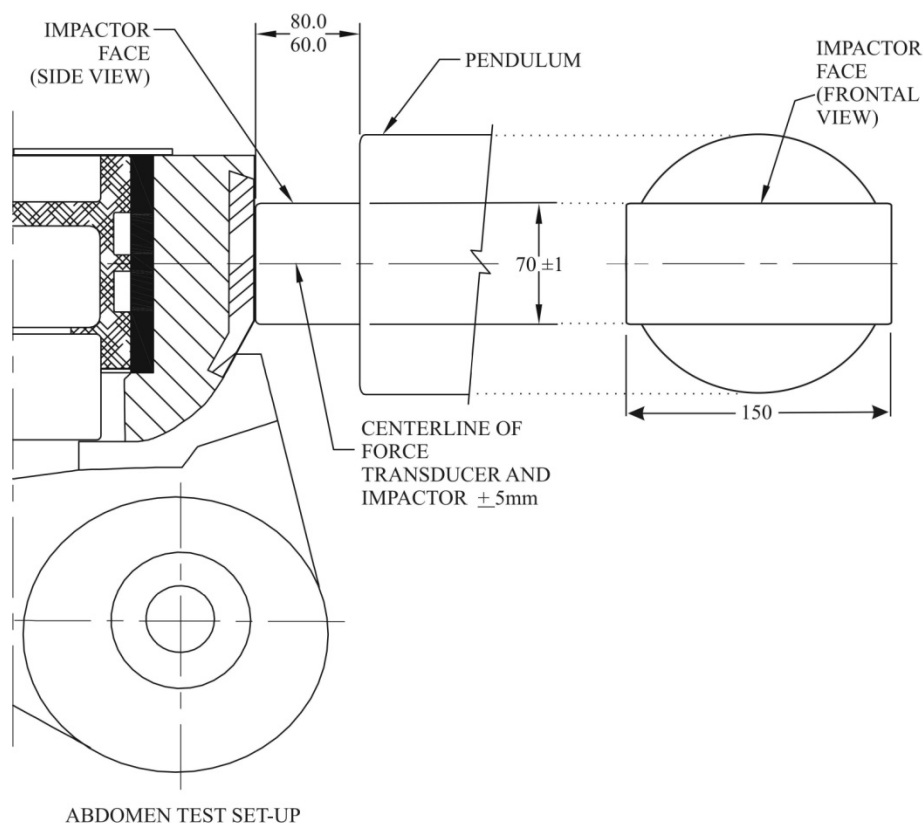


Figure 27. Abdomen Impact Face

Conduct Test, Collect Data and Verify Performance

- ___10 Record the room temperature and humidity in Table U8. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column.
- ___11 The pendulum is aligned so that at contact with the abdomen, its longitudinal axis is perpendicular $\pm 0.5^\circ$ to the midsagittal plane of the dummy and the impact face is centered on the abdomen's middle load measuring sensor within 5 mm.
- ___12 Release the pendulum such that it strikes the dummy's thorax with an impact speed of 4.0 ± 0.1 m/s.
- ___13 Record the impactor acceleration and digitally filter at SAE J211 CFC180.
- ___14. Record the abdomen forces from the three load cells and digitally filter at SAE J211 CFC 60.
- ___15. Verify that the maximum of the sum of the forces of the three abdominal load sensors is not less than 2200 N and not more than 2700 N occurring between 10 ms and 12.3 ms. The calculated sum of the three load cell forces must be concurrent in time.
- ___16. Verify that the maximum impactor force (e.g., impactor acceleration multiplied by its mass) is not less than 4000 N and not more than 4800 N occurring between 10.6 ms and 13.0 ms.

CHECK SHEET NO. U7 (Continued)
ABDOMEN IMPACT TEST (S572.186)

Table U8. Abdomen Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Head Assembly Soak Time		Minutes	≥240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Peak Impactor Force		kN	4.0 to 4.8		
Time of Peak Impactor Force		ms	10.6 to 13.0		
Sum of Abdomen forces		kN	2.2 to 2.7		
Time		ms	10 to 12.3		

Signature

Completion Date

CHECK SHEET NO. U8

LUMBAR SPINE FLEXION TEST (S572.187)

Dummy Serial No. _____
 Technician _____

Test Date _____

Pretest Preparation

- ___1 Remove the lumbar spine assembly (Part No. 175-9000) from the dummy's torso.
- ___2 Soak the lumbar spine assembly in a controlled environment at a temperature and relative humidity indicated in Table U10 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U10. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___3 Attach the top of the lumbar spine assembly to the headform lower mounting base (Part No. 175-9027) with two ¼-20 x 1 SHCS.
- ___4 Attach the base of the lumbar spine assembly to the headform mounting base (Part No. 175-9029) with four M6x12 SHCS (Figure 16).
- ___5 Attach the lower mounting base of the headform with lumbar spine assembly onto the pendulum with four M6x12 SHCS. Attach the headform with its rotational potentiometers on the left-hand side for left side impacts and on the right-hand side for right side impacts (Figure 17)
- ___6 Torque the lumbar hex nut (Part No. 9000057) on to the lumbar cable assembly to 50 ± 5 in-lb.
- ___7 Attach carbon fiber rods (i.e, Arrow Shafts) to each pivot assembly.
- ___8 Carefully insert a carbon fiber rod through the potentiometer assembly that is farthest from the honeycomb impact surface (i.e. Arrow Shaft – Pivot Assembly B).
- ___9 Slide the pivot assembly onto the central carbon fiber rod (i.e., Arrow Shaft). Then, place the spacer onto the central carbon fiber rod.
- ___10 Insert a second carbon fiber rod through the potentiometer assembly housing that is closest to the honeycomb impact surface (i.e., Arrow Shaft – Pivot Assembly A).
- ___11 Lightly tighten the two set screws at the base of Pivot Assembly A to firmly attach it to the central carbon fiber rod being careful not to damage the rod.
- ___12 Attach the potentiometers to the neck mounting plate in their correct orientation with Pivot Assembly A closest to the honeycomb.
- ___13 Prepare the pendulum for the test.
- ___14 Mount a uni-axial accelerometer on the pendulum with its sensitive axis 1657.4 mm from the pendulum pivot in accordance with Standard Part 572 Subpart E.

Conduct the Test, Collect Data and Verify Performance

- ___15 Record the room temperature and humidity in Table U10. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column. The data acquisition system conforms to SAE J211.
- ___16 Raise the pendulum and allow it to fall freely such that it achieves an impact velocity of 6.05 ± 0.1 m/s.
- ___17 Allow the lumbar spine to flex without the lumbar spine/headform assembly making contact with any object.
- ___18 Time zero is defined as the time of contact between the pendulum and the honeycomb. All channels should be at zero level at this point.
- ___19 Determine the velocity time history by integrating the pendulum acceleration beginning at time zero. Filter the pendulum acceleration using CFC 60.
- ___20 Verify that the velocity time history of the pendulum falls within the corridor determined by the upper and lower boundaries specified in Table U9.
- ___21 The fore (A), aft (B) and headform (C) angles are directly measured during the test and filtered using CFC180.
- ___22 The maximum lumbar spine flexion angle is calculated by summing the fore (A) and headform (C) angles.

CHECK SHEET NO. U8 (Continued)
LUMBAR SPINE FLEXION TEST (S572.187)

- _23 Verify that the maximum lumbar spine flexion angle meets specifications listed in Table U10.
- _24 Allow a period of at least thirty (30) minutes between successive tests on the same lumbar spine assembly.

Velocity Corridor for Lumbar Flexion Test

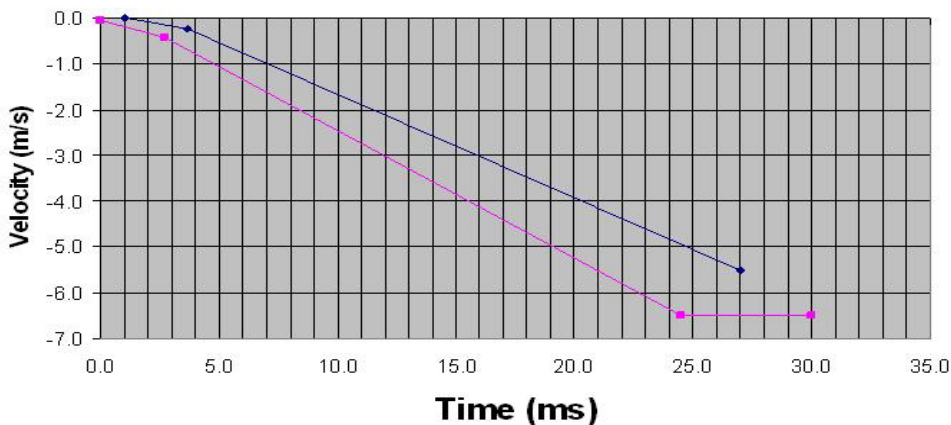


Table U9. Lumbar Spine Flexion Test Pendulum Velocity Corridors

Upper Boundary		Lower Boundary	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (ms)
1.0	0.0	0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.8	24.5	-6.50
		30.0	-6.50

Table U10. Lumbar Spine Flexion Test

Tested Parameter	Units	Specification	Result	Pass/Fail
Lumbar Spine Assembly Soak Time	minutes	≥ 240		
Temperature - During Soak	Max	20.6 to 22.2		
	Min			
Humidity - During Soak	Max	10.0 to 70.0		
	Min			
Temperature – During test	°C	20.6 to 22.2		
Humidity – During test	%	10.0 to 70.0		
Maximum headform flexion angle	deg	50±5°		
Time at Maximum flexion angle	ms	39 to 53		
Time of Decay to Zero Angle from Peak	ms	37 to 57		

Signature

Completion Date

CHECK SHEET NO. U9 PELVIS IMPACT TEST (S572.188)

Dummy Serial No. _____

Test Date _____

Technician _____

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table U11 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table U11. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Remove the shoulder foam pad and jacket.
- ___3 Sit the dummy on a flat, horizontal, rigid surface without back support covered by two PTFE Teflon sheets 2 mm thick.
- ___4 Adjust the dummy such that the anterior-posterior axis of the dummy is perpendicular to the direction of impact.
- ___5 Place the legs horizontal with the distance between the ankles at 100 ± 5 mm.
- ___6 Align the thorax vertically $\pm 2^\circ$ as measured at the torso back plate. Do not support the dummy to maintain this position (Figure 28).

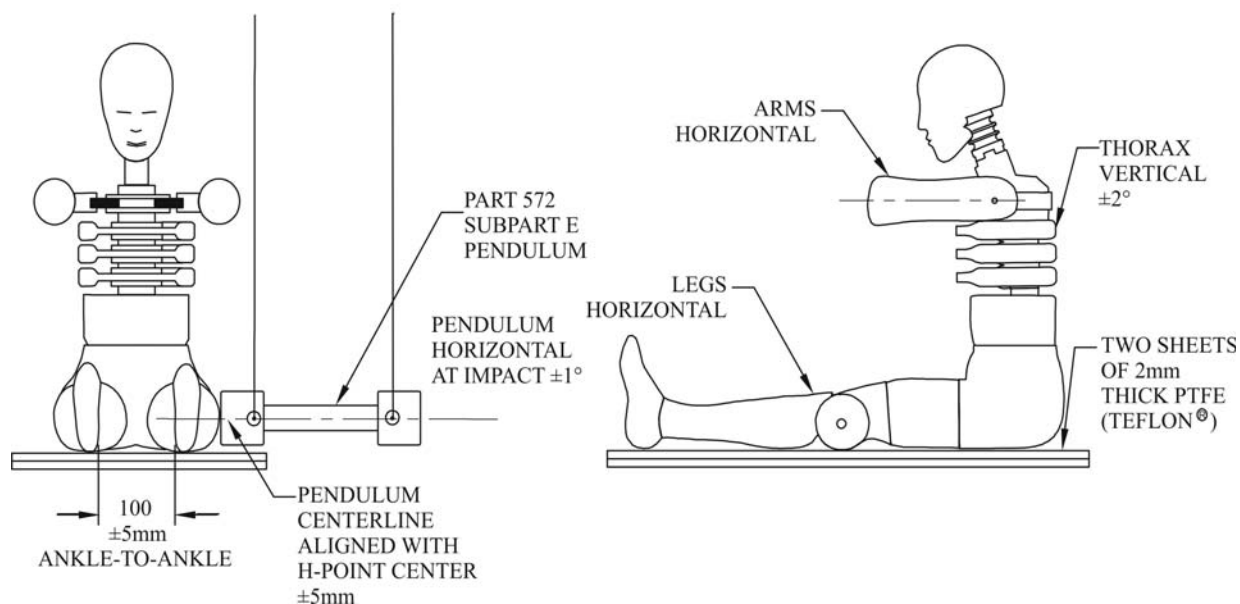


Figure 28. Pelvis impact test condition

CHECK SHEET NO. U9 (Continued)
PELVIS IMPACT TEST (S572.188)

Conduct the Test, Collect Data and Verify Performance

- ___1 Record the room temperature and humidity in Table U11. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- ___2 The data acquisition system conforms to SAE J211.
- ___3 The pendulum meets Part 572 Subpart E (572.36 (a)) and is equipped with an accelerometer with its sensitive axis collinear with the longitudinal axis of the pendulum.
- ___4 The pendulum is aligned so that at contact, the center-point of the impactor face is within 5 mm of the center of the H-point.
- ___5 Release the pendulum such that it strikes the dummy’s pelvis with an impact speed of 4.3 ± 0.1 m/s.
- ___6 Record the pendulum acceleration and digitally filter at SAE J211 CFC180.
- ___7 Verify that
- ___8 Calculate the impactor force as the acceleration of the impactor times its mass and record in Table U11. Verify that the peak impactor force meets specification by indicating “Pass” or “Fail” in the far right column.
- ___9 Plot the pubic symphysis load vs. time. Verify that the peak response meets specification by indicating “Pass” or “Fail” in the far right column.
- ___10 If the test results do not meet specification, wait at least thirty (30) minutes, conduct a second test.
- ___11 Record results of additional tests in separate tables.

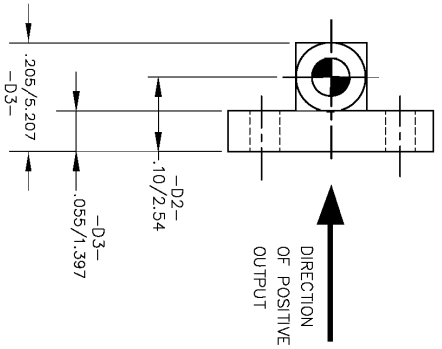
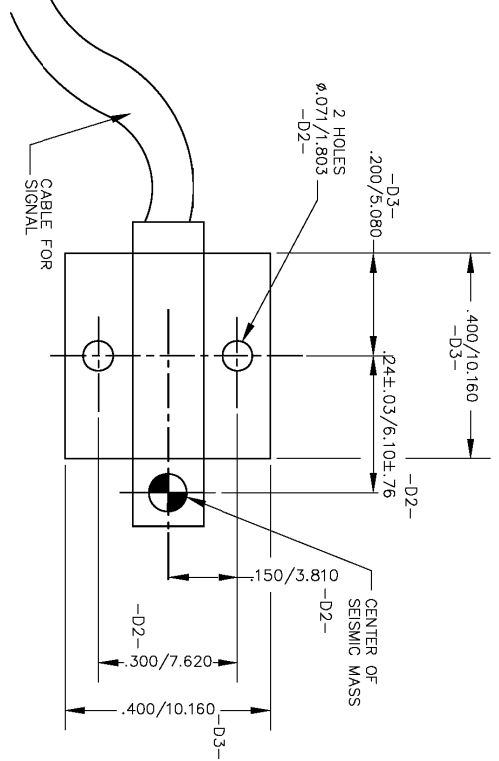
Table U11. Pelvis Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		minutes	≥ 240		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Pendulum Velocity		m/s	4.2 to 4.4		
Peak Impactor Force		kN	4.7 to 5.4		
Time at Peak Force		ms	11.8 to 16.1		
Peak Pubic Symphysis Load		kN	1.23 to 1.59		
Time at Peak Load		ms	12.2 to 17.0		

Signature

Completion Date

ATTACHMENT – Instrumentation Drawing



REVISION RECORD	
ITEM NO.	DATE
-A-	HP 01/09/99
-B1-	DW 09/27/99
-B2-	
-B3-	
-C1-	DW 02/8/00
-D1-	DW 08/15/01
-D2-	DW
-D3-	DW

DESCRIPTION	
-A-	TOLERANCES
-B1-	UPDATED NOTE
-B2-	CHANGE TRANSVERSE SENSITIVITY TO 1%
-B3-	REVISED FORMAT, ENLARGED TOLERANCES
-C1-	REVISED TOLERANCE
-D1-	CHANGED SINGLE DECIMAL PLACE TOLERANCE FROM ± 0.1/2.54 TO ± 0.1/2.5
-D2-	CORRECTED METRIC EQUIVALENTS
-D3-	ADDED DIMENSIONS

SPECIFICATIONS

- RANGE ±2000 g
- SENSITIVITY .20 mV/g MIN
- MOUNTED RESONANCE FREQUENCY 22,000 Hz MIN
- B1- SIGNAL OUTPUT MUST BE COMPATIBLE WITH AND RECORDABLE IN A DATA CHANNEL AS DEFINED BY SAE J211
- DAMPING RATIO UNDAMPED (.005)
- B2- TRANSVERSE SENSITIVITY ±1% MAX
- NON-LINEARITY & HYSTERESIS ±2% MAX
- ZERO OFFSET ±25 mV
- EXCITATION 10V DC
- TEMPERATURE EXPOSURE LIMITS -5% TYP AT 0F TO 150F
- WEIGHT 0/+200F WITHOUT DAMAGE
- HUMIDITY 1 gram (WITHOUT CABLE)
- SEALED

UNITS ARE in/mm

TOLERANCES ARE *	
-D1- DECIMALS	ANGLES
-C1- .X ±0.1/2.5	+ 0.5°
-B3- .XX ±0.01/25	
.XXX ±0.005/127	
* unless otherwise noted	

SCALE NONE	DATE
APPROVALS	3/5/98
ENG J.M.F.	
H.P.	

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

UNIAxIAL PIEZORESISTIVE ACCELEROMETER
 HYBRID III DUMMY FAMILY

SIZE A	FORMER NUMBER SA572-S4	REV D
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RELEASED
 AUG. 15 2001
NHTSA

APPENDIX B

SID-IIs Calibration Procedure

In addition to the following document, **49 CFR 572 Subpart V** may be referenced.

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
LABORATORY TEST PROCEDURE
FOR
Part 572, SUBPART V
PERFORMANCE CALIBRATION REQUIREMENTS



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

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1. PURPOSE AND APPLICATION

The purpose of this laboratory procedure is to provide dummy users (independent testing laboratories under contract with the Office of Vehicle Safety Compliance) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart V dummy so that repetitive and correlative test results can be obtained. The following tests have been developed to establish a uniform calibration procedure for all users as the means of verifying the performance of the dummy.

- A. EXTERNAL MEASUREMENTS
- B. HEAD DROP TEST (572.192)
- C. NECK FLEXION TEST (572.193)
- D. SHOULDER IMPACT TEST (572.194)
- E. THORAX w/ARM IMPACT TEST (572.195)
- F. THORAX w/o ARM IMPACT TESTS (572.196)
- G. ABDOMEN IMPACT TEST (572.197)
- H. PELVIS PLUG QUASI-STATIC TEST
- I. PELVIS ACETABULUM IMPACT TEST (572.198)
- J. PELVIS ILIAC IMPACT TEST (572.199)

2. GENERAL REQUIREMENTS

A properly configured Part 572, Subpart V SIDIIIs-D, 5th percentile female side impact dummy must be tested to the calibration requirements stated herein prior to and after being used in a compliance crash test. Contractors may use "passing" post test calibration data to indicate the pre-test condition of a test dummy used in consecutive crash tests occurring less than 90 days apart. Otherwise, a full pretest calibration must be performed.

3. SECURITY

All NHTSA test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as the dummy calibration laboratory. The contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of GFP. Any security problems shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

3. SECURITY....Continued

The contractor is responsible for maintaining the NHTSA test dummies in good working order, and shall protect and segregate the data that evolves from conducting dummy calibration tests before and after each vehicle crash usage.

No information concerning the dummy calibration data shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Branch or Division Chief.

NOTE: No individuals, other than contractor personnel directly involved in the dummy calibration test program, shall be allowed to witness dummy calibration tests unless specifically authorized by the COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire 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 Part 572, Subpart V dummies are being calibrated as test tools to be used in a vehicle test to determine compliance with the requirements of FMVSS 214. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. Upon request, all testing shall be coordinated to allow monitoring by the COTR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy calibration data available to the COTR for review and analysis as required. Calibration test data for each dummy will be sent to the COTR with each test report in the format indicated in this test procedure.

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

7. GOVERNMENT FURNISHED PROPERTY (GFP)

Part 572 test dummies will be furnished to the contract laboratory by the OVSC. The dummies shall be stored in an upright sitting position with the weight supported by the internal structure of the pelvis. The dummies head shall be held upright without supporting the weight of the dummy by using an eyebolt that can be secured in the top of the head. These dummies shall be stored in a secured room that is kept between 55°F and 85°F. The contractor will check dummy components for damage after each crash test and complete a dummy damage checklist that will be included with the posttest dummy calibration. The COTR will be kept informed of the dummies condition in order that replacement parts can be provided. The contractor shall calibrate the dummies before and verify the calibration after every crash test.

8. CALIBRATION AND TEST INSTRUMENTATION

Before the contractor initiates the dummy performance calibration test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration practices. The calibration system shall be set up and maintained as follows:

- 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 calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.
- C. All measuring and test equipment and measuring standards shall be labeled with the following information:
 - (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment
- D. The contractor shall provide a written calibration procedure that 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 calibrations.
- E. The contractor shall keep records of calibrations for all test instrumentation in a manner that assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the written acceptance of the COTR before testing begins.
- F. Test equipment shall receive a calibration check immediately prior to and after each test. This check shall be recorded by the test technician(s) and submitted with the final report.
- G. Anthropomorphic test devices shall be calibrated before and after each test. These calibrations shall be submitted with the final report.

9. PHOTOGRAPHIC DOCUMENTATION

Provide digital still photographs showing any damage that occurred to the test dummy as a result of the crash test. Provide copies of the photographs in the draft test report.

10. PRETEST REQUIREMENTS

10.1 HEAD DROP TEST FIXTURE (572.192(a) & 572.112(a))

A test fixture configured in accordance with the specifications contained in the figure below shall be used to conduct the head drop tests.

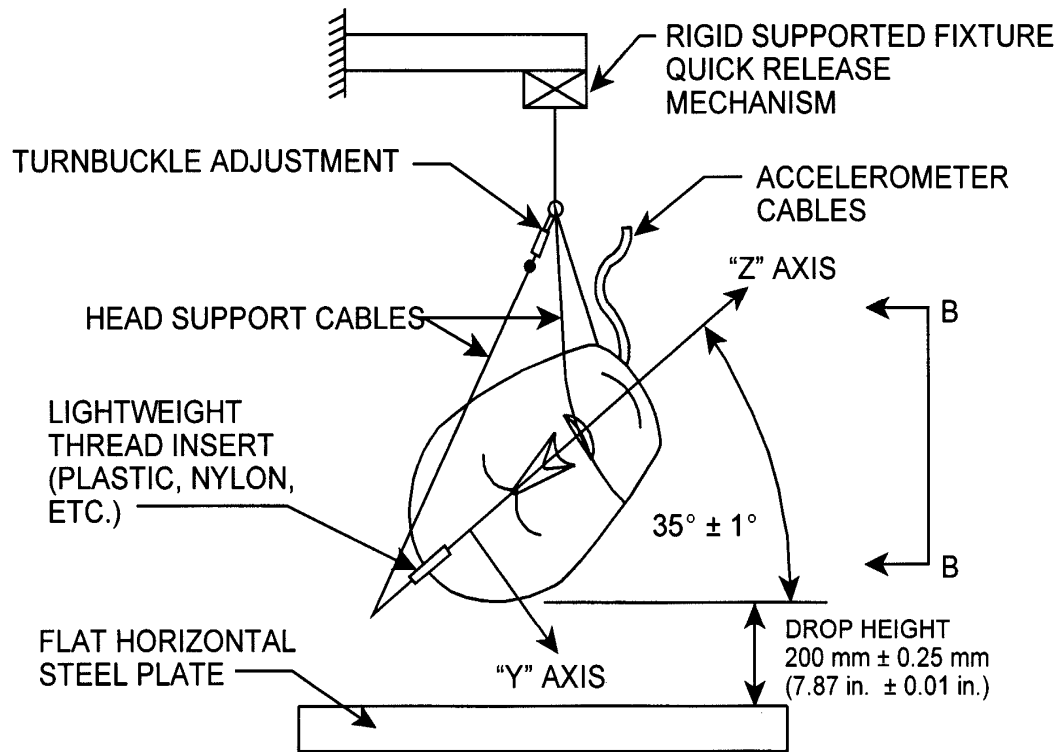
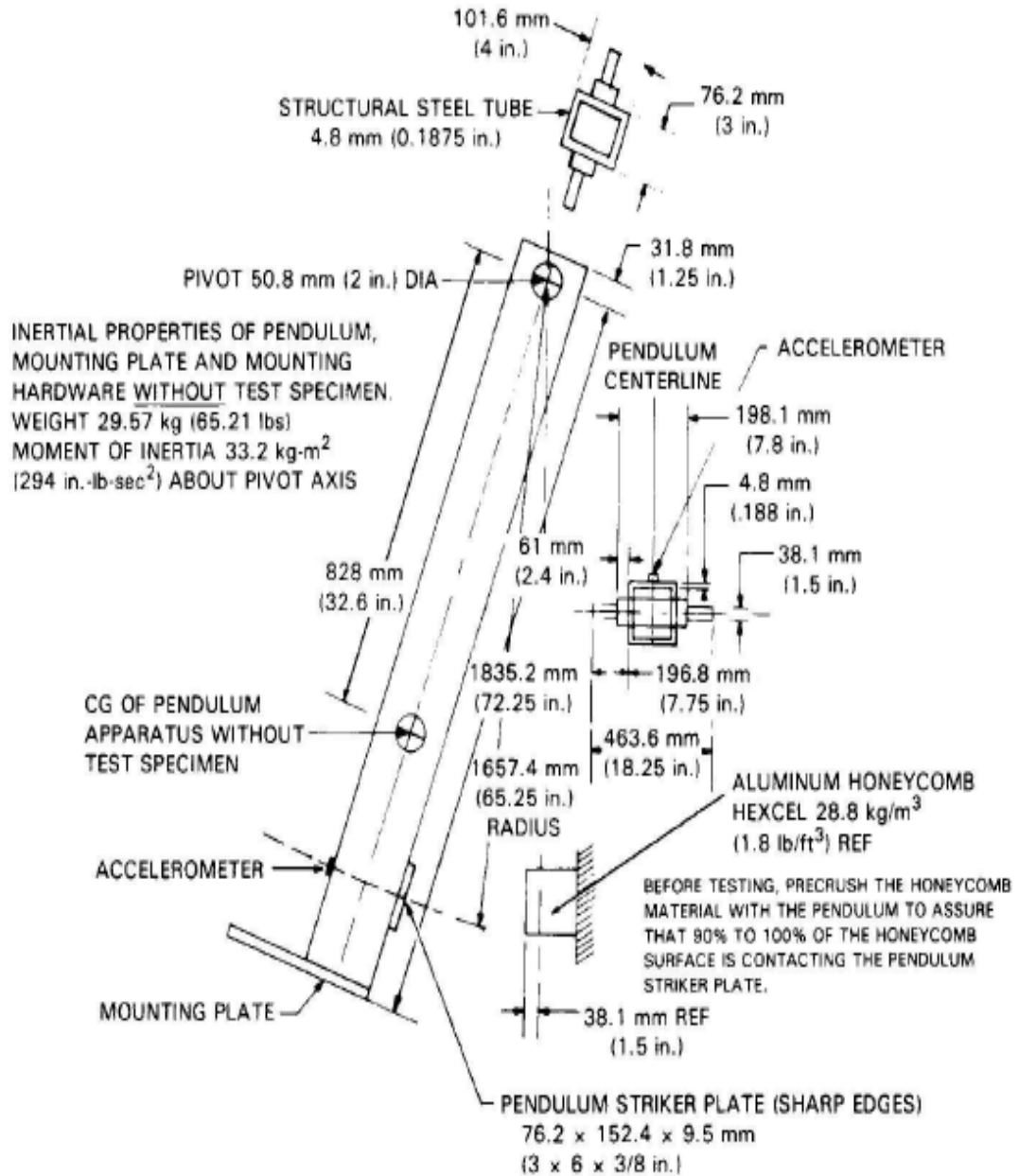


Plate is 51 mm x 610 mm x 610 mm (2 x 24 x 24 in.)
with SURFACE FINISH 0.2 microns (8 microinches) to
2.0 microns (80 microinches). IMPACT SURFACE to be
clean and dry.

10. PRETEST REQUIREMENTS...Continued

10.2 PART 572 PENDULUM TEST FIXTURE (572.193(b)(2), 572.33)

A pendulum configured in accordance with the specifications contained in the figure below shall be used to conduct the neck and lumbar flexion tests.



10. PRETEST REQUIREMENTS...Continued**10.3 TEST PROBES (572.200(a), 572.137(a))**

- A. All hardware attached directly to the impactor and one-third (1/3) of the mass of the suspension cables must be included in the calculations of the total impactor mass. The sum mass of the attachments and 1/3 cable mass must not exceed 5 percent of the total pendulum mass. No suspension hardware, suspension cables, or any other attachments to the test probe, including velocity vane, shall make contact with the dummy during the test (572.189(a)).
- B. The test probe for shoulder, lateral thorax, and pelvis-acetabulum impact tests is the same as that specified in 49 CFR 572.137(a) except that its impact face diameter is 120.70 ± 0.25 mm and it has a minimum mass moment of inertia of 3646 kg-cm^2 .
- C. The test probe for the lateral abdomen impact test is the same as that specified in 572.137(a) except that its impact face diameter is 76.20 ± 0.25 mm and it has a minimum mass moment of inertia of 3646 kg-cm^2 .
- D. The test probe for the pelvis-iliac impact tests is the same as that specified in 572.137(a) except that it has a rectangular flat impact surface 50.8×88.9 mm for a depth of at least 76 mm and a minimum mass moment of inertia of 5000 kg-cm^2 .

10.4 TRANSDUCER REQUIREMENTS

The contractor shall provide and install the following instrumentation;

- A. **ACCELEROMETERS**
Accelerometers for the head, the thoracic spine, and the pelvis that conform to specifications of SA572-S4.(572.200(d))
- B. **ROTARY POTENTIOMETER**
Rotary potentiometers for the neck-headform assembly that conform to SA572-51.(572.200(e))

10.5 OTHER TRANSDUCER CONDITIONS

- A. **TRANSDUCER MOUNTS**
The mountings for sensing devices shall have no resonance frequency within range of 3 times the frequency range of the applicable channel class. (572.200(h)).
- B. **TRANSDUCER SIGN CONVENTION**
Coordinate signs for instrumentation polarity shall conform to the Sign Convention For Vehicle Crash Testing, Surface Vehicle Information Report, SAE J1733, 1994-12 (refer to §572.191(a)(5)).

10. PRETEST REQUIREMENTS....Continued**C. TRANSDUCER OUTPUT FILTERING**

The outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified by this part are recorded with individual data channels. Each data channel is comprised of a sensor, signal conditioner, data acquisition device and all interconnecting cables. Instrumentation and sensors conform to the Recommended Practice SAE J-211 (Mar. 1995)—Instrumentation for Impact Test unless noted otherwise.

All instrumented response signal measurements shall be treated to the following specifications:

- (1) Head acceleration—Digitally filtered CFC 1000;
- (2) Neck headform assembly translation rotation – Digitally filtered at CFC 60;
- (3) Neck pendulum, T1 and T12 thoracic spine and pelvis accelerations—digitally filtered CFC 180;
- (4) Neck forces (for the purpose of occipital condyle calculation) and moments—digitally filtered at CFC 600;
- (5) Pelvis, shoulder, thorax and abdomen impactor accelerations—digitally filtered CFC 180;
- (6) Acetabulum and iliac wings forces—digitally filtered at CFC 600;
- (7) Shoulder, thorax, and abdomen deflection—digitally filtered CFC 600;

11. CALIBRATION TEST EXECUTION

See Check Sheets in Section 14.

12. POST TEST REQUIREMENTS

The contractor shall verify all required data has been collected and recorded on the tables provided in Section 14. The contractor shall perform instrumentation checks necessary to validate data results.

13. REPORTS**13.1 APPARENT NONCONFORMANCE**

During the post test calibration, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturdays and Sundays excluded). Written notification shall be submitted with a copy of the particular test data sheet(s) and preliminary data plot(s).

In the event of an apparent nonconformance, a post test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

13.2 FINAL PERFORMANCE CALIBRATION REPORTS

The pre-test calibration and post test calibration verification data for each Part 572, Subpart V dummy used in the vehicle compliance test shall be submitted with the FMVSS 214 final test report for the vehicle tested.

14. CHECK SHEETS

CHECK SHEET NO. V1
EXTERNAL MEASUREMENTS

Dummy Serial No. _____
Technician _____

Test Date _____

- ___1 With the dummy's jacket in place, seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface. The seating surface must be at least 406 mm (16-in) wide and 406-mm (16-in) deep, with a vertical section at least 406 mm (16 in) wide and 914-mm (36 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.
- ___2 Seat the dummy in the test fixture so that the torso is against the vertical surface of the fixture (Figure 1).

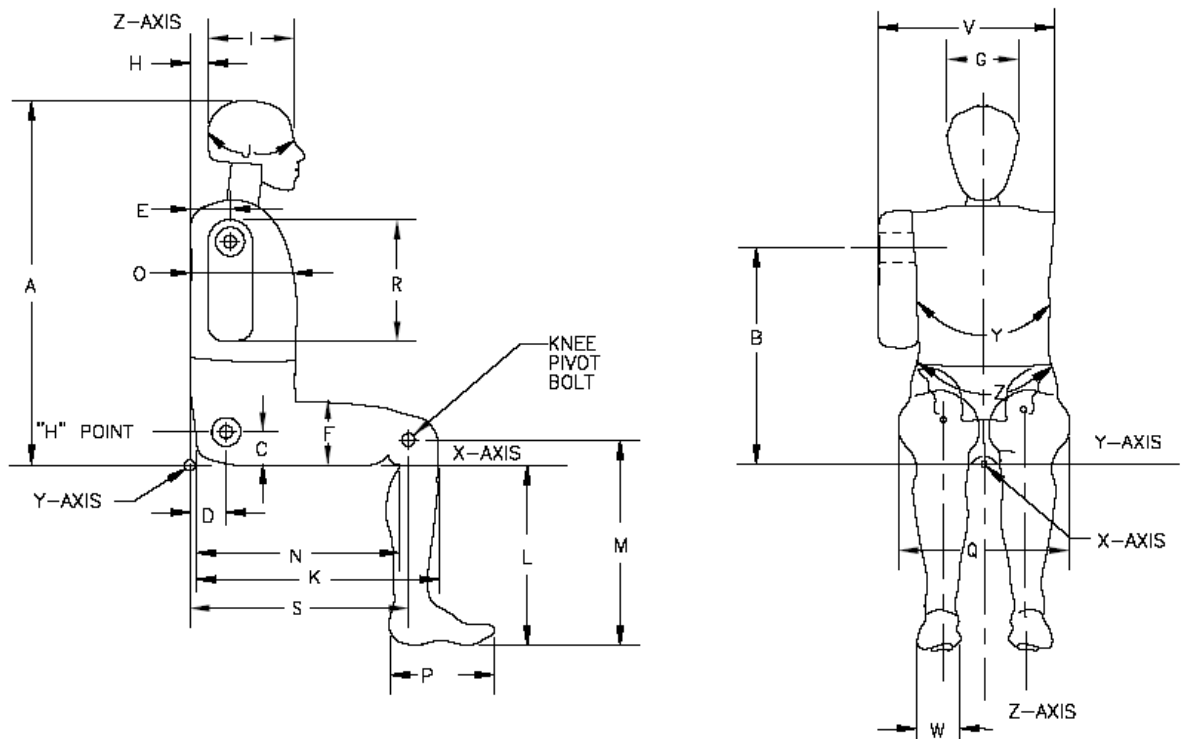


Figure 1. Seated Position of SID-IIISD for taking external measurements
(Dummy configured for right-side impact)

- ___3 Take the following measurements and record on Table V1. Verify that each measurement meets the specification by indicating "Pass" or "Fail" in the far right column.
- ___4 **Chest Circumference (Y):** With the jacket on, using a tape measure positioned 114 mm (4.5") below the top surface of the non-struck side shoulder, measure the chest circumference.
- ___5 Remove the chest jacket. Position the dummy against the vertical back plate so that dummy is in contact with the surface. Level the top surface of the top rib guide laterally. Extend the dummy's neck so that the base of the skull is level side-to-side, within 0.5 degrees. The rear surface of the skull cap should be 43 +/- 3 mm (1.70 +/- 0.10 in) from the vertical surface of the test fixture (parameter H). A 43-mm wide block mounted to the vertical surface of the seat behind the head will aid in this process. In addition, a strap or bungee cord may be placed around the forehead of the dummy to stabilize the head in this position.

CHECK SHEET NO. V1 (Continued)
EXTERNAL MEASUREMENTS

- ___6 Position the dummy's H-point (both left and right sides) so it is 84 +/- 5 mm (3.30 +/- 0.20 in) above the horizontal seating surface and 146 +/- 5 mm (5.75 +/- 0.20 in) forward of the rear vertical surface of the fixture (parameters **C** and **D**, respectively). A threaded cylindrical tool, as illustrated in Figure 2, which can be screwed into the acetabulum load cell replacement (Figure 3) in place of the 1/4-20 x 5/8" FHCS, will aid this process.



Figure 2. Threaded cylindrical tool



Figure 3. Threaded cylindrical tool installed at acetabulum

- ___7 **Sitting Height (A):** With the head positioned as indicated in step 6, measure the distance from the seat horizontal surface to a level placed on top of the head.
- ___8 **Shoulder Pivot Height (B):** Level the shoulder load cell structural replacement. Measure from the centerline of the shoulder yoke assembly to the seat horizontal surface. For ease of measurement, it is recommended to measure from the top of the load cell replacement to the horizontal seat surface and adjust this value by 1/2 the height of the structural load cell replacement.
- ___9 **Shoulder Pivot From Backline (E):** Level the shoulder load cell structural replacement. Measure from the centerline of the shoulder yoke assembly to the seat vertical surface (seatback). For ease of measurement, it is recommended to measure from the front of the load cell replacement to the seat back and adjust this value by 1/2 the width of the structural load cell replacement.
- ___10 **Thigh Clearance (F):** Measure from the horizontal seat surface to the highest point on the thigh flesh. A level placed laterally across both thighs at the highest point will aid in this process
- ___11 **Head Breadth (G)** Measure the widest part of the head.
- ___12 **Head Depth (I)** Measure from the back of the head to the forehead.
- ___13. **Head Circumference (J)** Measure at the point used for dimension "I".
- ___14 **Buttock to Knee Length (K):** Measure from the rear surface of the buttock to the front edge of the knee in line with the knee pivot and hip pivot. Use of a vertically positioned level will aid in this measurement.
- ___15 **Popliteal Height (L):** Position the front edge of the lower leg vertically. Level the bottom of the feet. Measure from the bottom of the feet to the seat horizontal surface.

CHECK SHEET NO. V1 (Continued)
EXTERNAL MEASUREMENTS

- __16 **Knee Pivot to Floor Height (M):** Position the front edge of the lower leg vertically. Level the bottom of the feet. Measure from the bottom of the feet to the knee pivot.
- __17 **Buttock Popliteal Length (N):** Place a ½" diameter rod behind the knee and pull it forward against the back of the knee joint. Measure from the (anterior) edge of the rod nearest the knee joint to the rear surface of buttock.
- __18 **Foot Length (P):** Measure the maximum foot length from heel to toe.
- __19 **Hip Breadth (Q)** Measure the widest part of the hip with both pelvic plugs installed.
- __20 **Arm Length (R)** Measure from the top of the shoulder to the bottom of the elbow.
- __21 **Knee Joint to Seat Back (S)** Measure from the center of the knee joint to the seat back. Use of a horizontally positioned level will aid in this measurement.
- __22 **Foot Width (W):** Measure the maximum foot width from left to right.
- __23 **Chest Depth (O):** Push the thorax against the seat back. At a distance of 381 mm (15") above the seat surface (on the rib guide between the first and second ribs), measure the horizontal distance from this point to the seatback.
- __24 **Shoulder Width (V):** With only one arm installed (left or right), measure the distance between the outside surface of the shoulder plug and the rib mounting bracket on the non-struck side.
- __25 **Waist Circumference (Z):** Use a tape measure to measure the circumference of the waist within 6 mm (0.25") of the topmost portion of the pelvis flesh, avoiding the zipper closure.

Table V1. External Measurements

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 – 788		
B	Shoulder Pivot Height	437 – 453		
C	H-point Height	79 – 89		
D	H-point from seatback	141 – 151		
E	Shoulder Pivot from Backline	97 – 107		
F	Thigh Clearance	119 – 135		
G	Head Breadth	140 – 148		
H	Head Back from Backline	40 – 46		
I	Head Depth	178 – 188		
J	Head Circumference	541 – 551		
K	Buttock to Knee Length	514 – 540		
L	Popliteal Height	343 – 369		
M	Knee Pivot to floor height	392 – 409		
N	Buttock Popliteal Length	416 – 442		
O	Chest Depth w/o jacket	195 – 211		
P	Foot Length	216 – 232		
Q	Hip Breadth (w/pelvic plugs)	313 – 323		
R	Arm Length	249 – 259		
S	Knee Joint to seatback	477 – 493		
V	Shoulder Width	341 – 357		
W	Foot Width	78 – 94		
Y	Chest Circumference w/jacket	851 – 881		
Z	Waist Circumference	761 - 791		

Signature

Completion Date

CHECK SHEET NO. V2 HEAD DROP TEST (S572.192)

Dummy Serial No. _____
Technician _____

Test Date _____

Pretest Preparation

- __1 Inspect the head skin for cracks, tears or other damage. Replace the skin if necessary.
- __2 Remove the skullcap from the head assembly (Part No. 180-1000) and inspect for defects. If defects are present, repair or replace.

Note: If the damage results from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

- __3 Soak the head assembly in a controlled environment at a temperature and relative humidity indicated in Table V2 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V2. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __4 Install the 3 accelerometers onto the mount (Figure 4) assuring that all axes are oriented properly.
- __5 Install the accelerometer mount into the head (Figure 5) and tighten all screws.

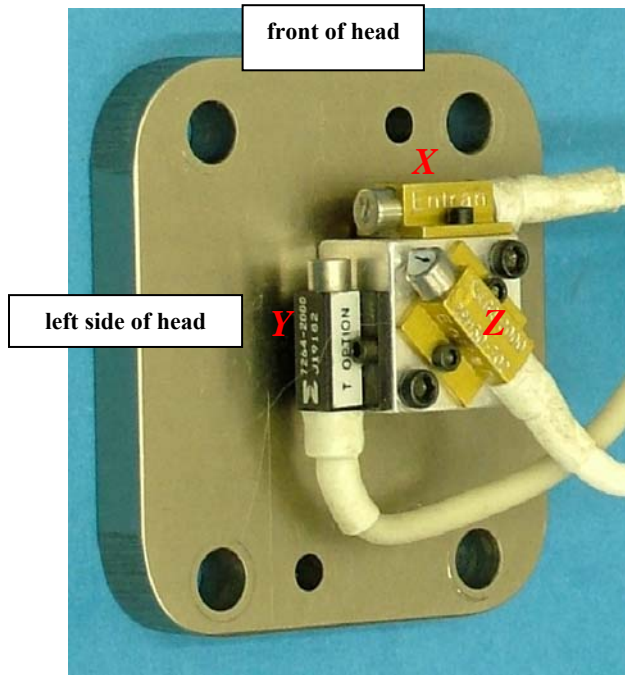


Figure 4. Installing head accelerometers to mount

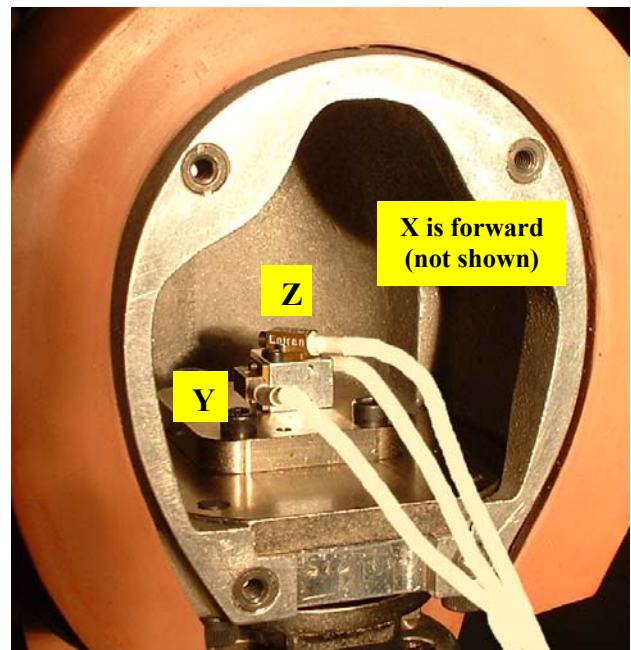


Figure 5. Installing accelerometers in head

CHECK SHEET NO. V2 HEAD DROP TEST (S572.192)

- __6 Replace the skullcap, taking care not to damage accelerometer wiring protruding from the head (Figure 6).
- __7 When replacing the skullcap, use the standard skullcap bolts for all but the bottom left (for left side impacts) or bottom right (for right side impacts) bolts. Instead, insert a threaded 4.2 cm long (1.3 cm of the 4.2 cm is threaded) hex rod so that it protrudes from the skullcap. Tighten the rod into the threaded hole with a wrench. This rod will be used to route the cabling which holds the head assembly for test.
- __8 Install the upper neck structural replacement to the base of the head.
- __9 Clean the headskin with isopropyl alcohol and allow it to dry thoroughly.

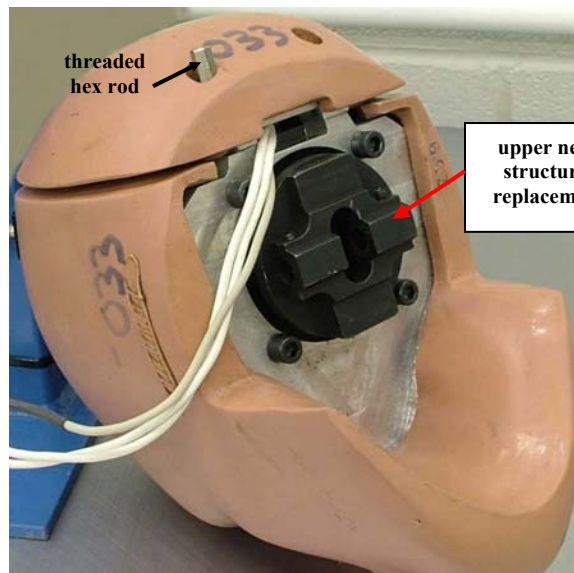


Figure 6. Head reassembly with hex rod installed for routing suspension cable

- __10 Install the threaded Teflon® cylinder with suspension cable attached into the top of the head (Figure 7).

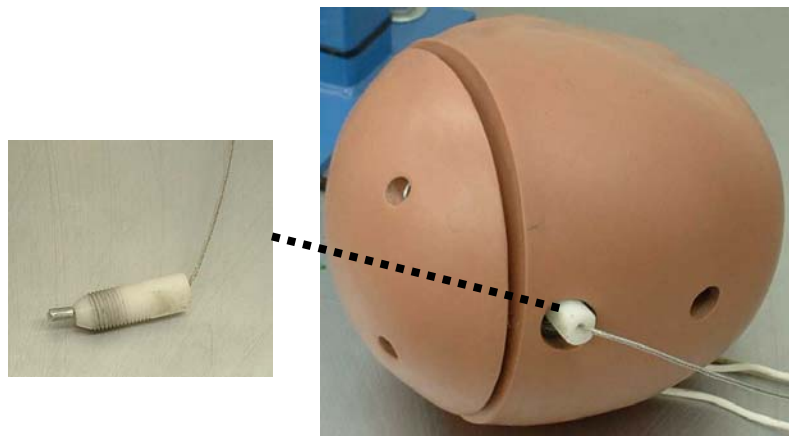


Figure 7. Securing the suspension cable to the top of the head

CHECK SHEET NO. V2 (Continued)
HEAD DROP TEST (S572.192)

- __11 Suspend the head assembly using the head suspension cables (Figure 8). Route the suspension cable around the protruding hex bolt, and between the lips.

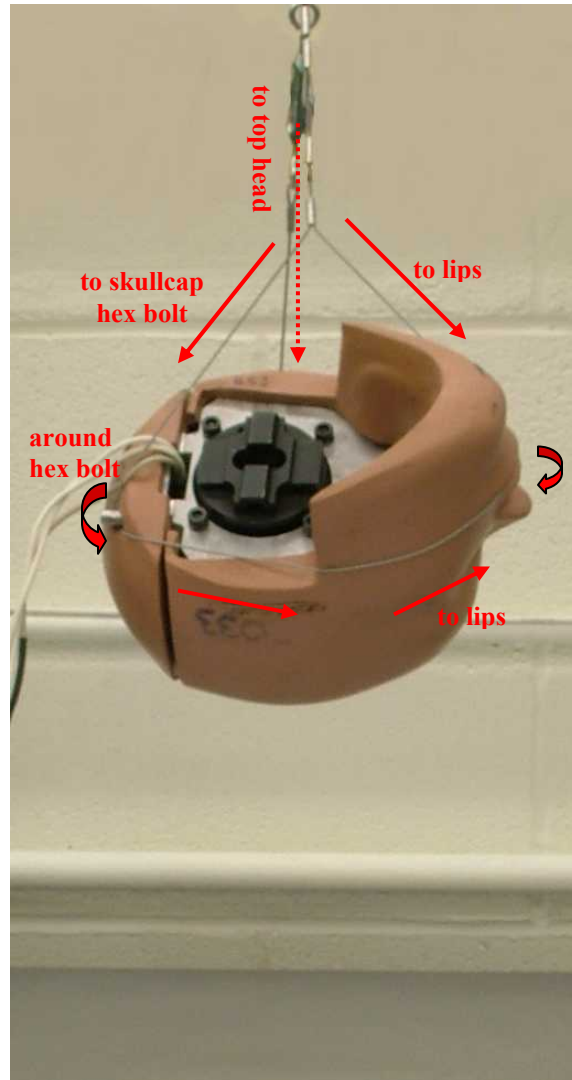


Figure 8. Routing the suspension cables for head drop tests (left-side impact)

CHECK SHEET NO. V2 (Continued)
HEAD DROP TEST (S572.192)

- __12 Adjust the head so that the skull base/D-plane is $35^\circ \pm 1^\circ$ from the vertical (Figure 9).

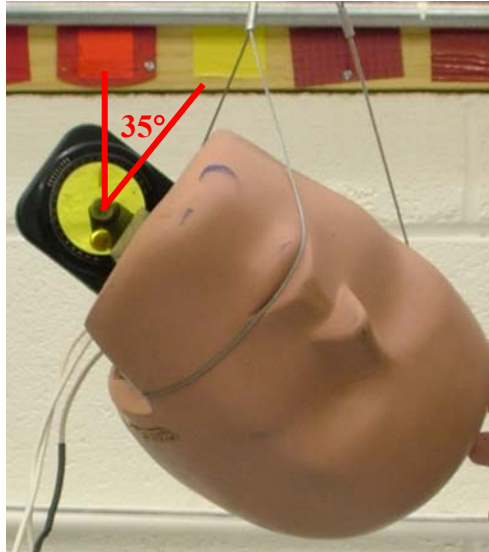


Figure 9. Adjusting the D-plane to 35°
(left side impact shown)

- __13 Level the head so that it is horizontal in the fore-aft direction (Figure 10).

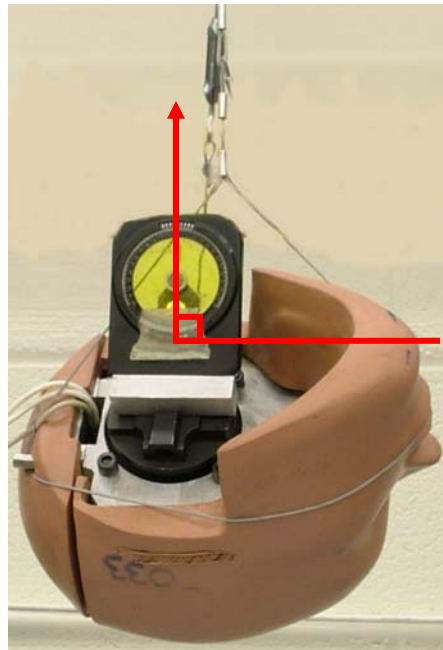


Figure 10. Leveling the head in
the fore-aft direction

CHECK SHEET NO. V2 (Continued)
HEAD DROP TEST (S572.192)

- __14 Raise the head assembly so that it is 200mm ± 1 (7.87in. ± 0.04) from the impact point to the lowest point on the head (Figure 10).
- __15 Clean the impact surface with isopropyl alcohol.

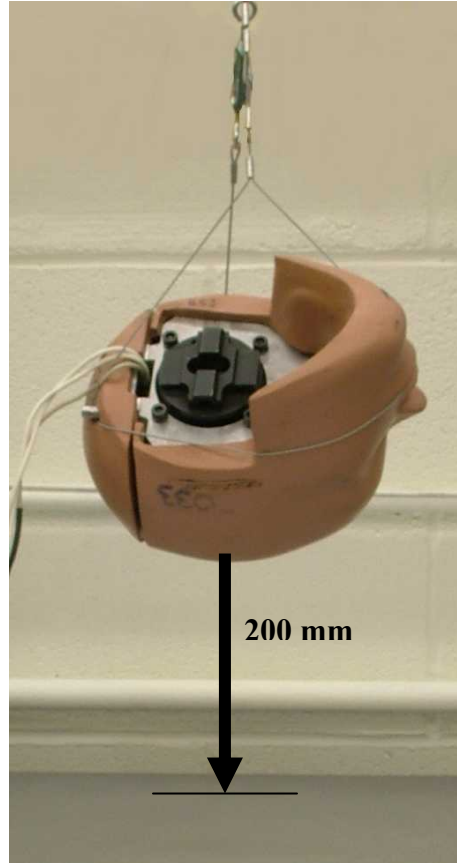


Figure 11. Raising head to proper drop height

Conduct the Test, Collect Data and Verify Performance

- __16 Record the room temperature and humidity in Table V2. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- __17 Release the head assembly so that it falls freely to the impact surface.
- __18 Record head accelerations and filter using a Channel Class 1000 phaseless filter.
- __19 Time zero is defined as the time of contact between the head and the impact surface. All channels should be at a zero level at this point.
- __20 Plot the Head X acceleration and resultant acceleration data traces.
- __21 Calculate the resultant head acceleration using the formula:

$$a_{res} = [(a_x)^2 + (a_y)^2 + (a_z)^2]^{1/2}$$
- __22 Record the peak head resultant acceleration and peak head X acceleration in Table V2. Verify that each measurement meets specification by indicating “Pass” or “Fail” in the far right column.
- __23 If the test results are not within specification, wait at least 2 hours, conduct another head drop test.
- __24 Record and report the results of each additional test in a separate table.

CHECK SHEET NO. V2 (Continued)
HEAD DROP TEST (S572.192)

Table V2. Head Drop Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Head Assembly Soak Time		Minutes	240		
Temperature - During Soak	Max	°C	18.9 to 25.6		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	18.9 to 25.6		
Humidity – During test		%	10.0 to 70.0		
Peak Head Resultant Acceleration		g's	115 to 137		
Peak Head X Acceleration		g's	<15		
Unimodal (Oscillation)		Yes/No	<15%		

Signature

Completion Date

CHECK SHEET NO. V3 NECK FLEXION TEST (S572.193)

Dummy Serial No. _____
Technician _____

Test Date _____

Prepare the Head Form

- __1 The head form is designed to simulate the SID-III head. To assemble the head form, gather the parts listed below in Table I.

Table I. Head Form Parts

Item Number	Quantity	Part Number	Description
1	1	SA572-S11	6 axis upper neck load cell (Ref)
2	4	9000115	Screw, SHCS ¼-28 x ½
3	1	180-1005	Pivot Pin, Neck
4	2	180-1007	Washer, Nodding Joint
5	1	180-9062	Head Form Rear Disk
6	6	9000151	Screw, SHCS #10-32 x ¾
7	1	SA572-S51	Chest Rotary Potentiometer
8	1	180-9011	Head Form Center Bracket
9	1	9000033	Roll Pin, 1/16 x 5/32 long
10	1	180-9051	Pot Shaft Collar
11	1	180-9050	Pot Extension Shaft
12	1	9002317	Ball Bearing
13	1	180-9052	Retaining Collar
14	4	9002360	Screw, SSCP #6-32 x 1/8
15	1	180-9061	Head Form Front Disk
16	2	9000452	Screw, SSCP #8-32 x ¼

- __2 When assembling the head form, it is critical that the parts are installed correctly. The head form consists of a center bracket and a front and a rear disk (Figure 12a). The front disk represents the front of the dummy head (stamped "front head") and the rear disk represents the rear of the dummy head (stamped "rear head").

Note - The front and rear disks appear identical, but are different and should not be interchanged.

- __3 The first step in assembling the head form is to install a rotary potentiometer (often referred to as a "pot") on the rear disk as shown in Figure 12b. As this pot is assembled to the head form, it is referred to as the "head potentiometer". When assembling the head potentiometer to the head form rear disk (Items 7 and 5, Figure 12b), it is important to position the roll pin (Item 9, Figure 12b), which is press fit into a hole in the potentiometer, within the locator hole in the rear head form disk. Inserting the roll pin into the locator hole of the head form disk ensures that the housing of the potentiometer will not slip within the assembly during testing. The potentiometer is secured to the head form disk with an internal tooth lock washer and threaded hex nut.

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Dummy Serial No. _____
 Technician _____

Test Date _____

Figure 12a. Center bracket, front and rear disks of head form

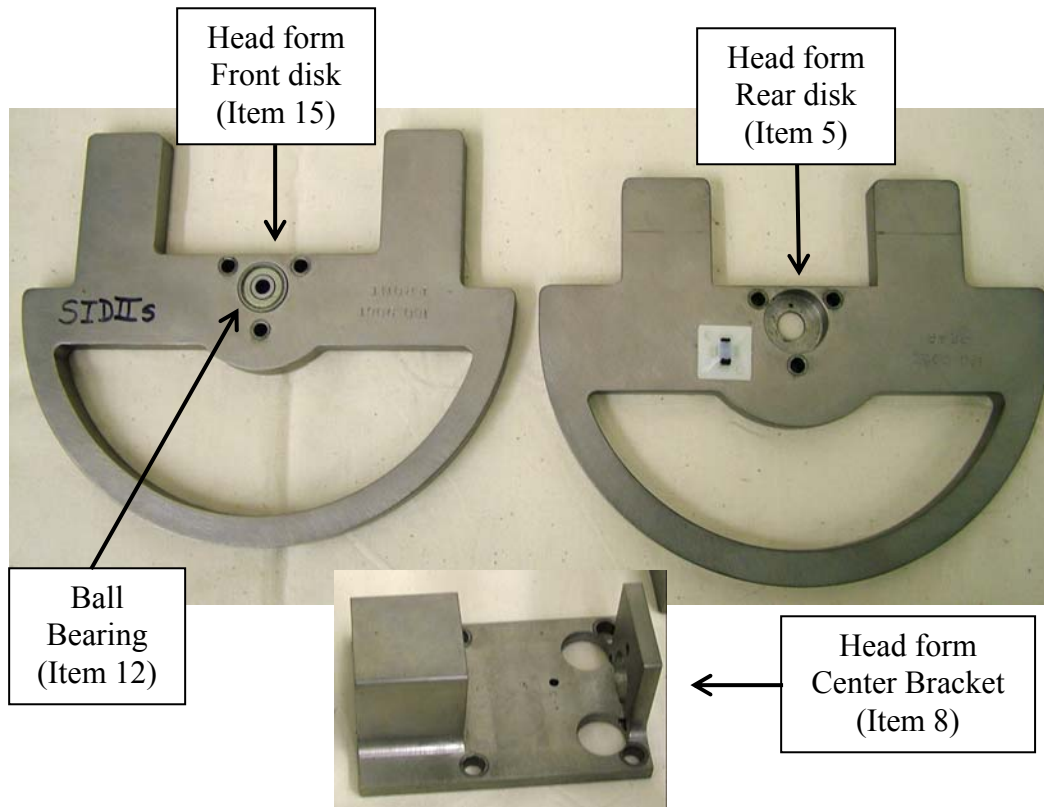
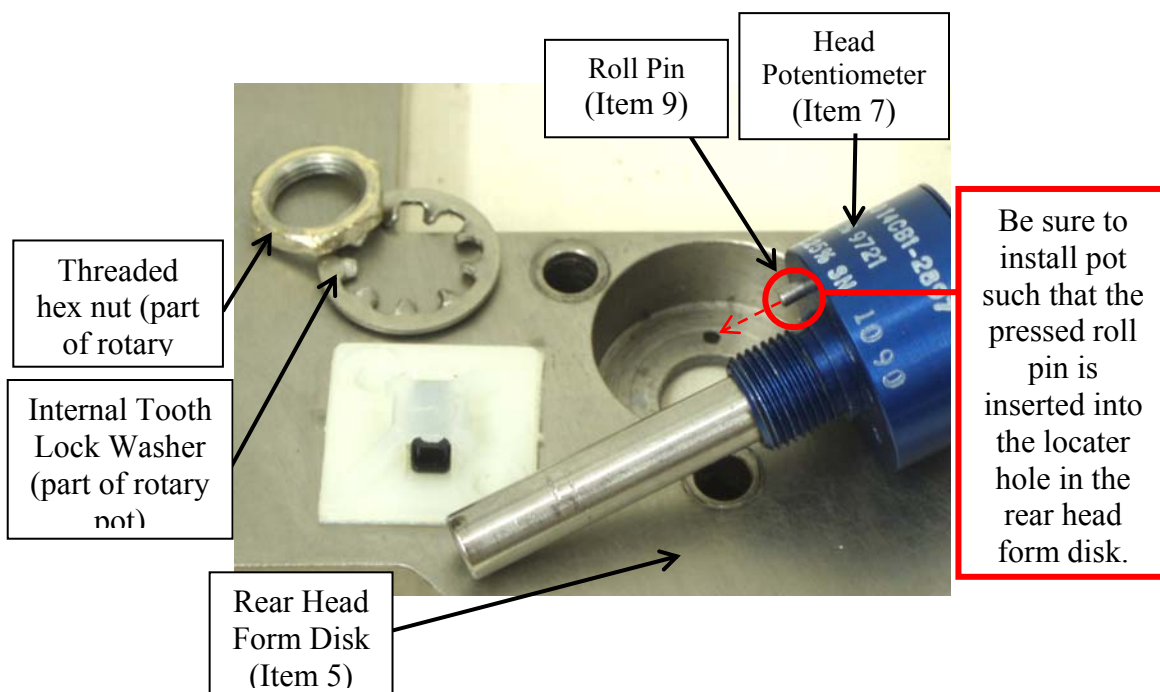


Figure 12b. Head Potentiometer



CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Dummy Serial No. _____

Test Date _____

Technician _____

- ___4 After the head pot is installed, the pot shaft collar is attached to the shaft of the head pot via one #6-32 x 1/8 SSCP (Figure 13). The center bracket and head form front disk are assembled to the rear disk using three #10-32 x 3/4 SHCS for each of the front and rear disks (Figure 14).

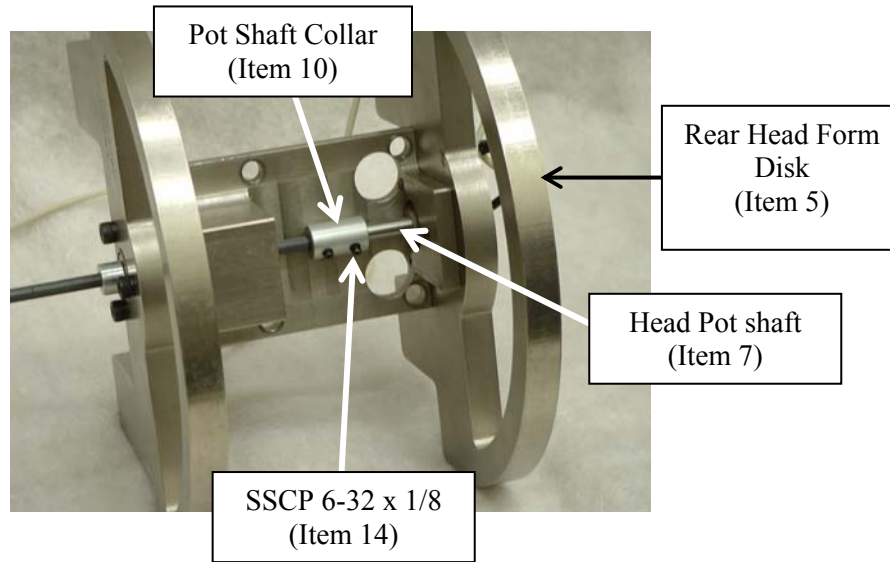


Figure 13. Attaching the pot shaft collar to the head pot

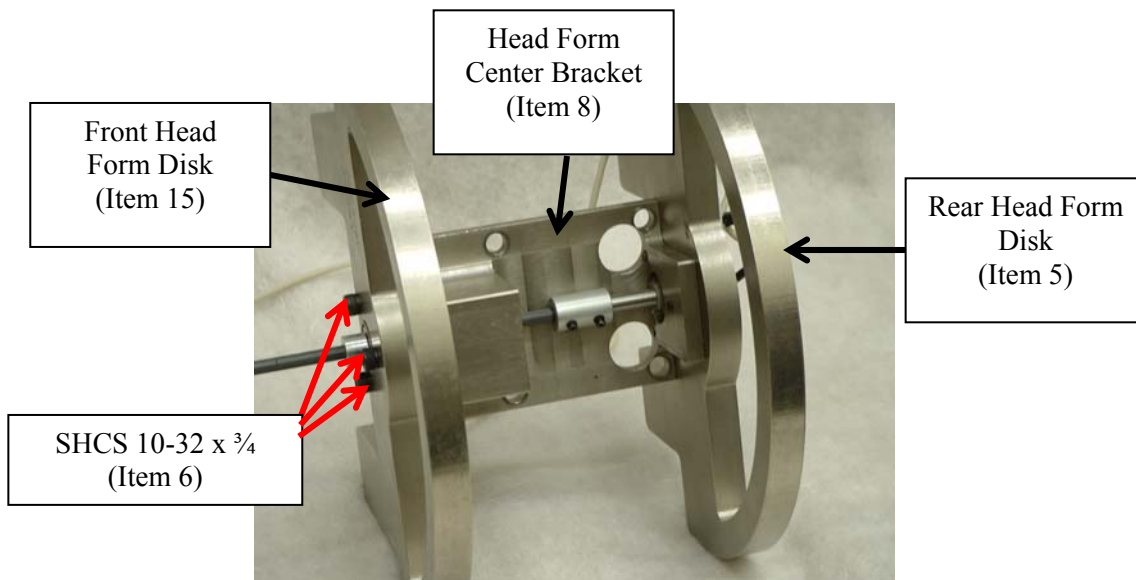


Figure 14. Assembling front head form disk to rear disk

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Dummy Serial No. _____
 Technician _____

Test Date _____

- 5 The pot extension shaft is attached to the pot shaft collar via two (perpendicular) #6-32 x 1/8 SSCP (Figure 15). The retaining collar is secured to the extension shaft on the outside of the front head form disk with one #6-32 x 1/8 SSCP (Figure 16).

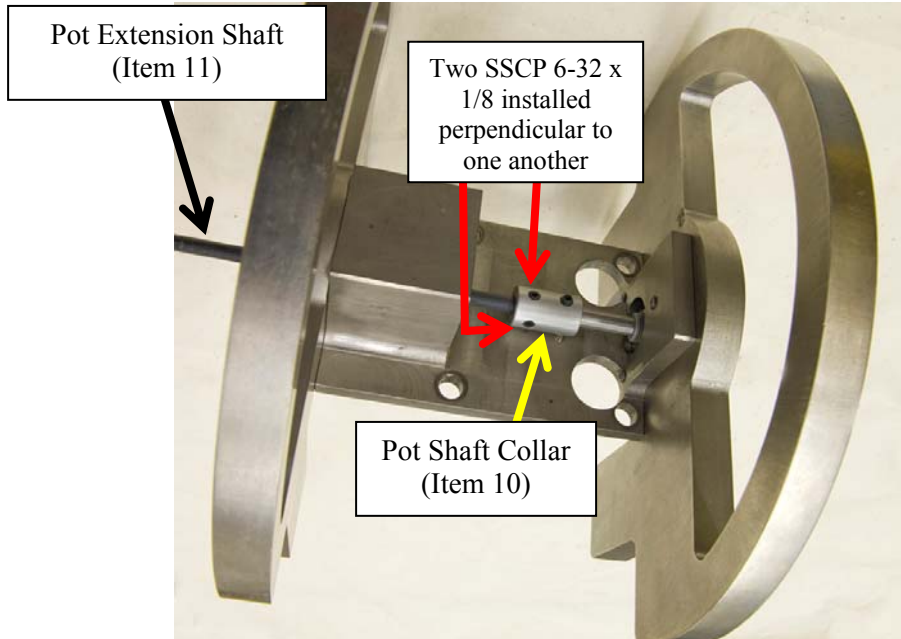


Figure 15. Attaching the pot extension shaft to the pot shaft collar

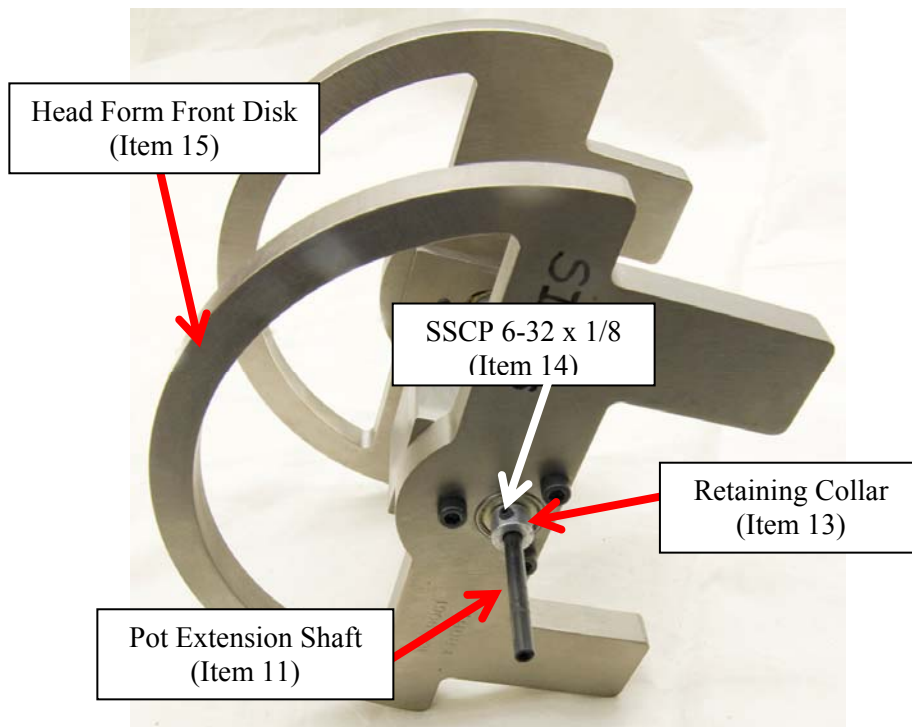


Figure 16. Attaching the retaining collar to the pot extension shaft

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Dummy Serial No. _____
 Technician _____

Test Date _____

- ___6 Table II lists the parts that make up the head form assembly. The base of the neck is mounted on the neck mounting plate with four 10-24 x 5/8 SHCS and four flat washers (Figure 16), with the bib simulator located between the base of the neck and the neck mounting plate. Four 1/4 -20 SHCS are used to mount the neck and head form assembly to the Part 572 neck pendulum.

Table II. Head Form Assembly Parts

Item Number	Quantity	Part Number	Description
1	1	180-9002	Head Form
2	1	180-9060	Spacer
3	1	180-9040	Potentiometer Inner-Rod Assembly
4	1	180-9030	Potentiometer Outer-Rod Assembly
5	1	180-2000	Neck Assembly (Ref.)
6	1	180-9058	Neck Mounting Plate
7	2	9001021	Screw, SHSS 5/16 x 5/8 Shoulder w/ 1/4-20 x 7/16 Thread
8	2	180-9021	Bracket, Potentiometer Pivot
9	4	9000155	Screw, SSCP #6-40 x 1/4
10	2	SA572-S51	Chest Rotary Potentiometer
11	2	180-9010	Potentiometer Housing Assembly
12	1	180-3006	Simulator, Bib
13	4	9000224	Screw, SHCS #10-24 x 5/8
The Upper Neck Bracket (180-2006) of the Neck Assembly is not utilized for Neck Qualification Tests.			

- ___7 Soak the neck assembly in a controlled environment at a temperature and relative humidity indicated in Table V3 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V3. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___8 Inspect the neck for deformation, tears or breaks in the rubber. Replace the neck if deformation or damage is observed.
- ___9 Inspect the two nodding blocks for deformation or damage. Deformed nodding blocks can cause the head to rattle and allow improper loading of the nodding joint and should be replaced.
- ___10 Remove the hex jam nut (9000018), 1.06 OD x .53 ID x .06 washer (9001260), and lower neck bushing (180-2005) from the end of the neck cable.
- ___11 Uninstall the four #10-24 x 5/8 FHCS to detach the nodding joint assembly (with nodding blocks) from the neck (Figure 17). Remove the neck cable (180-2013) from the neck assembly (180-2000). The upper neck bushing should be present, but need not be removed.

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Dummy Serial No. _____
Technician _____

Test Date _____



Figure 17. Removing the nodding joint assembly

- ___12 Inspect the neck cable by observing the condition of the strands. If they are not tightly wound, if frays are visible, or the cable appears larger in diameter on one end, replace the cable. If the cable is permanently bent, replace the cable.
- ___13 With the upper neck bushing installed, insert the neck cable through the top of the neck.

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- _14 Insert the bib simulator over the threaded end of the neck cable taking care to align the holes in the bib simulator with those in the neck (Figure 18).
- _15 Orient the molded neck so that the front of the neck (which has slits) faces the front of the neck mounting plate. Assemble the molded neck to the neck mounting plate with four #10-24 x 5/8 SHCS and four flat washers (Figure 19). *(Note: the upper neck bracket (180-2006) of the neck assembly is not used in the neck qualification test.)*



Figure 18. Install bib simulator



Figure 19. Assemble molded neck to neck mounting plate

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- __16 Insert the lower neck bushing into the neck mounting plate over the neck cable, then the 1.06 OD x .53 ID x .06 washer and finally the hex jam nut (Figure 20). Torque the nut to 10-12 in-lbs (Figure 21). If the proper torque cannot be achieved, replace the neck cable.



Figure 20. Install lower neck bushing, washer, and hex nut onto neck cable



Figure 21. Torque hex nut on neck cable to 10-12 in-lbs

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- _17 Reinstall the nodding joint assembly with nodding blocks using the four #10-24 x 5/8 FHCS (Figure 22).
- _18 Install the potentiometer pivot brackets to the neck mounting plate using one SHSS 5/16 x 5/8 shoulder screw with 1/4-20 x 7/16 thread for each bracket (Figure 23).

Note - For a left side test (shown) the pivot bracket is placed in the innermost threaded hole on the right side of the neck, and on the outermost threaded hole on the left side of the neck.



Figure 22. Reinstall neck nodding joint assembly

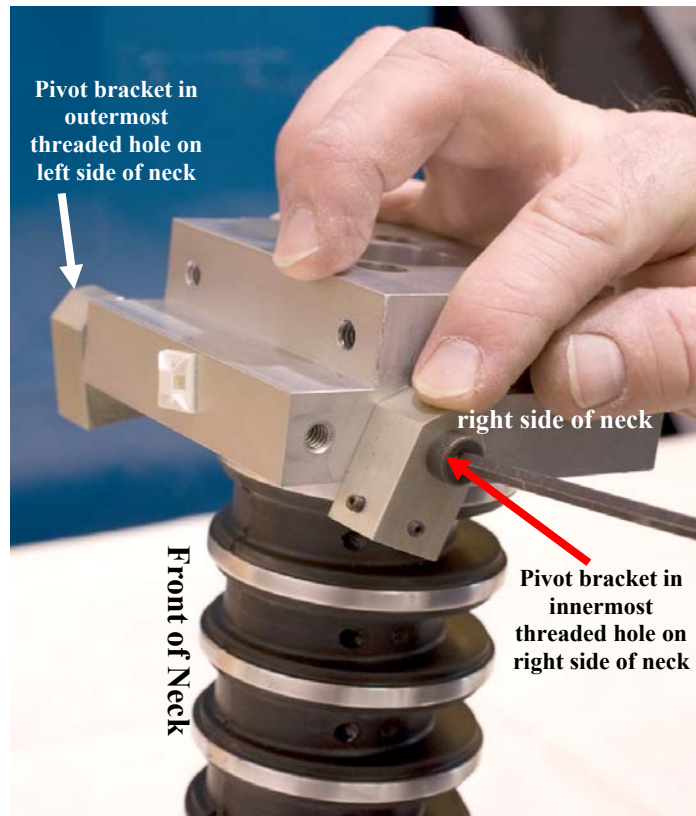


Figure 23. Install potentiometer brackets (left side neck test illustrated)

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- __19 Prior to installing the neck to the six axis upper neck load cell, install the brass nodding joint washers by holding them on either side of the pivot hole on the neck cap (Figure 24); orient the upper neck load cell so that the straight edge of the load cell is towards the back of the neck, and press the upper neck load cell onto the pivot while maintaining the positioning of the brass washers (Figure 25).



Figure 24. Install brass nodding joint washers

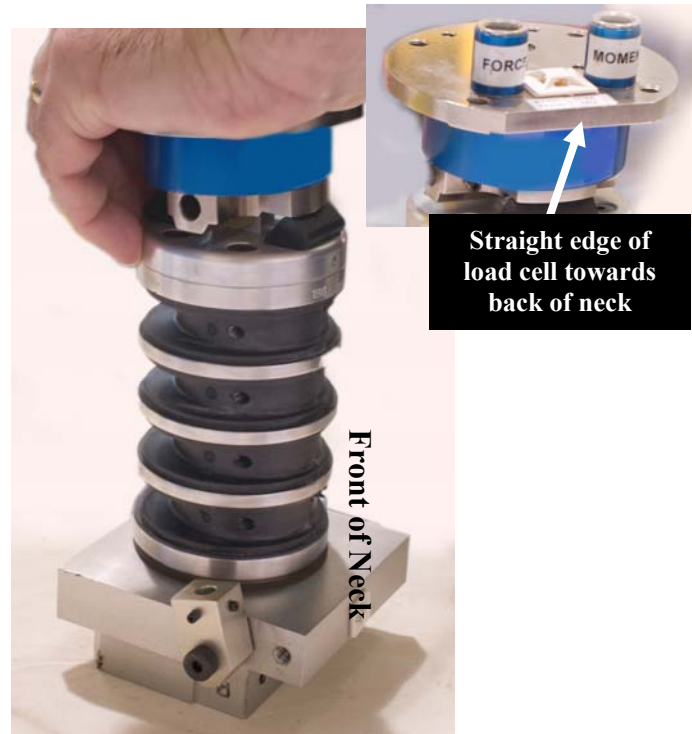


Figure 25. Install the upper neck load cell

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- _20 In order to insert the pivot pin through the neck, the brass nodding joint washers must be aligned properly with the holes. A punch tool or other appropriate tool, may aid in this alignment (Figure 26).
- _21 Uninstall the two #8-32 x 1/4 set screws located on the back underside of the load cell. Insert the neck pivot pin so that the “flat” sections of the pin face the rear of the load cell. Using a nylon or similar “soft” mallet so that the load cell will not be damaged (Figure 27), drive the neck pivot pin into the nodding joint. When the flat portions of the pivot pin are visible through the set screw holes, the pin is properly located. Reinstall and tighten the set screws.

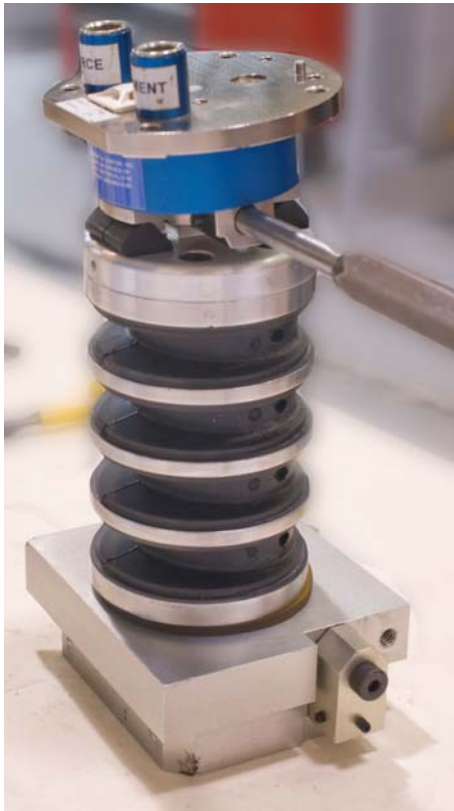


Figure 26. Align brass nodding joint washers with holes

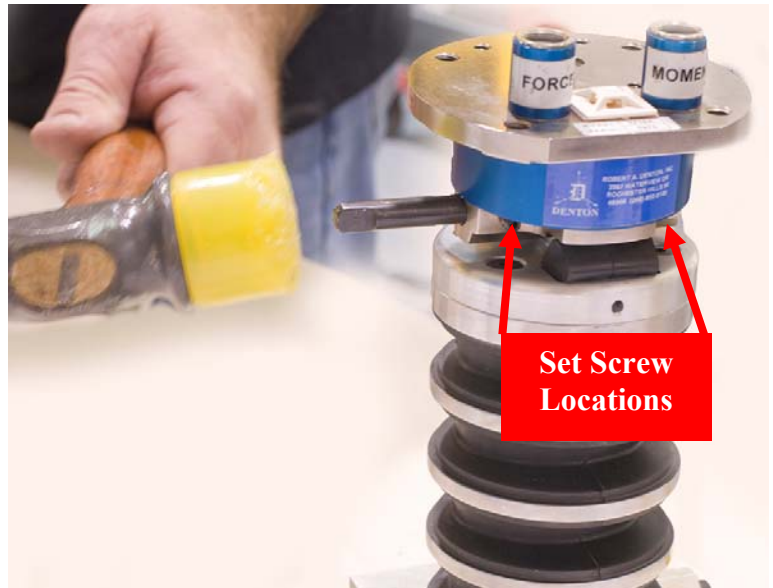


Figure 27. Insert and install neck pivot pin

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- __22 Install the upper neck load cell to the head form using four $\frac{1}{4}$ - 28 x $\frac{1}{2}$ SHCS (Figure 28). Be sure to orient the neck appropriately with the Rear Head Form Disk at the rear of the neck and the Front Head Form Disk at the front of the neck. Recall that the straight edge of the load cell corresponds to the back of the neck and the front of the neck has slits.

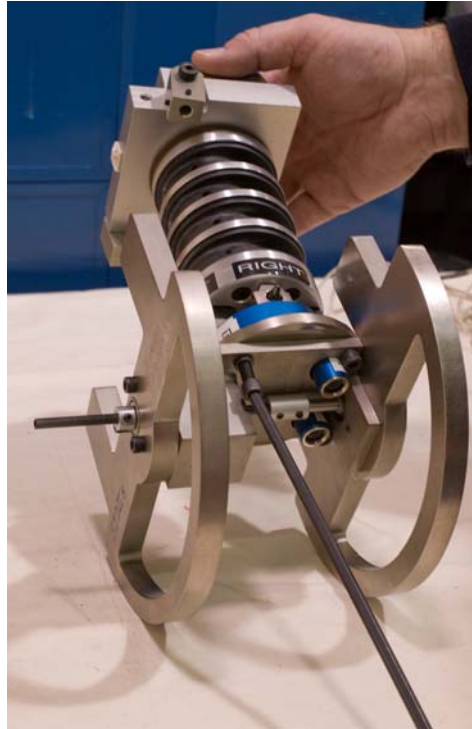


Figure 28. Install upper neck load cell to head form

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- __23 Carefully slide the potentiometer inner rod assembly (which has a bearing in the clevis) onto the head potentiometer extension shaft (Figure 29). The pot/rod assemblies are referred to as the inner and outer pot rod assemblies due to their relative positions on the head pot extension shaft.

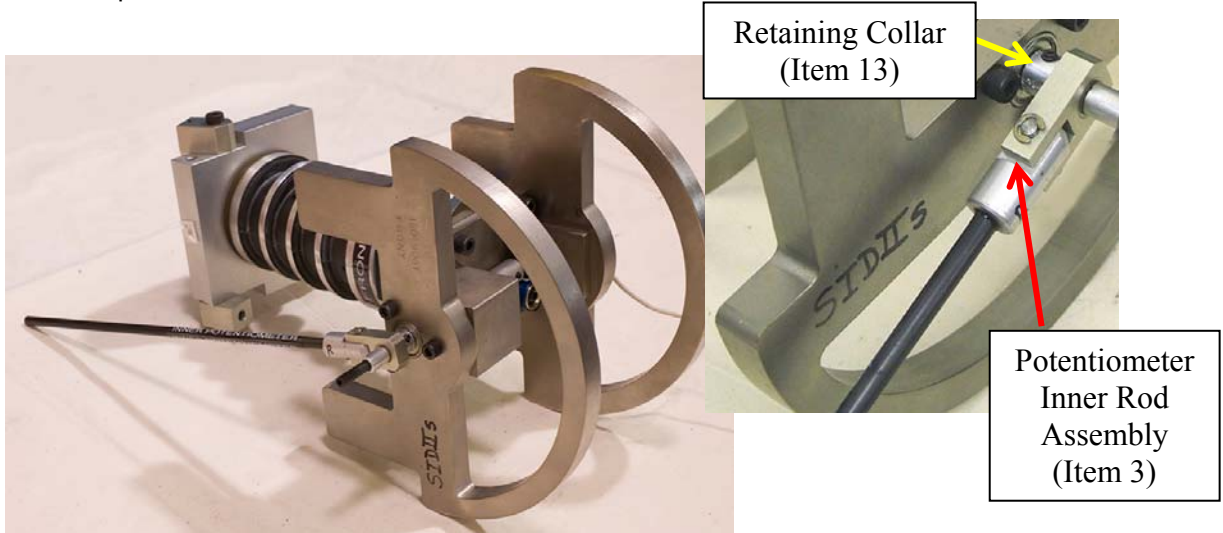


Figure 29. Install the inner potentiometer rod assembly

- __24 Place the spacer onto the head pot extension shaft, followed by the potentiometer outer rod assembly (which has holes for set screws in the clevis) (Figure 30). Lightly tighten the two set screws in the outer rod assembly clevis to clamp it to the head pot extension shaft, being careful not to damage the shaft.

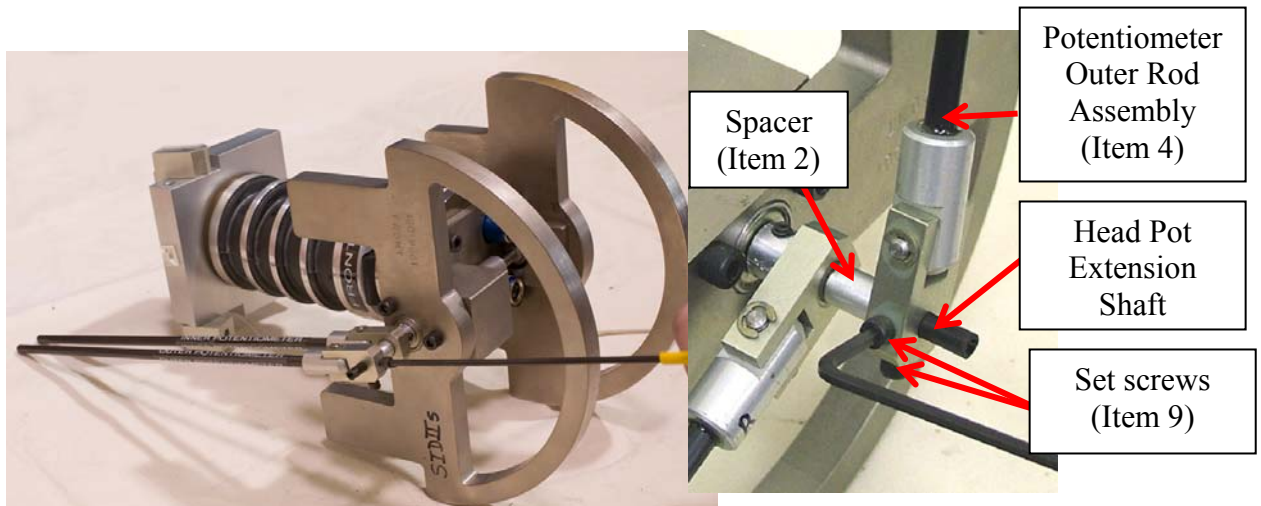


Figure 30. Install the outer potentiometer rod assembly

CHECK SHEET NO.V3 (Continued)
NECK FLEXION TEST (S572.193)

- __25 Install the chest rotary potentiometers into the potentiometer housing assemblies (Figure 31). During installation, it is important to insert the roll pin, which is press fit into the potentiometer housing assembly, into one of the locator holes of the potentiometer. **Inserting the roll pin of the potentiometer housing assembly into the locator hole of the potentiometer ensures that the potentiometer will not slip within the assembly during testing.** The potentiometer is secured to the assembly with an internal tooth lock washer and threaded hex nut.

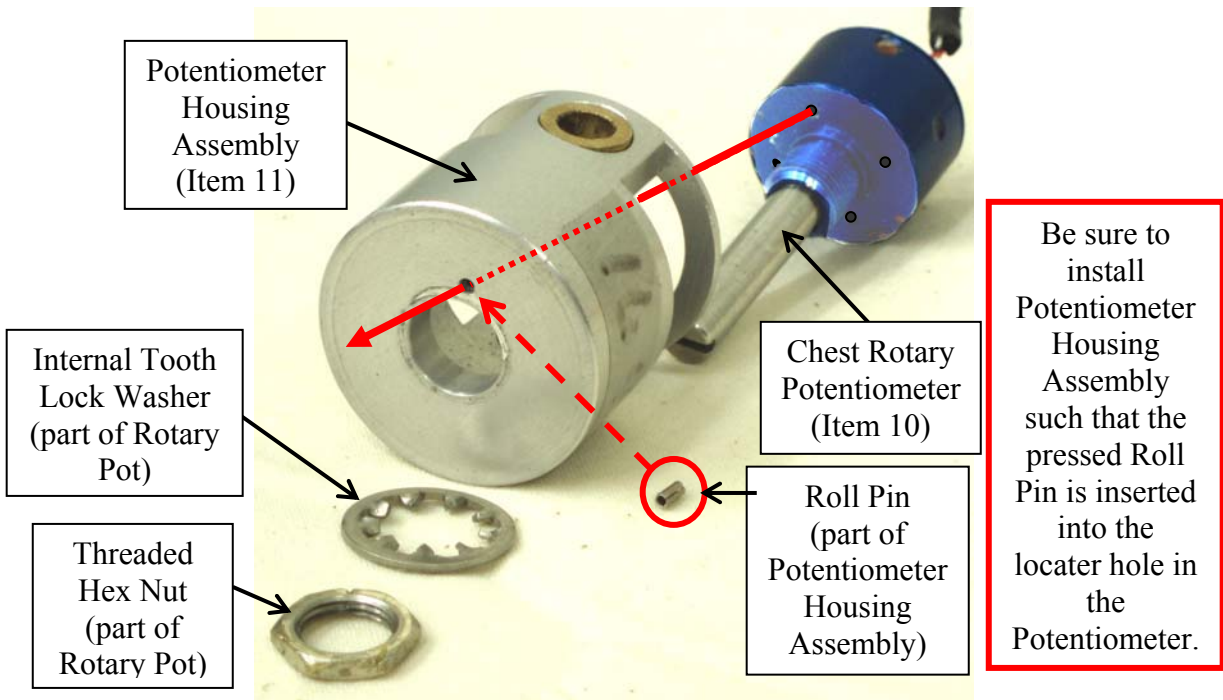


Figure 31. Assembling chest rotary potentiometer and potentiometer housing assembly

- __26 Slide a potentiometer housing assembly onto each potentiometer rod.
- __27 Install the shaft of the potentiometer on the inner pot rod onto the inner potentiometer pivot bracket (Figure 32). Note that the pivot bracket is bolted to the innermost bolt location for this pot (Figures 23 and 32). Tighten the two #6-40 x ¼ SSCP set screws into the pot shaft (Figures 32 and 33).

NOTE -These potentiometers are referred to as “forward” and “rearward” or “fore” and “aft” to describe their position on the neck mounting plate relative to the honeycomb. Regardless of which side of the neck is tested (left or right), the *inner* pot rod should **always** be attached to the pot housing assembly that is *farthest* from the honeycomb, referred to as the Aft/Inner Pot; the *outer* pot rod should **always** be attached to the pot housing assembly that is *nearest* to the honeycomb, referred to as the Fore/Outer Pot. It is important to assure that the potentiometers are in the correct locations in order to obtain the appropriate rotation measurements

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- __28 Repeat the same installation procedure for the potentiometer on the outer pot rod using the outer potentiometer pivot bracket. For the outer rod, be sure the pot bracket is installed in the outermost position (Figure 23).

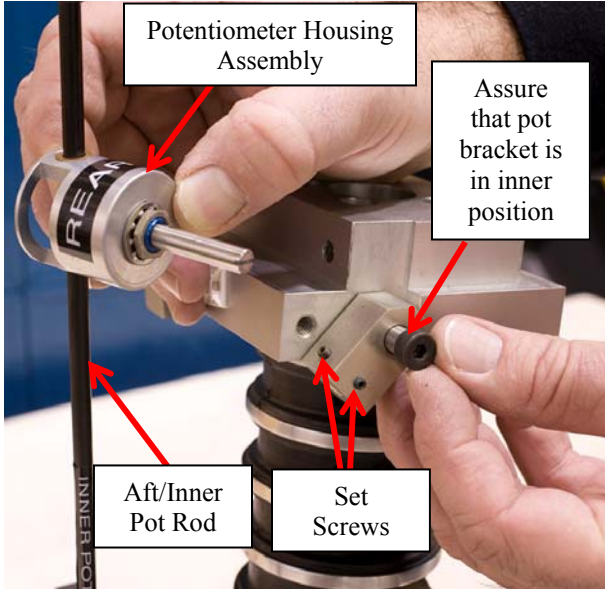


Figure 32. Install potentiometer on inner pot rod onto inner potentiometer pivot bracket



Figure 33. Tighten set screws for inner potentiometer pivot bracket

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

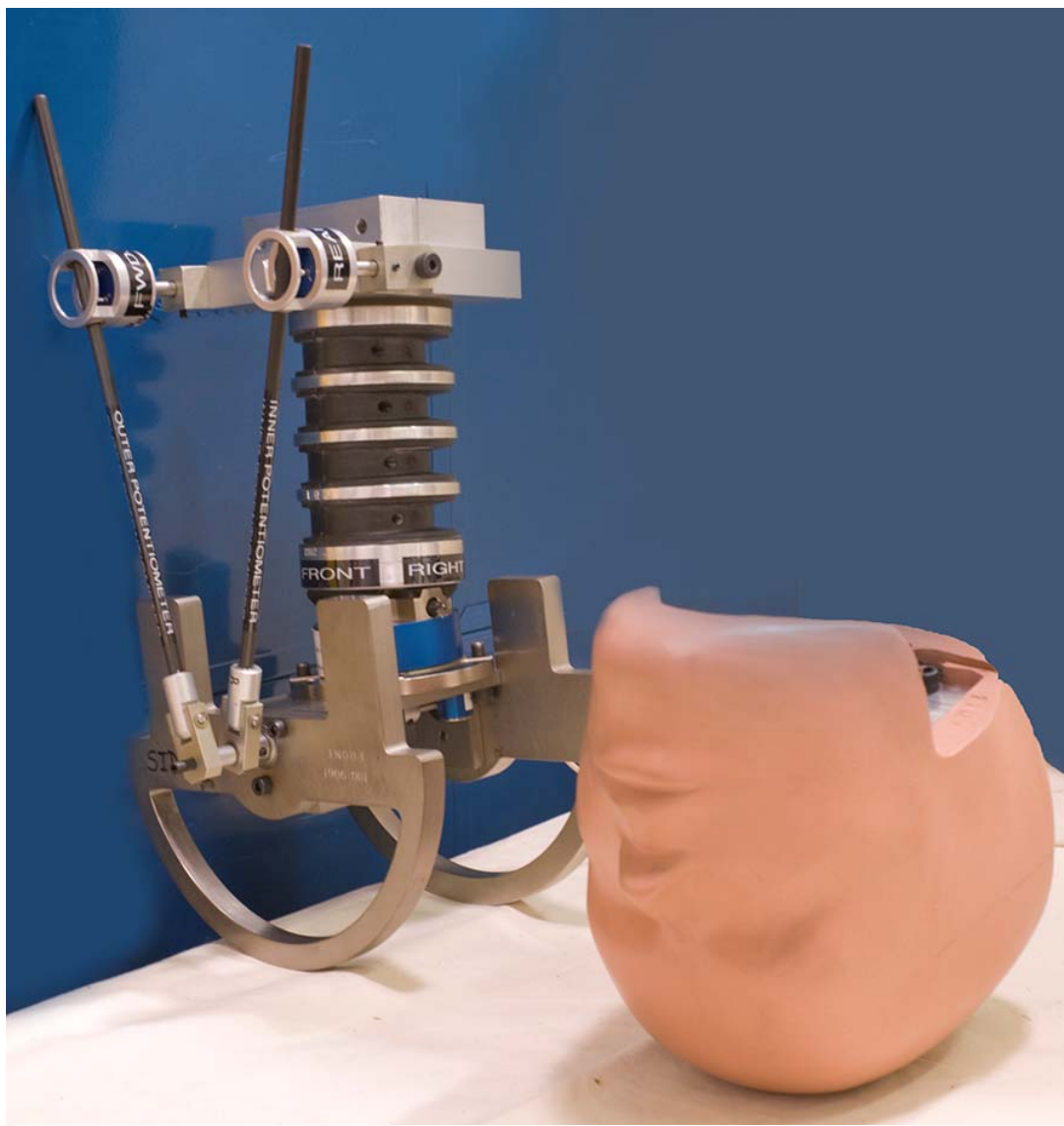


Figure 34. Final configuration of head form attached to neck with dummy head shown for orientation (head form is configured for left side impact)

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

- __29 Insert the neck mounting plate into the pendulum such that the impact side of the neck is closest to the honeycomb, screw and tighten with four 1/4-20 x 5/8 SHCS. Note that the CG of the head form is not in line with the centerline of the neck, causing the head form to "sag." Figure 35 shows a neck and head form installed for a left side impact. Figure 36 shows a schematic for the configuration viewed from above.

Note -The outermost pot, which is closest to the honeycomb, is used for obtaining $\Delta\Theta_{Outer}$ (Figure 39).

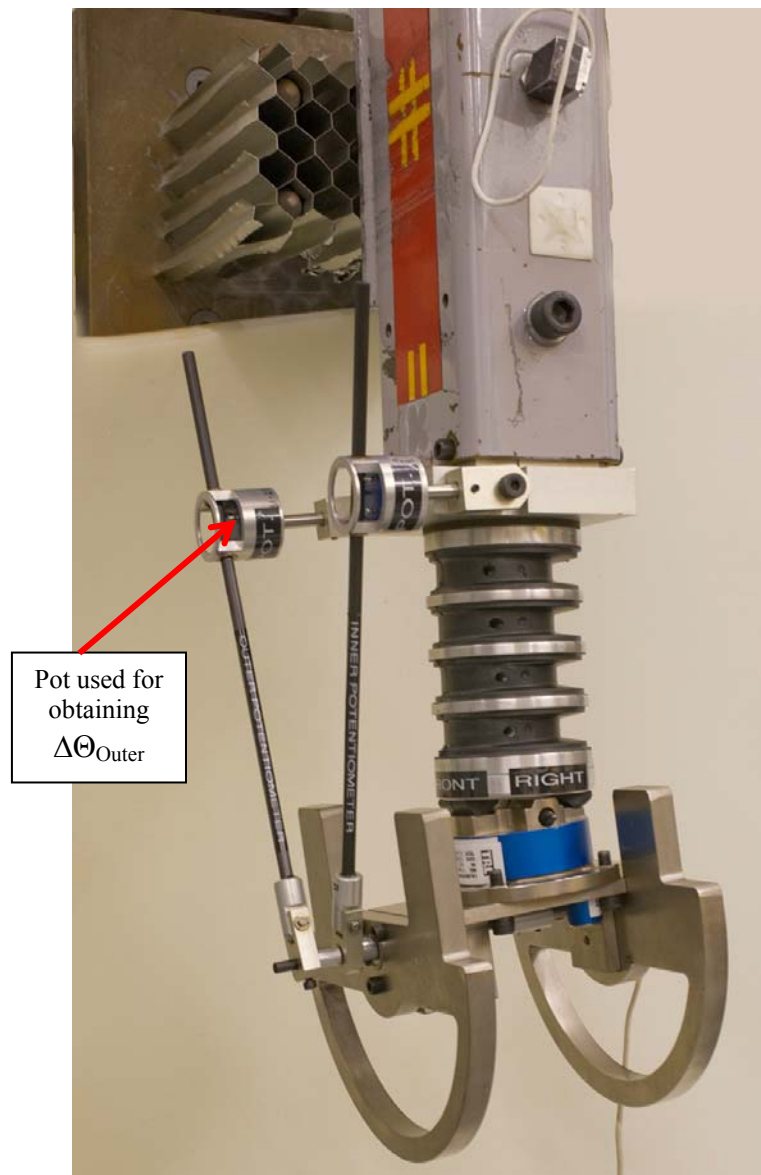


Figure 35. Pendulum configuration for a left side neck test

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

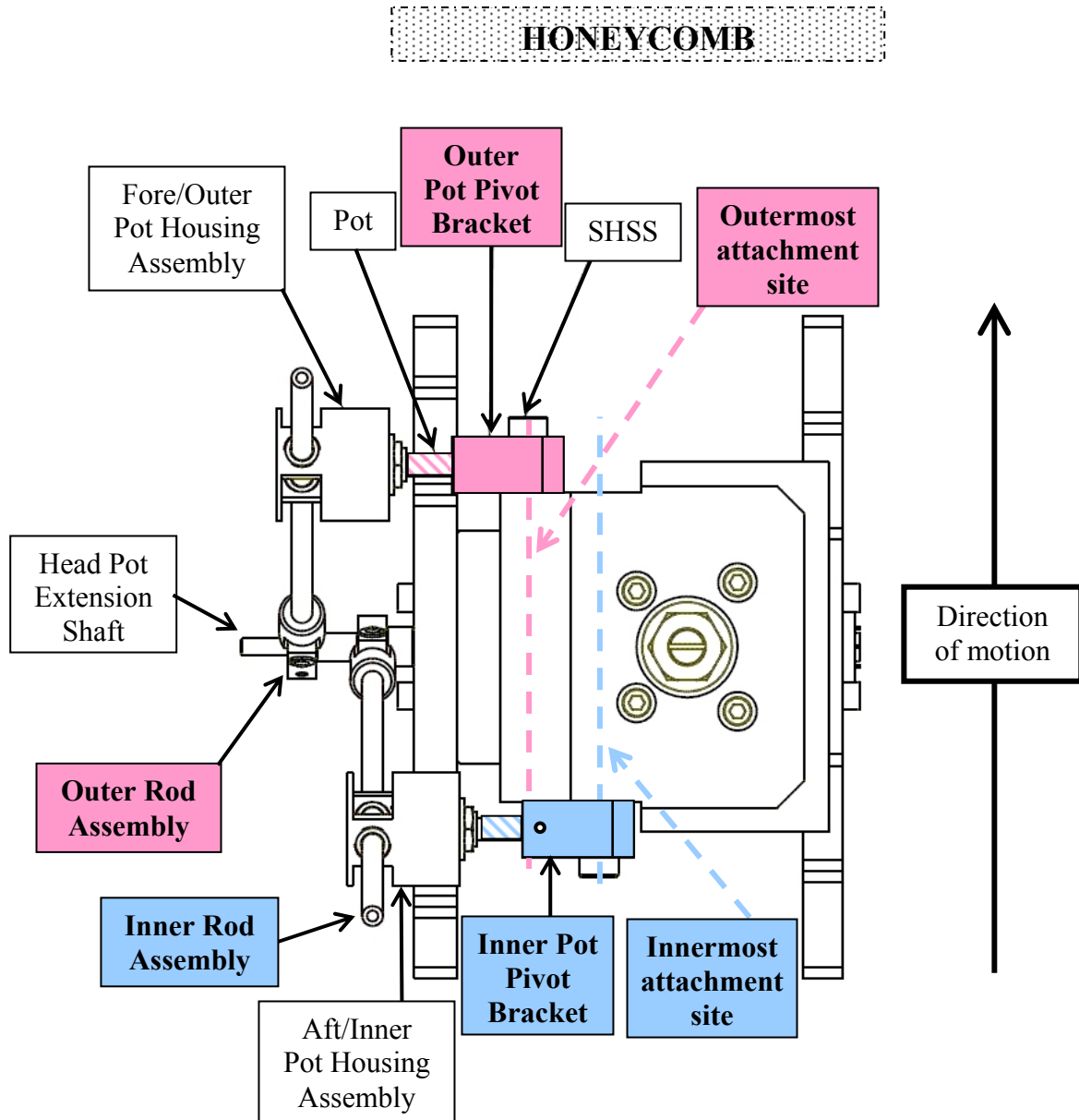


Figure 36. Attachment of inner and outer pot rod assemblies to neck mounting plate for left side impact (view from above)

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Opposite Side Test Preparation - To test the opposite side of the neck, follow these steps:

- 1 Remove the entire assembly from the pendulum, rotate it 180 degrees and reassemble the neck mounting plate to the pendulum.
- 2 Switch the position of the two potentiometer rod assemblies by removing the potentiometer pivot brackets at the neck mounting plate and securing the outer rod/pot pivot bracket to the outermost attachment site closest to the honeycomb (i.e., in the fore position) and the inner rod/pot pivot bracket to the innermost attachment site furthest from the honeycomb (i.e., in the aft position) (Figures 37 and 38). **When calculating the D-plane rotation, be sure that the potentiometers being used are in the appropriate locations during the test.**

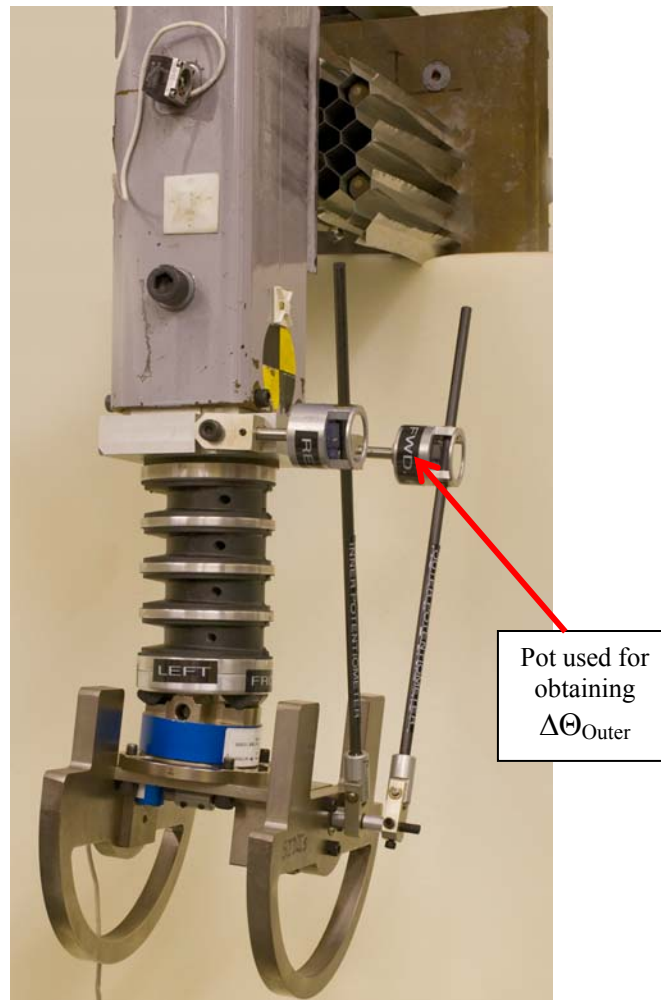


Figure 37 Pendulum configuration for a right side neck test

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

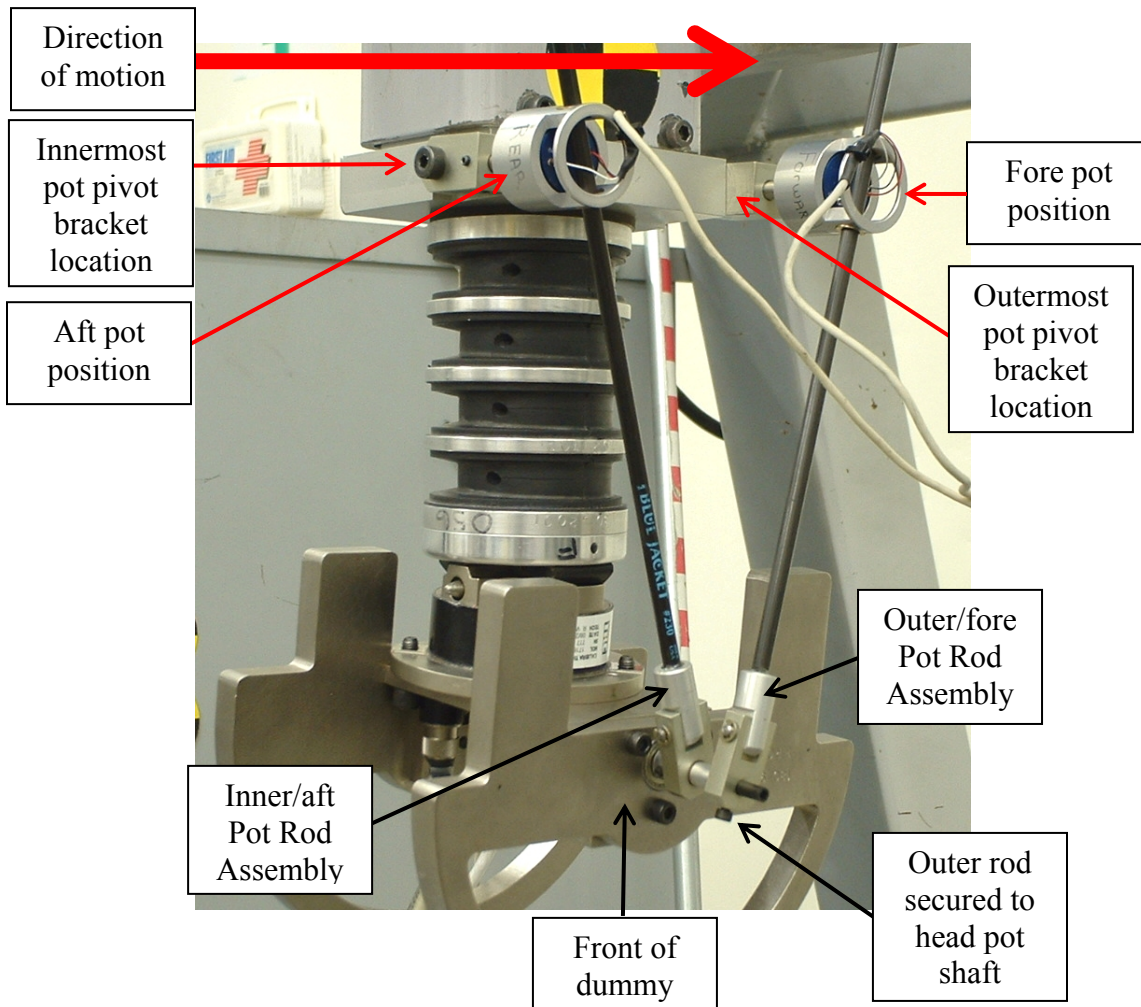


Figure 38. Correct outer and inner pot/rod assembly locations for a right-side test

Conduct the Test, Collect Data and Verify Performance

- ___1 Record the room temperature and relative humidity on the table. Verify that each measurement meets specifications by indicating "Pass" or "Fail" in the far right column.
- ___2 The neck pendulum should have a mass as specified in Figure 22, 49 CFR 572.33.
- ___3 Mount an accelerometer on the pendulum with its sensitive axis on the side of the pendulum that impacts the honeycomb at the location specified in Figure 22, 49 CFR 572.33.
- ___4 Raise the pendulum and allow it to fall freely such that it achieves an impact velocity of 5.51-5.63 m/s at the time of contact with the arresting block.
- ___5 The pendulum acceleration is filtered using a Channel Class 180 phaseless filter.
- ___6 The potentiometers are filtered using a Channel Class 60 phaseless filter.
- ___7 The neck lateral shear force is filtered using Channel Class 600 phaseless filter for the purpose of occipital condyle calculation.
- ___8 The neck moment about the x-axis is filtered using Channel Class 600 phaseless filter.
- ___9 Time zero is defined as the time of contact between the pendulum and the honeycomb. All channels should be at the zero level at this point.

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

__10 Calculate the moment about the occipital condyle for lateral flexion using the formula:
 $M_{x_{oc}} = M_x + (0.01778 * F_y)$

where $M_{x_{oc}}$ is the moment about the occipital condyle for lateral flexion in Newton-meters,

M_x is the moment about the x axis measured by the upper neck load cell in Newton-meters

and F_y is the lateral shear force measured by the upper neck load cell in Newtons.

__11 Calculate the D-plane rotation using the formula: (see Figure 39)

$$\beta_{D\text{-plane}} = \Delta\Theta_{\text{Head}} + \Delta\Theta_{\text{Outer}}$$

where $\Delta\Theta_{\text{Head}}$ and $\Delta\Theta_{\text{Outer}}$ are the deviations of the angles Θ_{Head} and Θ_{Outer}

__12 Determine the change in pendulum deceleration by integrating the pendulum acceleration beginning at time zero.

__13 Record the test parameters indicated in Table V3. Verify that the parameters meet specification by indicating "Pass" or "Fail" in the far right column.

__14 If the test results are not within specification, wait at least 30 minutes, conduct another test.

__15 Record and report the results of each additional test in a separate table.

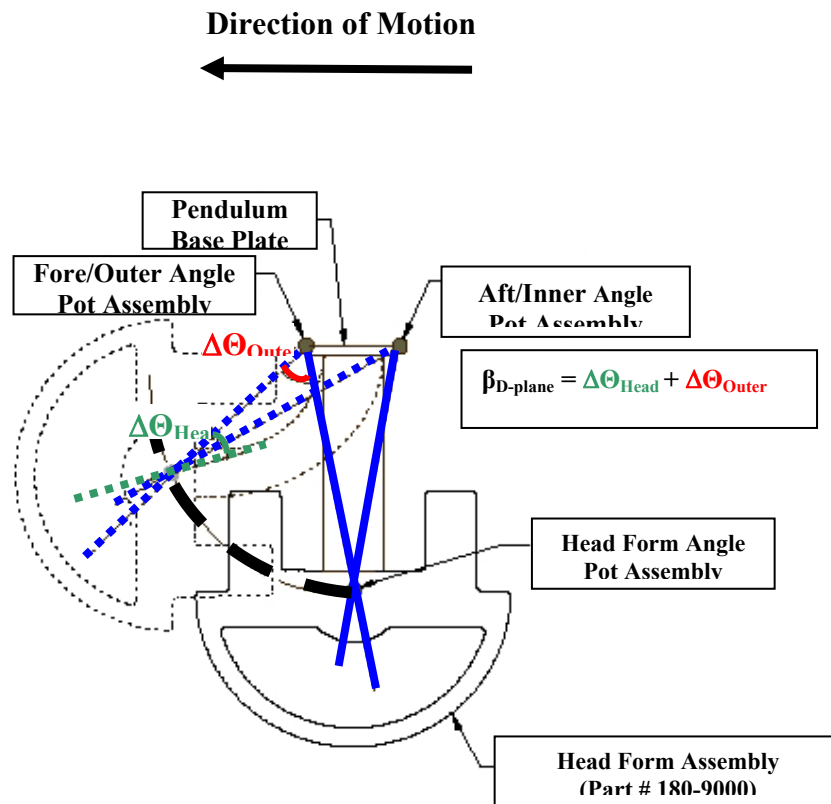


Figure 39. Angle measurements with the head form setup

CHECK SHEET NO. V3 (Continued)
NECK FLEXION TEST (S572.193)

Table V3. Neck Flexion Test

Tested Parameter		Units	Spec.	Result	Pass/ Fail
Neck Assembly Soak Time		Minutes	≥240		
Temperature – During Soak	Max	C°	20.6 to 22.2		
	Min				
Humidity – During Soak	Max	%	10.0 to 70.0		
	Min				
Temperature – During test		C°	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Pendulum Velocity		m/s	5.51 to 5.63		
Pendulum Deceleration	10 ms	G's	2.20 to 2.80		
	15 ms	G's	3.30 to 4.10		
	20 ms	G's	4.40 to 5.40		
	25 ms	G's	5.40 to 6.10		
	25-100 ms	G's	5.50 to 6.20		
Maximum D-plane rotation		deg	71 to 81		
Time of Maximum D-plane rotation		ms	50 to 70		
Peak Occ. Condyle Moment		Nm	-44 to -36		
Time of Moment Decay		ms	102 to 126		

Signature

Completion Date

CHECK SHEET NO. V4 SHOULDER IMPACT TEST (S572.194)

Dummy Serial No. _____
Technician _____

Test Date _____

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table V4 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V4. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Install the thoracic and abdominal pads using cable ties.
- ___3 Place the chest jacket on the dummy.
- ___4 Clothe the dummy with cotton underwear pants, cut off just above the knees, but no shirt or shoes.
- ___5 Ground the dummy using a cable between a metal component of the dummy and the ground.
- ___7 Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another.
- ___8 Place the bench (Figure 40) in the probe's impact area so that the dummy can be impacted in the shoulder.

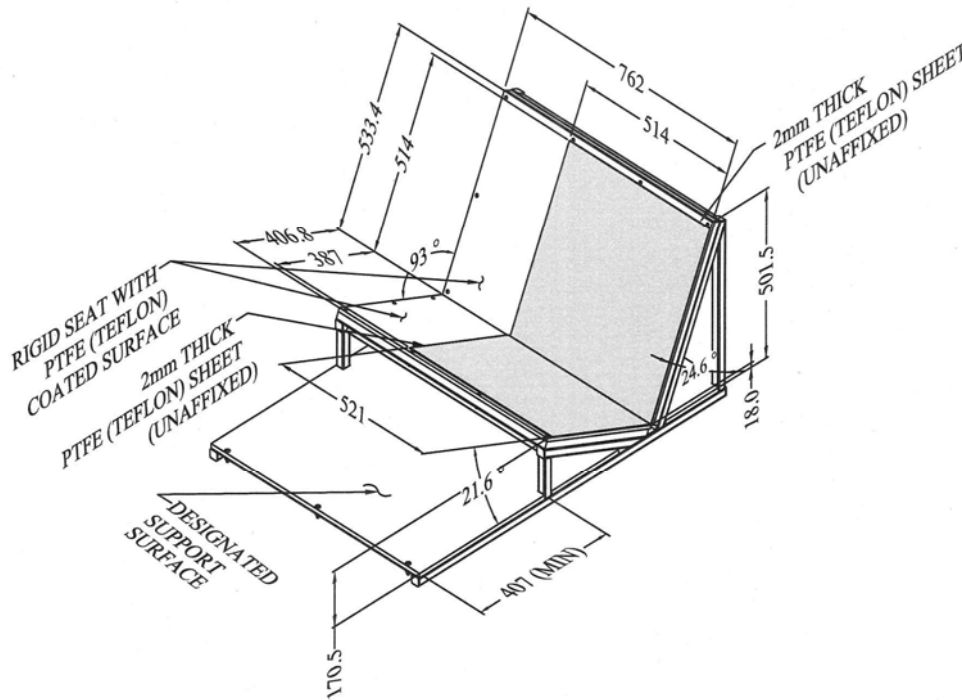


Figure 40. Certification bench seat specifications

- ___9 Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2-mm thick) on the bench. Position the dummy so that the outermost pelvic flesh is within 10 mm of the edge of the Teflon® sheet; the edge of the sheet must be along the impact side of the bench's seat pan (Figure 41).
- ___10 Place a sheet of 514 x 514 mm PTFE (Teflon®) (2-mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet must be along the impact side of the bench's seatback.

CHECK SHEET NO. V4 (Continued)
SHOULDER IMPACT TEST (S572.194)

- __11 Be sure that the molded arm assembly plug (drawing 180-6019) is completely inserted into the arm and secured to the arm bone with screws.
- __12 Position the arm so that it points forward at $90^\circ \pm 2^\circ$ relative to the inferior-superior orientation of the upper torso (spine box).

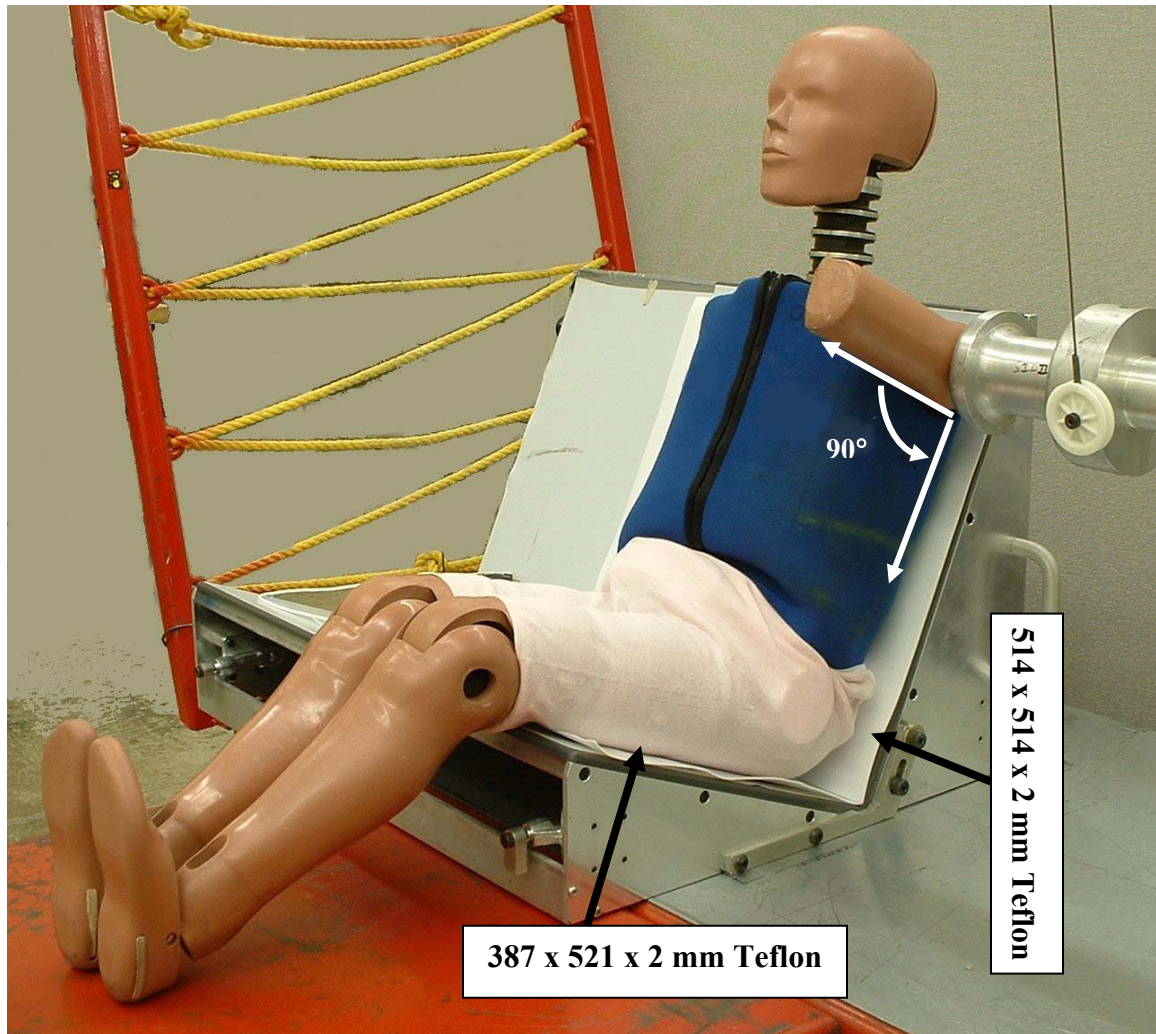


Figure 41. Shoulder impact test configuration for SID-IIIsD

- __13 Position the dummy so that the centerline of the arm bolt (ref. item 23 in drawing 180-3000) is centered on the centerline of the impact probe within 2 mm. The face of the impactor should be parallel to, and just touching, the surface of the molded arm assembly plug when the pendulum is at its lowest position during travel.
- __14 Push the dummy's chest towards the seatback, so that the back of the thorax is touching the seatback (Figure 42).

CHECK SHEET NO. V4 (Continued)
SHOULDER IMPACT TEST (S572.194)

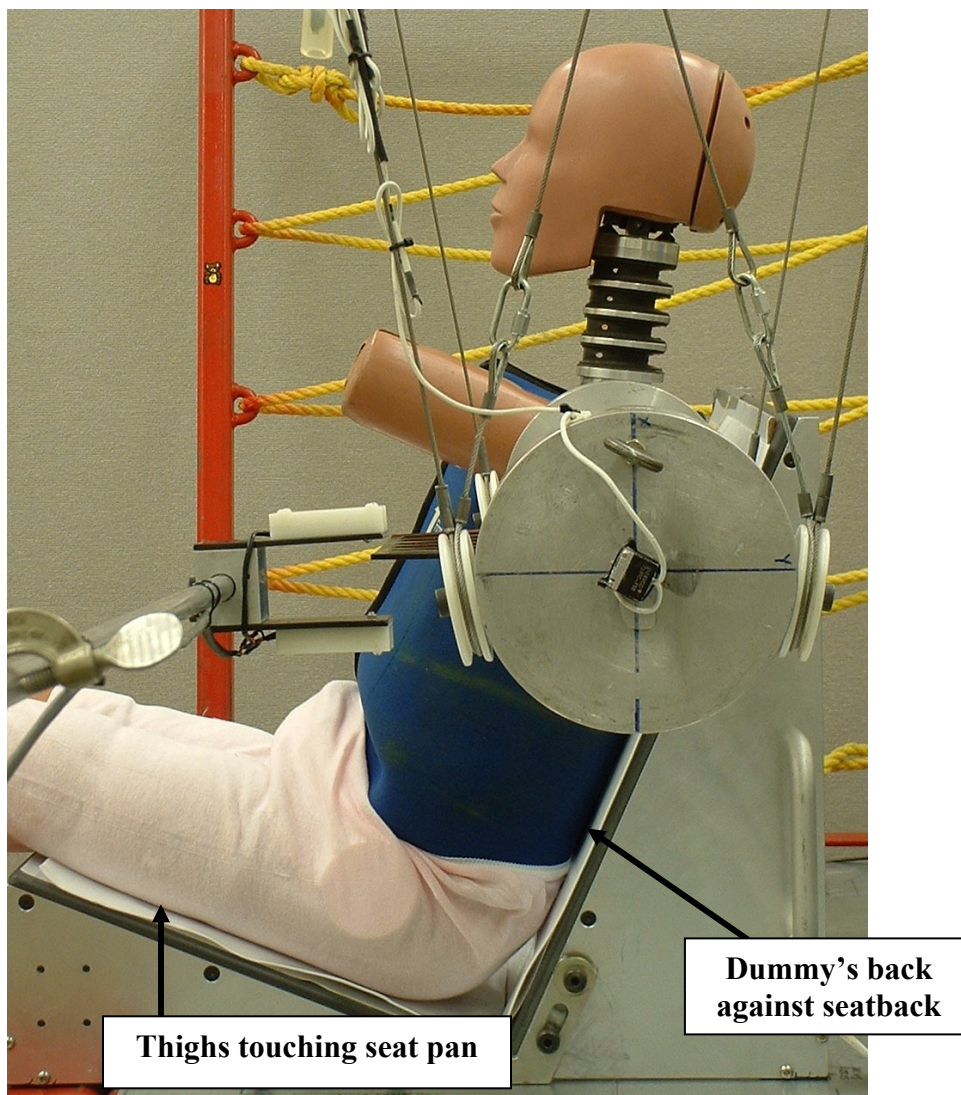


Figure 42. Impact probe and dummy seating position

CHECK SHEET NO. V4 (Continued)
SHOULDER IMPACT TEST (S572.194)

- __15 Push the femurs towards the seat pan so that the thighs are in contact with the seat.
- __16 Move the legs together so that the knees are as close together as possible (Figure 43).

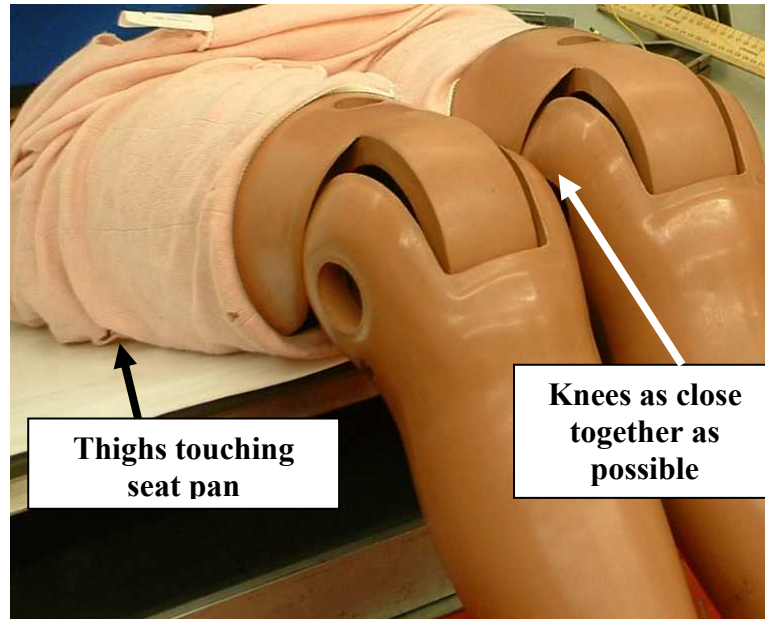


Figure 43. SID-IIIsD leg positioning

- __17 Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (Figure 44).

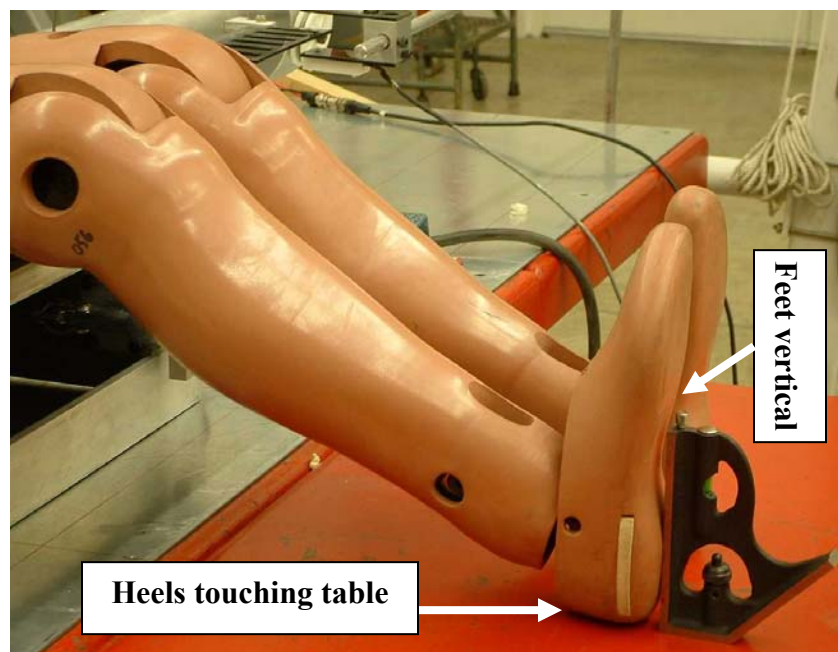


Figure 44. SID-IIIsD feet positioning

CHECK SHEET NO. V4 (Continued)
SHOULDER IMPACT TEST (S572.194)

- __18 Adjust the dummy so that the thoracic lateral plane is $0^\circ \pm 1$ relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 45).



Figure 45. Adjusting the SID-IIIsD dummy in the lateral direction

CHECK SHEET NO. V4 (Continued)
SHOULDER IMPACT TEST (S572.194)

- __19 Adjust the dummy so that the thoracic fore/aft plane measures $24.6 \pm 2^\circ$ relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 46).



Figure 46. Adjusting the SID-IIsD in the fore/aft plane

Conduct the Test, Collect Data and Verify Performance

- __20 Record the room temperature and humidity in Table V4. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- __21 The impactor should have a mass of $13.97 \pm 0.23 \text{ kg}^1$ with a $120.7 \pm 0.25 \text{ mm}$ face diameter, and a 12.7 mm radius.
- __22 Mount an accelerometer on the impactor with its sensitive axis in line with the longitudinal centerline of the test probe.
- __23 Release the impactor so that it achieves a velocity between 4.2 – 4.4 m/s at the instant of contact with the dummy.
- __24 At the instant of contact, the impactor should be horizontal $\pm 1^\circ$ with its centerline within 2 mm of the dummy’s arm rotation centerline (ref. item 23 in drawing 180-3000).

¹ Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

CHECK SHEET NO. V4 (Continued)
SHOULDER IMPACT TEST (S572.194)

- __25 The impactor and spine accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- __26 The shoulder deflection is collected and filtered using a Channel Class 600 phaseless filter.
- __27 Time zero is defined as the time of contact between the impactor probe and the shoulder. All channels should be at a zero level at this point.
- __28 Record impactor velocity, peak impactor acceleration, peak shoulder deflection and peak lateral spine acceleration in Table V4. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __29 If test results do not meet specifications, wait at least 30 minutes, conduct another test.
- __30 Record and report the results of each additional test in a separate table.

Table V4. Shoulder Impact Test

Tested Parameter		Units	Spec.	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥180		
Temperature – During Soak	Max	C°	20.6 to 22.2		
	Min				
Relative Humidity – During Soak	Max	%	10.0 to 70.0		
	Min				
Temperature – During test		C°	20.6 to 22.2		
Relative Humidity - During test		%	10.0 to 70.0		
Impactor Velocity		m/s	4.2 to 4.4		
Peak Shoulder Deflection		mm	28 to 37		
Peak Lateral Spine (T1) Acceleration (Y)		G's	17 to 22		
Peak Impactor Acceleration		G's	13 to 18		

Signature

Completion Date

CHECK SHEET NO. V5 THORAX WITH ARM IMPACT TEST (S572.195)

Dummy Serial No. _____

Test Date _____

Technician _____

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table V5 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V5. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column
- ___2 Install the thoracic and abdominal pads using cable ties².
- ___3 Place the chest jacket on the dummy.
- ___4 Place on the dummy's lower torso cotton underwear pants, cut off just above the knees, but no shirt or shoes.
- ___5 Ground the dummy using a cable between a metal component of the dummy and the ground.
- ___6 Align the upper and lower neck brackets of the load cell replacement so that the top edges are flush with one another. **DO NOT USE THE LOWER NECK LOAD CELL.** (Figure 47)

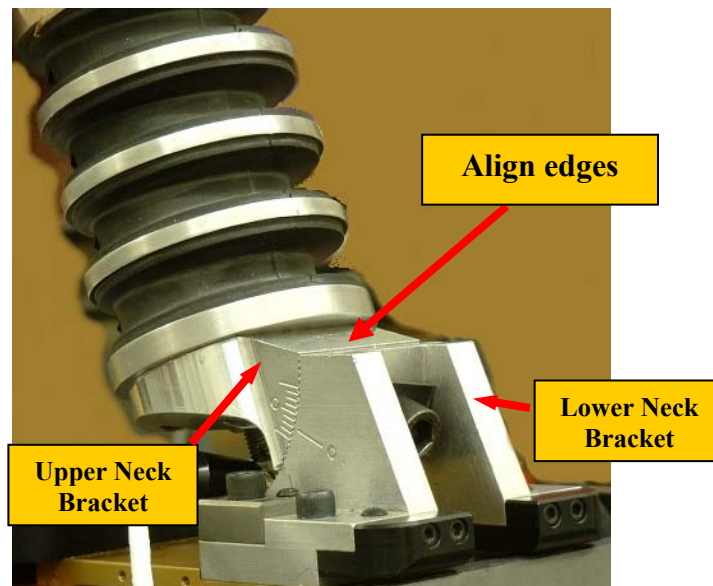


Figure 47. Aligning the upper and lower neck brackets flush for testing.

- ___7 Place the bench seat in the probe's impact area.
- ___8 Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2 mm thick) on the bench. Position the dummy within 25mm of the edge of the Teflon® sheet; the edge of the sheet should be along the impact side of the bench's seat pan.
- ___9 Place a sheet of 514 x 514 mm PTFE (Teflon®) (2 mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet should be along the impact side of the bench's seatback.
- ___10 Position the impact arm to its lowest detent, so that it points downward, parallel to the seatback.

² See Attachment of Thoracic and Abdominal Pads in the SID-IIsD.

CHECK SHEET NO. V5 (Continued)
THORAX WITH ARM IMPACT TEST (S572.195)

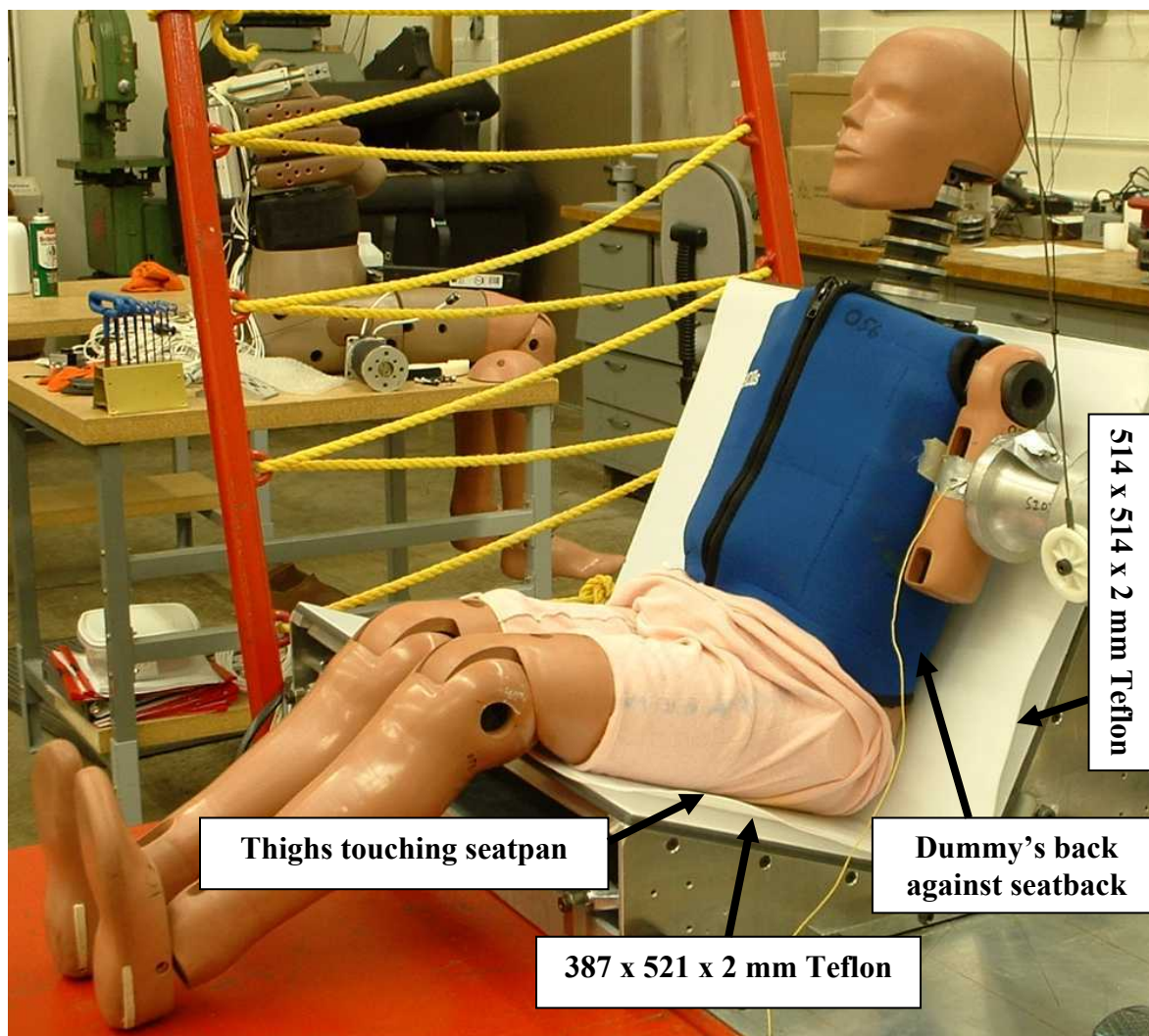


Figure 48. Thorax with arm impact test configuration for SID-IIIsD

CHECK SHEET NO. V5 (Continued)
THORAX WITH ARM IMPACT TEST (S572.195)

- __11 Position the dummy so that the centerline of impact probe is centered on the centerline of the middle rib within 2 mm. This corresponds to a reference measurement of 93 ± 2 mm below the centerline of the shoulder yoke assembly arm pivot when measured along the length of the arm. The face of the pendulum should be parallel to ($\pm 1^\circ$), and just touching, the surface of the arm, when the pendulum probe is at its lowest position during travel (Figure 49). (Once the dummy is adjusted in the lateral and fore/aft directions, the probe positioning with respect to the surface of the arm jacket will be complete).
- __12 Push the dummy's chest towards the seatback, so that the back of the thorax is touching the seat.

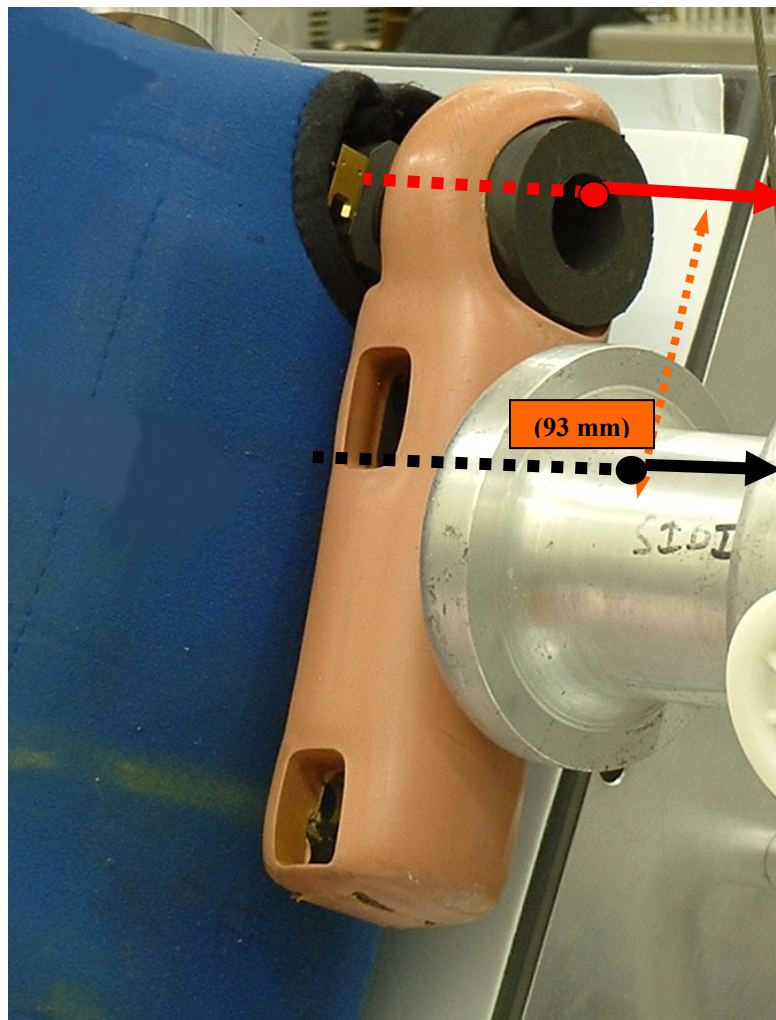


Figure 49. Impact probe position for the SID-IIIsD thorax with arm test

- __13 Push the femurs towards the seat pan so that the thighs make full contact with the seat.
- __14 Move the legs together so that the knees are touching (see Figure 43).
- __15 Position the feet so that they are vertical within 2° , with the heels touching the surface of the support table (see Figure 44).
- __16 Adjust the dummy so that the thoracic lateral plane is $0^\circ \pm 1$ relative to horizontal as referenced at the top surface of the lower neck bracket (see Figure 45).

CHECK SHEET NO. V5 (Continued)
THORAX WITH ARM IMPACT TEST (S572.195)

- __17 Adjust the dummy so that the thoracic fore/aft plane measures $24.6 \pm 2^\circ$ relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 46).

Conduct the Test, Collect Data and Verify Performance

- __18 Record the room temperature and humidity in Table V5. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column
- __19 The impactor shall have a mass of $13.97 \pm 0.23 \text{ kg}^3$ with a $120.7 \pm 0.25 \text{ mm}$ face diameter, and a 12.7 mm radius.
- __20 Mount an accelerometer on the impactor with its sensitive axis in line with the longitudinal centerline of the impactor.
- __21 Release the impactor so that it achieves a velocity 6.6 – 6.8 m/s at the instant of contact with the dummy.
- __22 At the instant of contact, the impactor should be horizontal $\pm 1^\circ$, and the centerline of the probe should be within 2 mm of the centerline of the middle rib.
- __23 The data acquisition system conforms to SAE Recommended Practice J211.
- __24 Collect the impactor and spine accelerations and filter data using a Channel Class 180 phaseless filter.
- __25 Collect shoulder and thoracic deflections and filter using a Channel Class 600 phaseless filter.
- __26 Time zero is defined as the time of contact between the impactor and the arm. All channels should be at a zero level at this point.
- __27 Record the peak impactor acceleration, peak rib deflections and peak spine accelerations in Table V5. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __28 If test results do not meet specifications, wait at least 30 minutes, conduct another test.
- __29 Record and report the results of each additional test in a separate table.

³ Mass includes impactor mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

CHECK SHEET NO. V5 (Continued)
THORAX WITH ARM IMPACT TEST (S572.195)

Table V5. Thorax with Arm Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥180		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Relative Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Relative Humidity – During test		%	10.0 to 70.0		
Impactor Velocity		m/s	6.6 to 6.8		
Peak Shoulder Deflection		Mm	31 to 40		
Peak Upper Rib Deflection		Mm	25 to 32		
Peak Middle Rib Deflection		Mm	30 to 36		
Peak Lower Rib Deflection		Mm	32 to 38		
Peak Upr Spine (T1) Acceleration (Y)		G's	34 to 43		
Peak Lower Spine (T12) Accel (Y)		G's	29 to 37		
Peak Impactor Acceleration		G's	30 to 36		

Signature

Completion Date

CHECK SHEET NO. V6
THORAX WITHOUT ARM IMPACT TEST (S572.196)

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table V6 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V6. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Remove the arm on the impact side.
- ___3 Install the thoracic and abdominal pads using cable ties⁴.
- ___4 Place the chest jacket on the dummy.
- ___5 The dummy should wear cotton underwear pants, cut off just above the knees, but no shirt or shoes.
- ___6 Ground the dummy using a cable between a metal component of the dummy and the ground.
- ___7 Align the upper and lower neck brackets so that the top edges are flush.
- ___8 Place the bench in the pendulum's impact area so that the dummy can be impacted in the thorax.
- ___9 Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2 mm thick) on the bench. Position the dummy within 25mm of the edge of the Teflon® sheet; the edge of the sheet should be along the impact side of the bench's seat pan (Figure 50).
- ___10 Place a sheet of 514 x 514 mm PTFE (Teflon®) (2 mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet should be along the impact side of the bench's seatback.
- ___11 Position the dummy so that the centerline of impact probe is vertically centered on the centerline of the middle thoracic rib within 2 mm. This corresponds to a reference measurement of 93 ± 2 mm below the centerline of the shoulder yoke assembly arm pivot when measured along a line parallel to the seatback (Figure 51). The center point of the impactor face is aligned horizontally with a line parallel to the seatback incline passing through the center of the shoulder yoke assembly arm pivot. The face of the impactor should be approximately parallel to, and just touching, the surface of the thorax, when the pendulum is at its lowest position during travel. Once the dummy is adjusted in the lateral and fore/aft directions, the impactor positioning with respect to the surface of the thorax jacket will be complete.

⁴ See Attachment of Thoracic and Abdominal Pads in the SID-IIsD.

CHECK SHEET NO. V6 (Continued)
THORAX WITHOUT ARM IMPACT TEST (S572.196)

- _12 Push the dummy's chest towards the seatback, so that the back of the thorax is touching the seat.

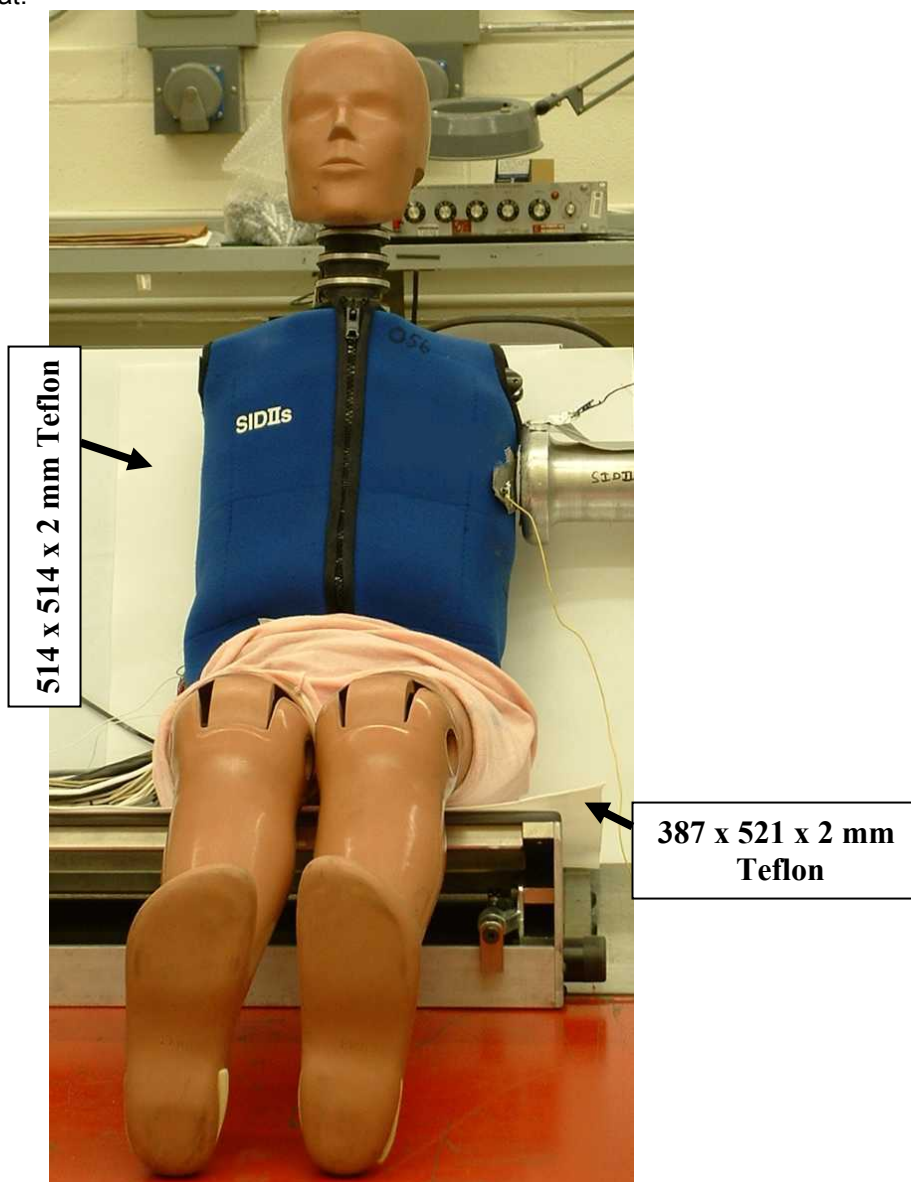


Figure 50. Thorax without arm impact test configuration for SID-IIIsD

CHECK SHEET NO. V6 (Continued)
THORAX WITHOUT ARM IMPACT TEST (S572.196)

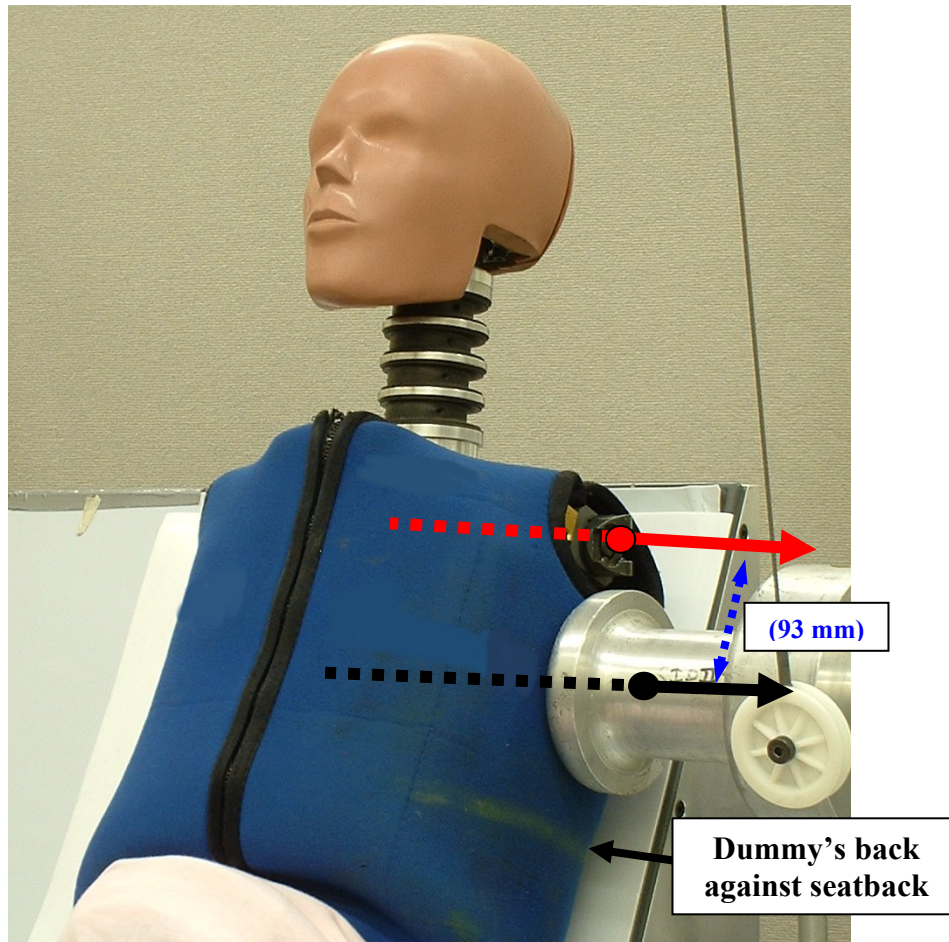


Figure 51. Impactor position for the SID-IIIsD thorax without arm test

- __13 Move the legs together so that the knees are touching (see Figure 43).
- __14 Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (see Figure 44).
- __15 Adjust the dummy so that the thoracic lateral plane is $0^\circ \pm 1^\circ$ relative to horizontal (see Figure 45).
- __16 Adjust the dummy so that the thoracic fore/aft plane measures $24.6 \pm 2^\circ$ relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (see Figure 46). Once this positioning is complete, the face of the impactor should be approximately parallel to ($\pm 1^\circ$), and just touching, the surface of the thorax, when the pendulum is at its lowest position during travel.

Conduct the Test, Collect Data and Verify Performance

- __17 Record the room temperature and humidity in Table V6. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column
- __18 The impactor shall have a mass of 13.97 ± 0.23 kg with a 120.7 mm face diameter, and a 12.7 mm radius.
- __19 Mount an accelerometer on the impactor with its sensitive axis in line with the longitudinal centerline of the test probe.
- __20 Release the impactor at an impact speed between 4.2 - 4.4 m/s at the instant of contact with the dummy.
- __21 The data acquisition system should conform to SAE Recommended Practice J211.

CHECK SHEET NO. V6 (Continued)
THORAX WITHOUT ARM IMPACT TEST (S572.196)

- __22 The impactor and spine accelerations are collected and filtered using a Channel lass 180 phaseless filter.
- __23 The rib deflections are collected and filtered using a Channel Class 600 phaseless filter.
- __24 Time zero is defined as the time of contact between the impactor and the thorax. All channels should be at a zero level at this point.
- __25 Record the peak impactor acceleration, peak rib deflections and peak spine accelerations in Table V6. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __26 If test results do not meet specifications, wait at least 30 minutes, conduct another test.
- __27 Record and report the results of each additional test in a separate table.

Table V6. Thorax without Arm Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥180		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Relative Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Relative Humidity – During test		%	10.0 to 70.0		
Impactor Velocity		m/s	4.2 to 4.4		
Peak Upper Rib Deflection		mm	32 to 40		
Peak Middle Rib Deflection		mm	39 to 45		
Peak Lower Rib Deflection		mm	35 to 43		
Peak Upr Spine (T1) Acceleration (Y)		G's	13 to 17		
Peak Lower Spine (T12) Accel (Y)		G's	7 to 11		
Peak Impactor Acceleration		G's	14 to 18		

Signature

Completion Date

CHECK SHEET NO. V7
ABDOMEN IMPACT TEST (S572.197)

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table V7 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V7. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Remove the arm on the impact side.
- ___3 Install the thoracic and abdominal pads using cable ties⁵.
- ___4 Place the chest jacket on the dummy.
- ___5 The dummy should wear cotton underwear pants, cut off just above the knees, for this procedure. No shirt or shoes should be worn.
- ___6 Ground the dummy using a cable between a metal component of the dummy and the ground.
- ___7 Align the upper and lower neck brackets so that the top edges are flush.
- ___8 Place the bench in the pendulum's impact area so that the dummy can be impacted in the abdomen.
- ___9 Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2 mm thick) on the bench. Position the dummy within 25mm of the edge of the Teflon® sheet; the edge of the sheet should be along the impact side of the bench's seat pan.
- ___10 Place a sheet of 514 x 514 mm PTFE (Teflon®) (2 mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet should be along the impact side of the bench's seatback

⁵ See Attachment of Thoracic and Abdominal Pads in the SID-IIsD.

CHECK SHEET NO. V7 (Continued)
ABDOMEN IMPACT TEST (S572.197)

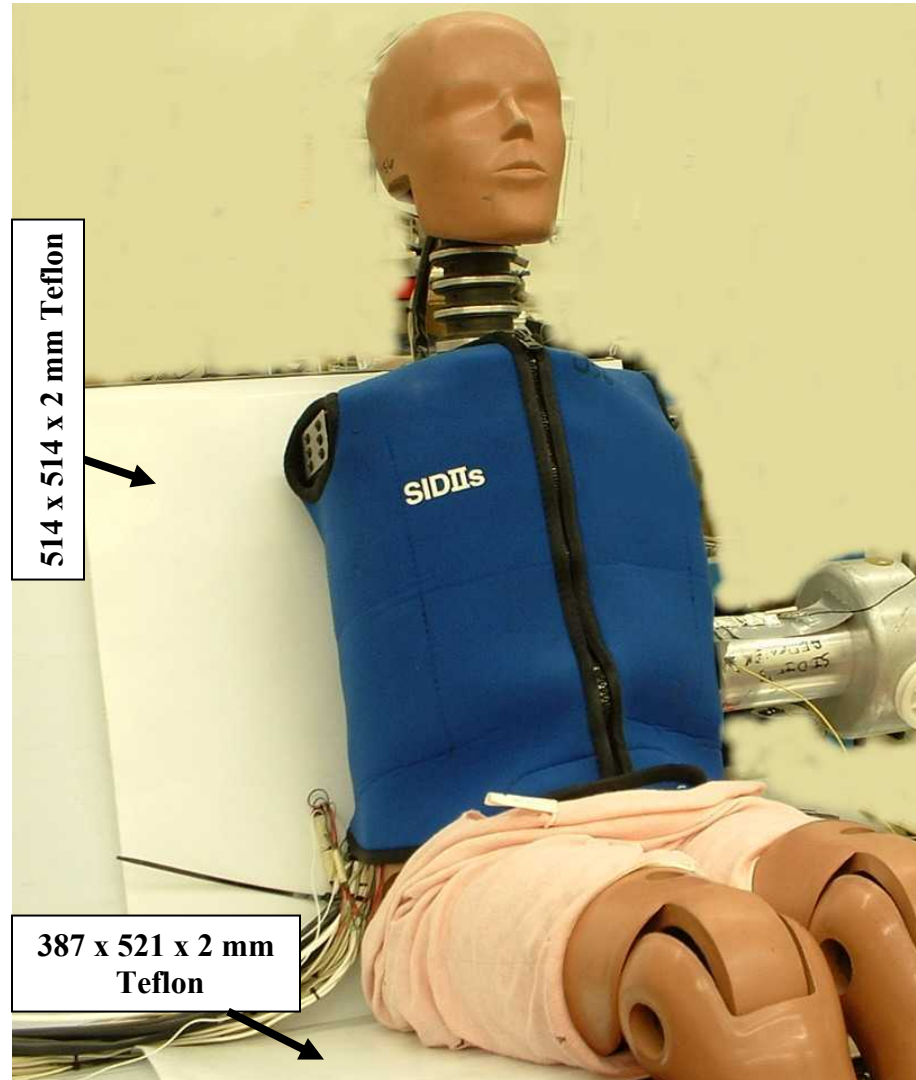


Figure 52. Abdomen impact test configuration for SID-IIIsD

- __11 Position the dummy so that the centerline of impact probe is centered vertically on the midpoint between the two abdominal ribs within 2 mm. This corresponds to a reference measurement of 208 ± 2 mm below the centerline of the shoulder yoke assembly arm pivot when measured along a line parallel to the seatback (Figure 52). The center point of the impactor face is aligned horizontally with a line parallel to the seatback incline passing through the center of the shoulder yoke assembly arm rotation pivot. The face of the probe should be approximately parallel to, and just touching, the surface of the abdomen, when the pendulum probe is at its lowest position during travel. (Once the dummy is adjusted in the lateral and fore/aft directions, the probe positioning with respect to the surface of the jacket at the abdomen will be complete).

CHECK SHEET NO. V7 (Continued)
ABDOMEN IMPACT TEST (S572.197)

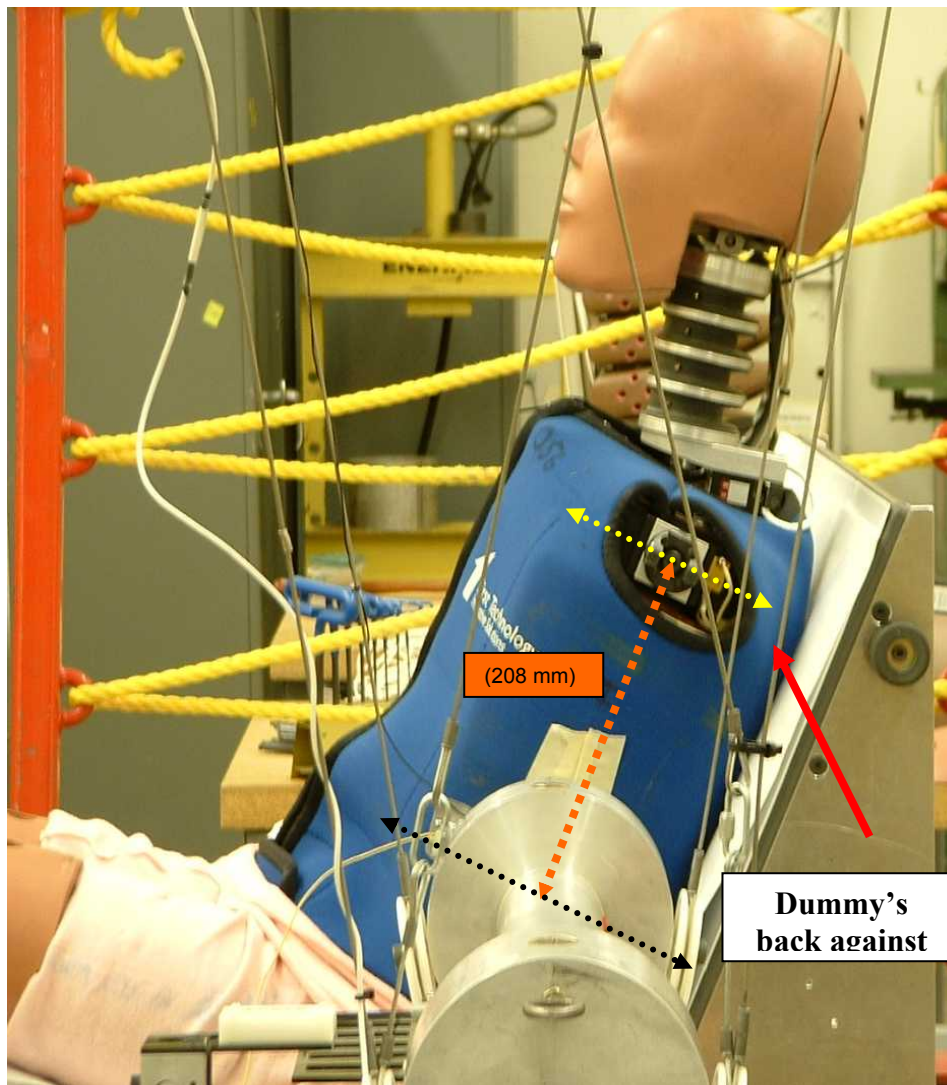


Figure 53. Impact probe position for the SID-II sD abdomen

- __12 Push the dummy's chest towards the seatback, so that the back of the thorax is touching the seat (Figure 53).
- __13 Push the femurs towards the seat pan so that the thighs are in contact with the seat.
- __14 Move the legs together so that the knees are touching (see Figure 43).
- __15 Position the feet so that they are vertical within 2° , with the heels touching the surface of the support table (see Figure 44).
- __16 Adjust the dummy so that the thoracic lateral plane is $0^\circ \pm 1$ relative to horizontal (see Figure 45).
- __17 Adjust the dummy so that the thoracic fore/aft plane measures $24.6 \pm 2^\circ$ relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (see Figure 46).

CHECK SHEET NO. V7 (Continued)
ABDOMEN IMPACT TEST (S572.196)

Conduct Test, Collect Data and Verify Performance

- __1 Record the room temperature and humidity in Table V7. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column
- __2 The impactor shall have a mass of 13.97 ± 0.23 kg⁶ with a 76.2 mm face⁷ and a 12.7 mm radius.
- __3 Mount an accelerometer on the impactor with its sensitive axis in line with the longitudinal centerline of the impactor.
- __4 Release the impactor at an impact speed between 4.2 - 4.4 m/s.
- __5 At the instant of contact, the impactor shall be horizontal $\pm 1^\circ$ and the centerline of the impactor shall be within 2 mm of the centerline of the abdominal ribs.
- __6 The data acquisition system should conform to SAE Recommended Practice J211.
- __7 The impactor and spine accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- __8 The abdominal rib deflections are collected and filtered using a Channel Class 600 phaseless filter.
- __9 Time zero is defined as the time of contact between the impact probe and the abdomen. All channels should be at a zero level at this point.
- __10 Record the peak impactor acceleration, peak abdominal rib deflections and peak lower spine acceleration in Table V7. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __11 If test results do not meet specification, wait at least 30 minutes, conduct another test.
- __12 Record and report the test results of each additional test in a separate table.

Table V7. Abdomen Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥ 180		
Temperature - During Soak	Max	$^\circ\text{C}$	20.6 to 22.2		
	Min	$^\circ\text{C}$			
Relative Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		$^\circ\text{C}$	20.6 to 22.2		
Relative Humidity – During test		%	10.0 to 70.0		
Impactor Velocity		m/s	4.2 to 4.4		
Peak Upr Abdominal Rib Deflection		mm	36 to 47		
Peak Lwr Abdominal Rib Deflection		mm	33 to 44		
Peak Lower Spine (T12) Accel (Y)		G's	9 to 14		
Peak Impactor Acceleration		G's	12 to 16		

 Signature

 Completion Date

⁶ Mass includes impactor mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

⁷ Note that this impactor face differs from impactor faces used in the other certification tests.

CHECK SHEET NO. V8 PELVIS PLUG QUASI-STATIC TEST

Dummy Serial No. _____

Test Date _____

Technician _____

- __1 Clean the contact surfaces of the compression device.
- __2 Assure that the compression head surface and support surfaces are parallel.
- __3 Place the pelvis plug on the support surface and center it under the compression head surface, assuring that the top and bottom of the plug are in full contact with the surfaces.
- __4 Select a maximum displacement value within the corridors indicated in Figures 55 & 56 as a halting point for the compression head.
- __5 Configure the compression system to halt (and return) at the specified displacement.

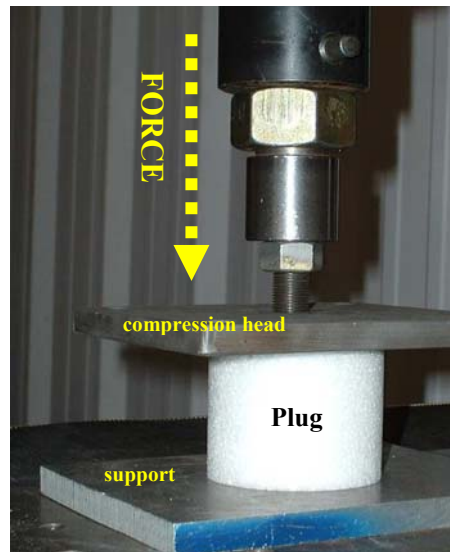


Figure 54. Pelvis plug quasi-static test

- __6 Record the room temperature and humidity in Table V8. Verify that the temperature and relative humidity meets specification by indicating "Pass" or "Fail" in the far right column.
- __7 Record the serial number of the plug in Table V8.
- __8 The force and displacement measurements are collected at a minimum sample rate of 20Hz.
- __9 Pre-load the pelvis plug to 2.27kg (5lb) and zero both the force and displacement measurement channels. Time zero is defined at this point and all channels should be at a zero level.
- __10 With the channels at zero level, compress the plug at a quasi-static rate, nominally 12.7mm/min (0.5"/min), but no greater than 50.8mm/min (2"/min).
- __11 Stop and reverse the compression head when the displacement reaches the preselected value (see pretest setup – step 6).
- __12 Plot force (N) versus displacement (mm). Plot displacement (mm) versus time (ms).
- __13 Record the maximum force achieved at maximum displacement in Table V8. Verify that the measurements meet specification by indicating "Pass" or "Fail" in the far right column.
- __14 Wait at least 4 hours before utilizing the pelvis plug in any certification test or full-scale dummy test.

CHECK SHEET NO. V8 (Continued)
PELVIS PLUG QUASI-STATIC TEST

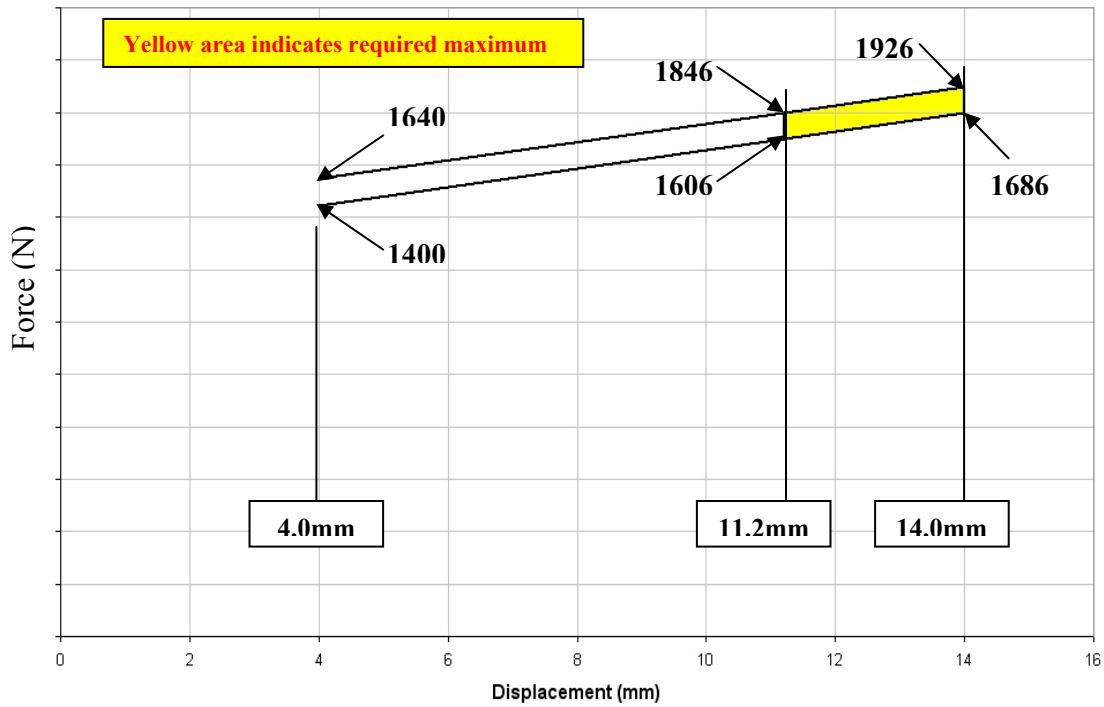


Figure 55. Corridor for pelvis plug certification test

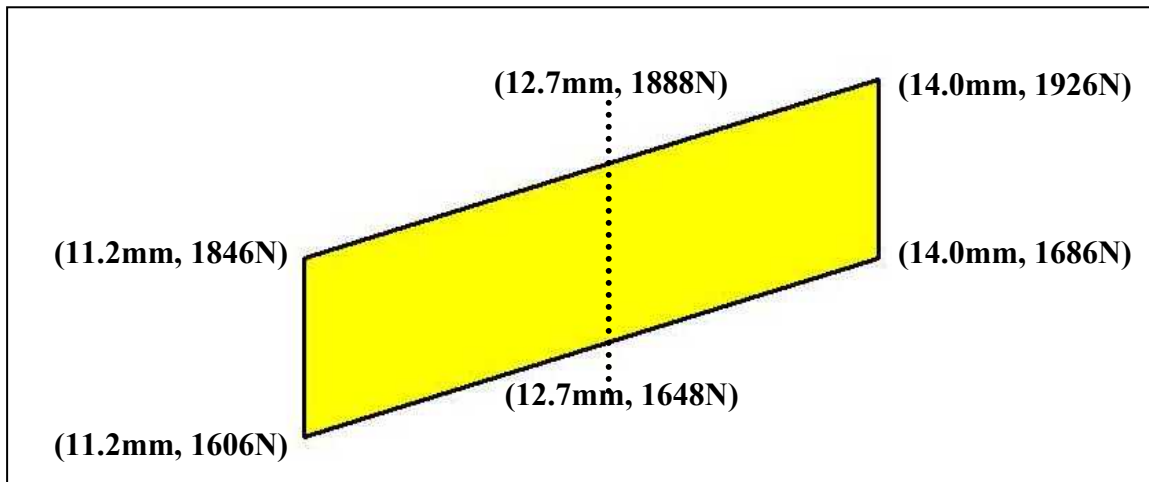


Figure 56. Maximum force and displacement corridors for pelvis plug certification test

Table V8. Pelvis Plug Quasi-Static Test

Tested Parameter	Units	Spec.	Result	Pass/ Fail
Laboratory Temperature	C°	20.6 to 22.2		
Laboratory Relative Humidity	%	10.0 to 70.0		
Maximum Displacement	mm	11.2 to 14.0		
Maximum Force	N	1606 to 1926		
Pelvis Plug Serial No.				

CHECK SHEET NO. V9
PELVIS ACETABULUM IMPACT TEST (572.198)

Pretest Preparation

- __1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table V9 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V2. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- __2 Remove the chest jacket from the dummy.
- __3 Be sure the thoracic and abdominal pads are installed using cable ties⁸.
- __4 Install a certified pelvis plug (see *Pelvis Plug Quasi-Static Test*)
- __5 Position the arm on the impact side downwards (lowest detent) and parallel to the seatback.
- __6 The dummy should not wear clothing or shoes for this procedure.
- __7 Ground the dummy using a cable between a metal component of the dummy and the ground.
- __8 Align the upper and lower neck brackets so that the top edges are flush.
- __9 Place the bench in the pendulum's impact area so that the dummy can be impacted in the pelvis.
- __10 Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2 mm thick) on the bench. Position the dummy within 25mm of the edge of the Teflon® sheet; the edge of the sheet should be along the impact side of the bench's seat pan.
- __11 Place a sheet of 514 x 514 mm PTFE (Teflon®) (2 mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet should be along the impact side of the bench's seatback (Figure 57).

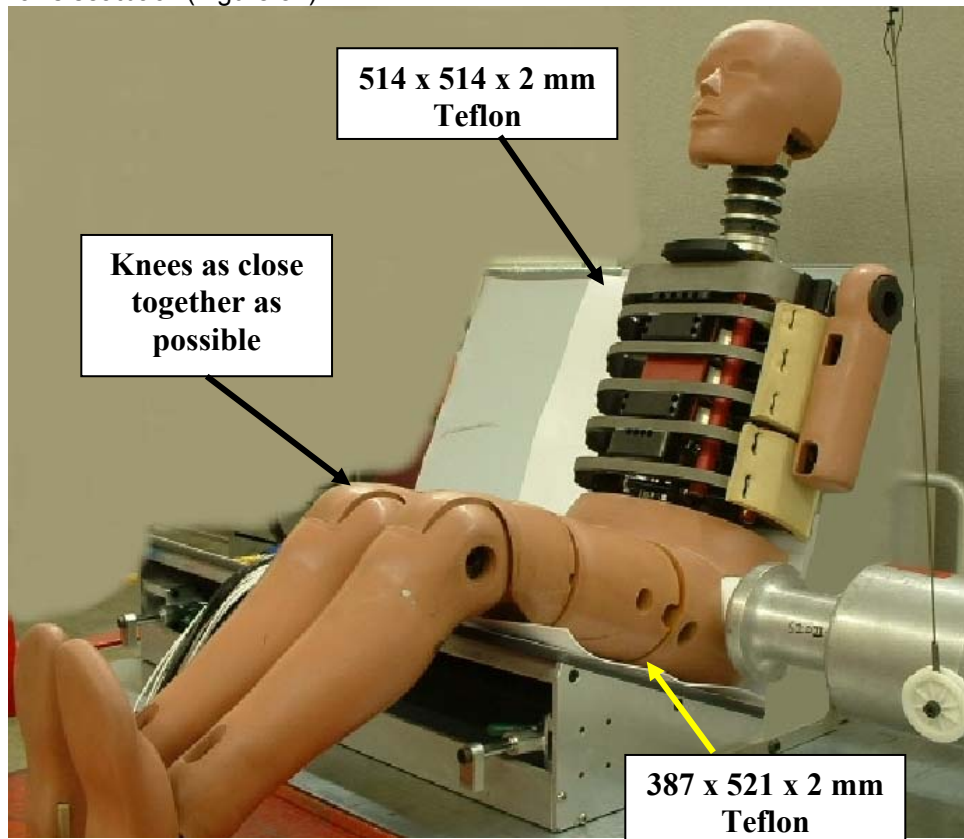


Figure 57. Acetabulum test for SID-IIIsD

⁸ See Attachment of Thoracic and Abdominal Pads in the SID-IIIsD

PELVIS ACETABULUM IMPACT TEST (572.198)

- _11 Position the dummy so that the centerline of impact probe is centered on the centerline of the pelvis plug within 2 mm. The face of the pendulum should be parallel to ($\pm 1^\circ$), and just touching, the surface of the pelvis plug, when the pendulum probe is at its lowest position during travel (Figure 58).

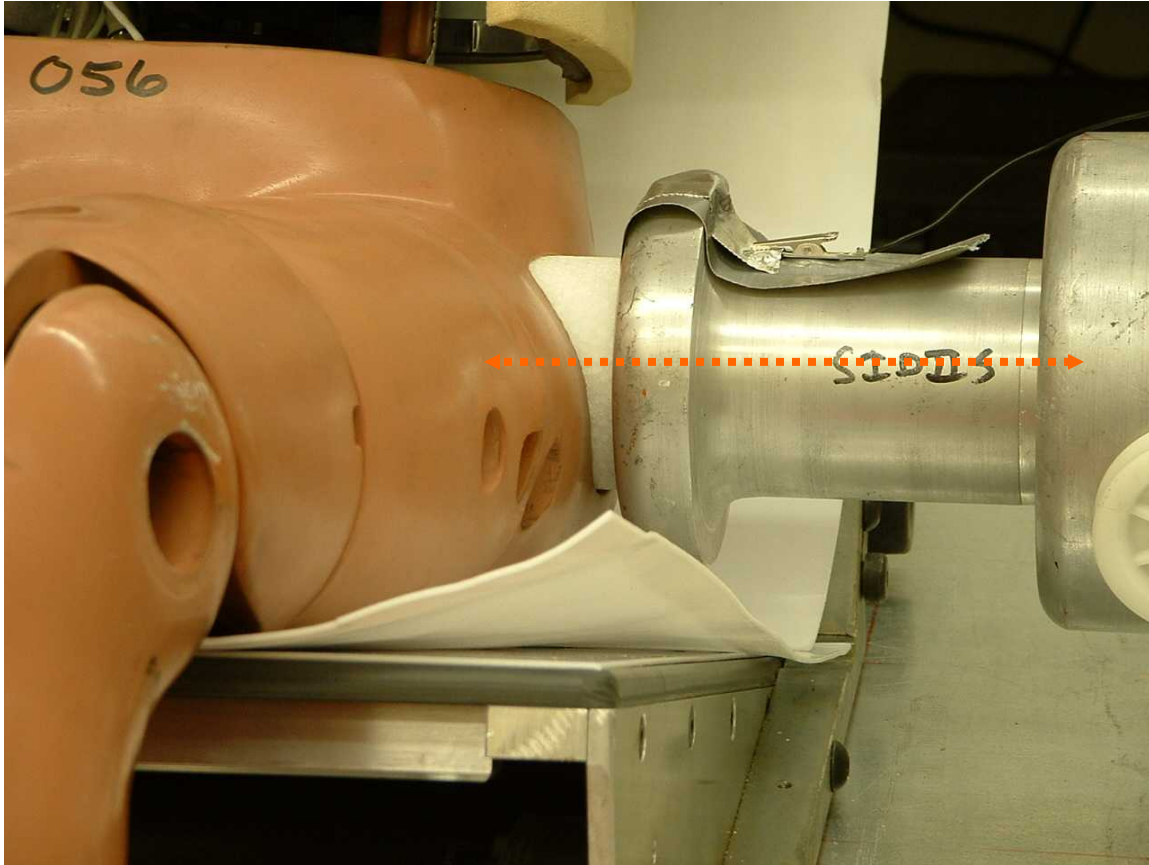


Figure 58. Impact probe position for the SID-IIIsD pelvis certification test

CHECK SHEET NO. V9 (Continued)
PELVIS ACETABULUM IMPACT TEST (572.198)

- __12 Push the dummy's chest towards the seatback, so that the back of the thorax is touching the seat (Figure 59).

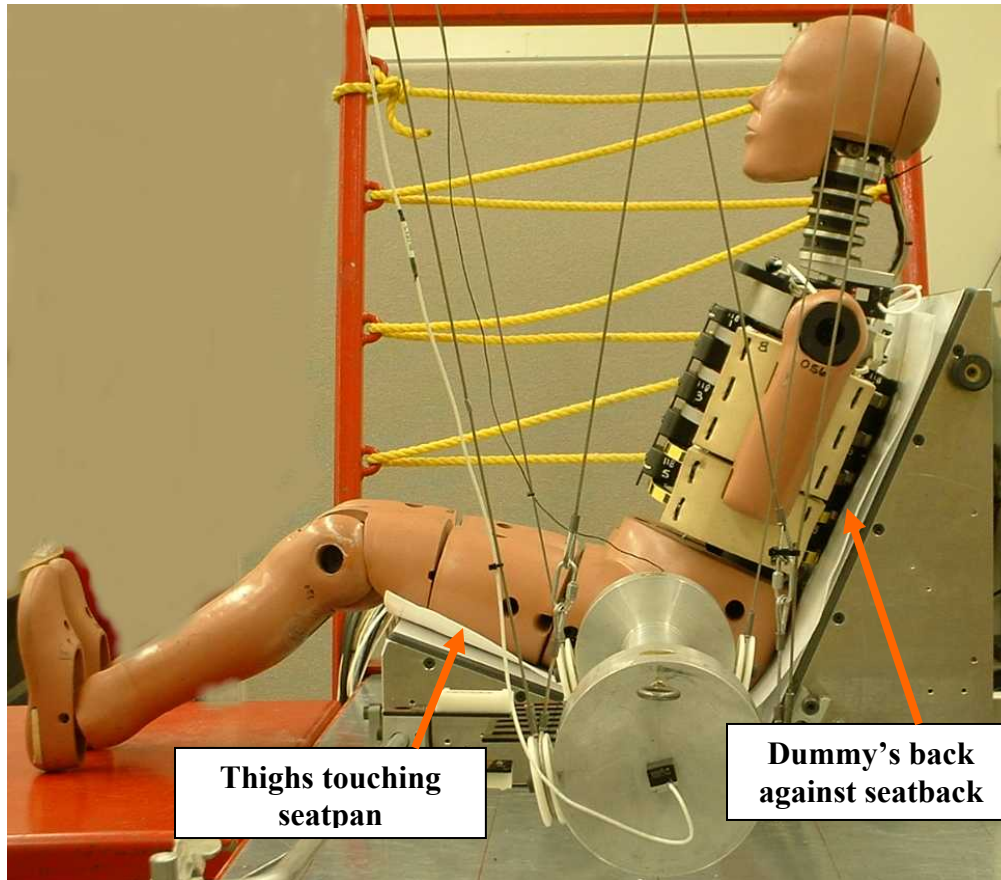


Figure 59. SID-IIIsD leg and back positioning for pelvis certification tests

- __13 Push the femurs towards the seat pan so that the thighs are in contact with the seat.
 __14 Move the legs together so that the knees are touching (see Figure 43).
 __15 Position the feet so that they are vertical within 2° , with the heels touching the surface of the support table (see Figure 44).
 __16 Adjust the dummy so that the thoracic lateral plane is $0 \pm 1^\circ$ relative to horizontal (see Figure 45).
 __17 Adjust the dummy so that the thoracic fore/aft plane measures $24.6 \pm 2^\circ$ relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (see Figure 60).

CHECK SHEET NO. V9 (Continued)
PELVIS ACETABULUM IMPACT TEST (572.198)



Figure 60. Adjusting the SID-IIsD in the fore/aft plane for pelvis certification tests

Conduct Test, Collect Data and Verify Performance

- __18 Record the room temperature and humidity in Table V9. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- __19 Record the serial number of the pelvis plug in Table V9.
- __20 The impactor shall have a mass of 13.97 ± 0.23 kg⁹ with a 120.7 mm face diameter and a 12.7 mm radius.
- __21 Mount an accelerometer on the impactor with its sensitive axis in line with the longitudinal centerline of the impactor.
- __22 Release the impactor at an impact speed between 6.6 – 6.8 m/s.
- __23 At the instant of contact, the probe shall be horizontal $\pm 1^\circ$ and the centerline of the impactor shall be within 2 mm of the centerline of the acetabulum load cell.
- __24 The data acquisition system conforms to SAE Recommended Practice J211.
- __25 The impactor and pelvis accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- __26 The acetabulum force is collected and filtered using a Channel Class 600 phaseless filter.
- __27 Time zero is defined as the time of contact between the impact probe and the pelvis. All channels should be at a zero level at this point.

⁹ Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

CHECK SHEET NO. V9 (Continued)
PELVIS ACETABULUM IMPACT TEST (572.198)

- __28 Record the peak impactor acceleration, peak pelvic acceleration (after 6 ms) and peak acetabulum force in Table V9. Verify that the measurements meet specifications by indicating "Pass" or "Fail" in the far right column.
- __29 If the test results do not meet specification, wait at least 2 hours, conduct another test. Record test results in a separate table.
- __30 Discard the impacted pelvis plug and replace it with another certified plug after each test.

Table V9. Pelvis Acetabulum Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥180		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Impactor Velocity		m/s	6.6 to 6.8		
Peak Impactor Acceleration		G's	38 to 47		
Pelvis Acceleration (Y) after 6 ms		G's	34 to 42		
Peak Acetabulum Force (Y)		kN	3.60 to 4.30		
Pelvis Plug Serial No. _____					

Signature

Completion Date

CHECK SHEET NO. V10
PELVIS ILIAC IMPACT TEST (572.199)

Pretest Preparation

- ___1 Soak the dummy in a controlled environment at a temperature and relative humidity indicated in Table V10 for at least four hours prior to a test. Record the length of time for the soak and the maximum and minimum temperature and humidity in Table V10. Verify that each measurement meets specification by indicating "Pass" or "Fail" in the far right column.
- ___2 Remove the chest jacket from the dummy.
- ___3 Be sure the thoracic and abdominal pads are installed using cable ties¹⁰.
- ___4 Install a certified pelvis plug (see ***Pelvis Plug Quasi-Static Test***). Be certain that the plug is fully seated in the cavity by pushing on the end of the plug until it fully contacts the acetabulum load cell surface.
- ___5 Position the arm on the impact side downwards (lowest detent) and perpendicular to the seating surface. No bench is used in this procedure.
- ___6 The dummy wears no clothing or shoes for this procedure.
- ___7 The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- ___8 Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another¹¹ (Figure 47).
- ___9 Place two sheets of 2-mm thick Teflon® on top of one another on the seating surface. The sheets should be large enough to fit completely under the dummy's pelvis, legs, and feet.
- ___10 Position the dummy on the Teflon® (Figure 61) in the probe's impact area so that the dummy can be impacted in the iliac area, with the centerline of the probe aligned with the centerline of the iliac load cell access hole in the pelvis flesh.
- ___11 The probe tip has a 50.8 mm x 88.9 mm face, with an alignment tool access hole in the center. Appendix B includes dimensions for a possible iliac probe face. Care should be taken to adjust probe depth dimensions as needed to maintain the proper 13.97 ± 0.23 kg weight of the probe assembly according to the needs of each test lab.
- ___12 The probe tip should be positioned vertically ($0 \pm 1^\circ$).
- ___13 Position the dummy so that the centerline of impact probe is centered on the centerline of the iliac load cell access hole. When the pendulum probe is at its lowest position during travel, it should be just touching the pelvis. Push the femurs downward so that the thighs make full contact with the test surface.

¹⁰ See *Attachment of Thoracic and Abdominal Pads in the SID-IIsD*.

¹¹ The lower neck load cell should not be used since its fixed setting creates a neck angle (of $\sim 14^\circ$) which is less than the neck angle (of $\sim 19^\circ$) when the upper and lower neck brackets are set flush.

CHECK SHEET NO. V10 (Continued)
PELVIS ILIAC IMPACT TEST (572.199)

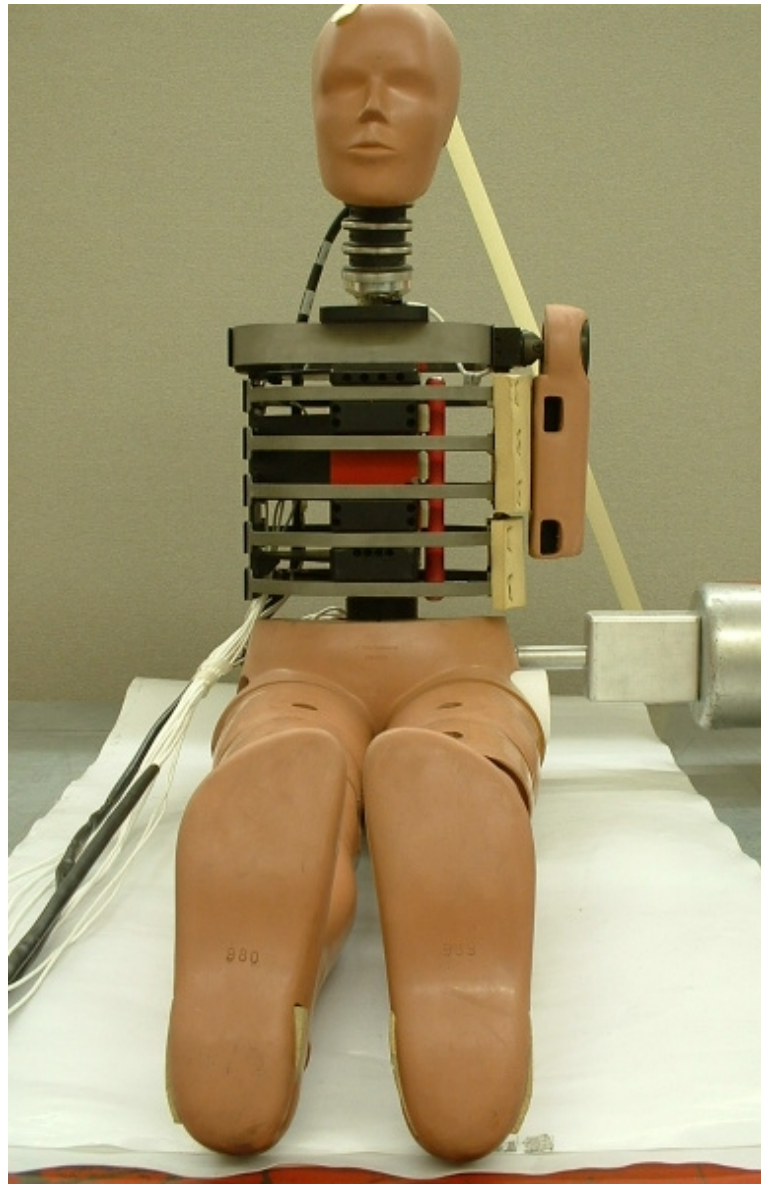


Figure 61. Setup of the dummy for iliac

CHECK SHEET NO. V10 (Continued)
PELVIS ILIAC IMPACT TEST (572.199)

- __14 Move the legs together so that the knees are as close together as possible (Figure 40).
- __15 Position the feet so that they are in dorsiflexion with toes angled towards the dummy's head.
- __16 Using approximately 3 feet of standard 1-inch wide masking tape¹² from the top of the dummy's head to the seating surface (Figure 62), level the shoulder rib so that the fore/aft plane is $0^{\circ} \pm 1^{\circ}$ relative to horizontal. This measurement can be taken at the top of the shoulder rib mount. Adjust the masking tape as necessary to achieve these results (Figure 63).

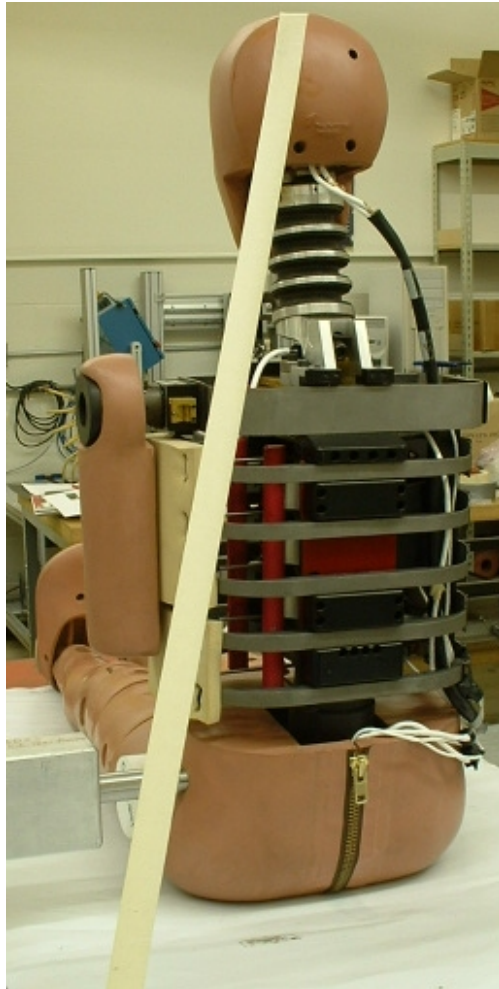


Figure 62. Using masking tape to seat the dummy upright



Figure 63. Adjusting the SID-IIIsD in the fore/aft plane for iliac certification test

- __17 Adjust the dummy so that the thoracic lateral plane is $0^{\circ} \pm 1^{\circ}$ relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 63).
- __18 Adjust the masking tape as necessary to achieve these results, taking care to maintain level in the fore/aft direction as well.

¹² Alternatively, a material with a maximum static breaking strength of 311 N (70 lb) may be used to support the dummy in position.

CHECK SHEET NO. V10 (Continued)
PELVIS ILIAC IMPACT TEST (572.199)

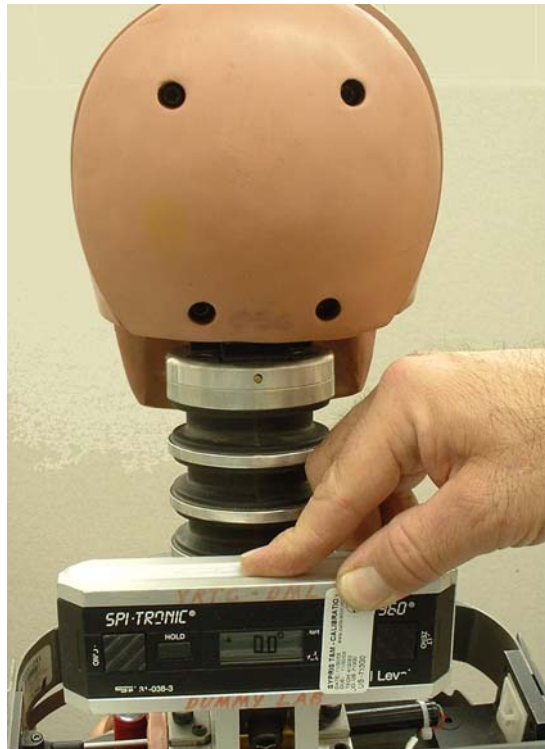


Figure 64. Adjusting the SID-IIsD in the lateral direction for iliac certification test

- __19 To correctly position the probe face to the iliac, use the iliac alignment tool shown in Figure 65 (see Attachment 3 for dimensions).

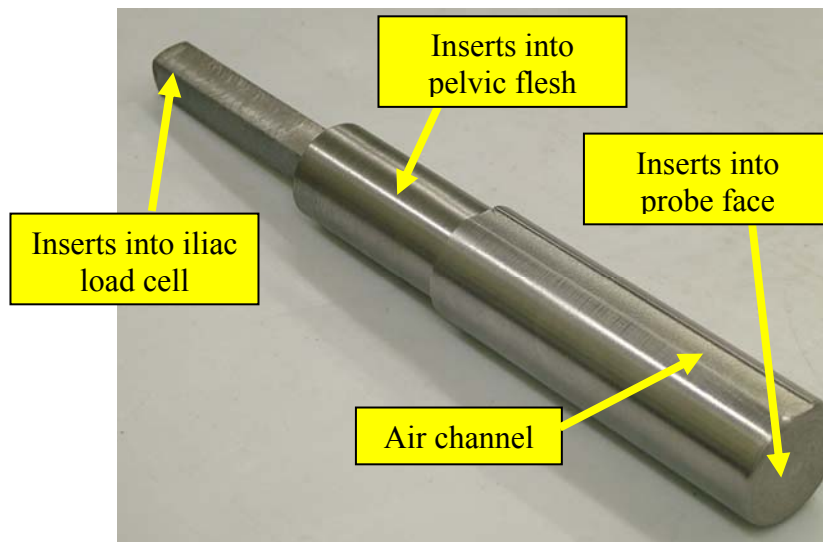


Figure 65. Iliac alignment tool

CHECK SHEET NO. V10 (Continued)
PELVIS ILIAC IMPACT TEST (572.199)

- __20 The access hole in the center of the probe face should mate with the iliac alignment tool such that there is a good fit (with minimal play) when the shaft of the tool is inserted into the probe access hole (Figure 66).

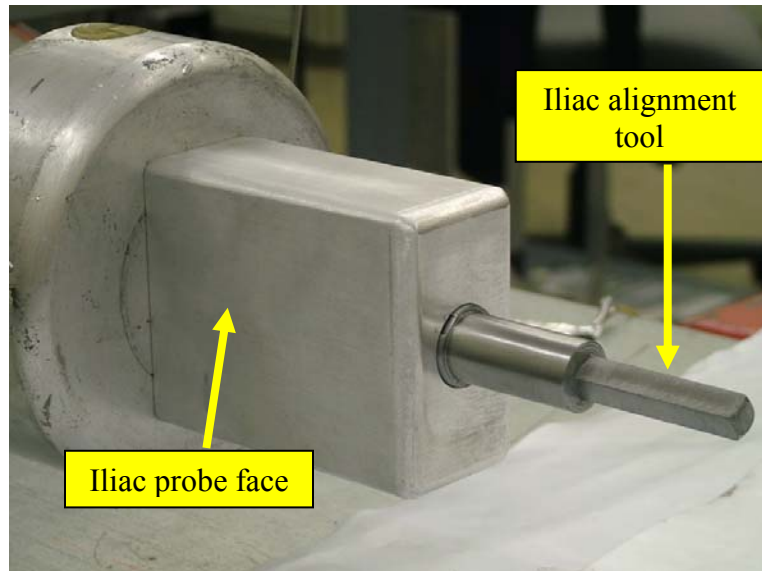


Figure 66. Iliac probe with alignment tool inserted

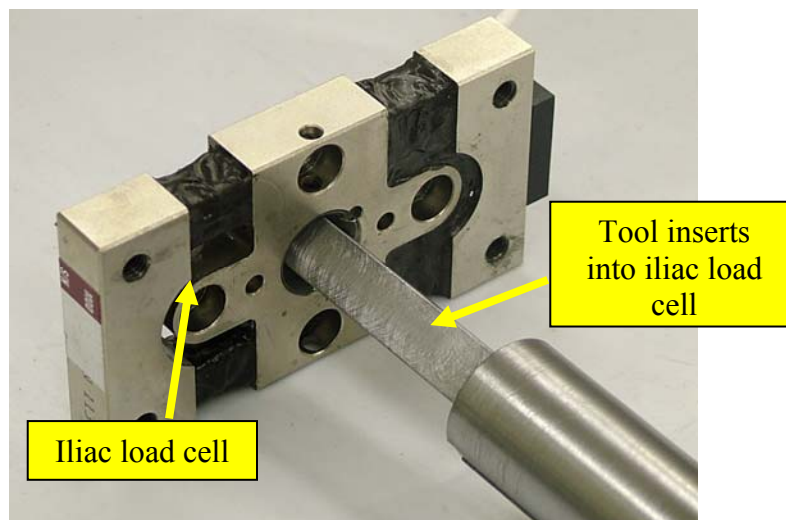


Figure 67. Iliac alignment tool inserted into iliac load cell (shown outside of dummy for clarity)

- __21 To properly align the impact probe for an iliac impact, the square end of the alignment tool is inserted into the center of the iliac load cell through the iliac load cell access hole in the pelvis flesh (Figure 67).
- __22 The dummy's position is then adjusted so that moving the pendulum towards contact with the iliac allows for smooth motion (minimal resistance) of the alignment tool within the probe face (Figures 68 and 69).

CHECK SHEET NO. V10 (Continued)
PELVIS ILIAC IMPACT TEST (572.199)

- __23 Once this position has been achieved, a check of the fore/aft level and right/left level should be conducted and adjusted as necessary.

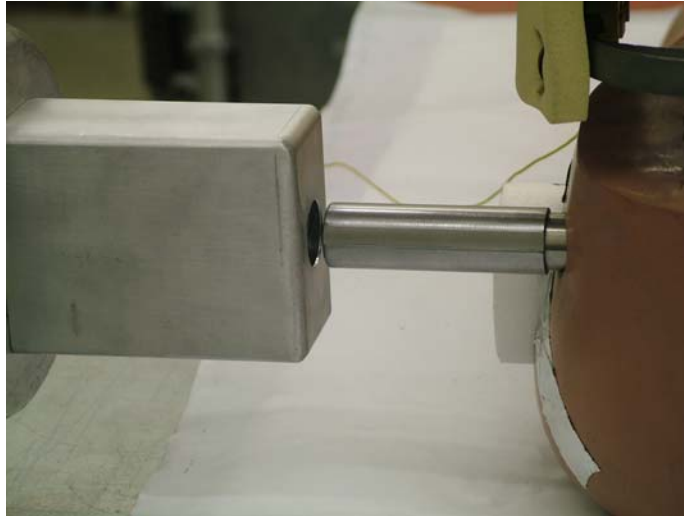


Figure 68. Adjusting the pelvic position for inserting the alignment tool

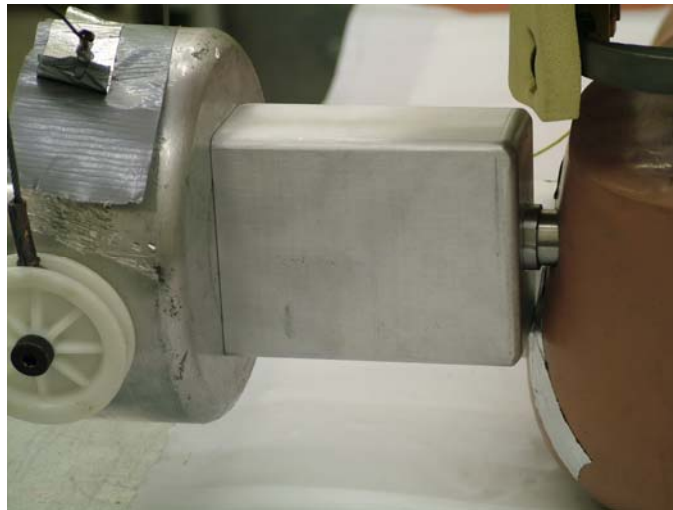


Figure 69. Assuring smooth motion of the alignment tool shaft within the probe.

- __24 Once probe alignment has been achieved, and assuring that the dummy is level, pull back the pendulum probe and carefully remove the alignment tool while maintaining dummy position.

CHECK SHEET NO. V10 (Continued)
PELVIS ILIAC IMPACT TEST (572.199)

Conduct the Test, Collect Data and Verify Performance

- ___25 Record the room temperature and humidity in Table V10. Verify that the temperature and relative humidity meets specification by indicating “Pass” or “Fail” in the far right column.
- ___26 Install a certified pelvis plug. (NOTE - The pelvis plug must be installed in the dummy during this test. However, since it is not impacted, it remains certified and usable after the iliac impact test).
- ___27 The impactor has a mass of $13.97 \pm 0.23 \text{ kg}^{13}$ with a 50.8 mm x 88.9 mm face, (with a minimum depth of 76 mm) and a 6.4 mm edge radius. In addition, the impactor face shall contain an access hole such that an alignment tool can be inserted for proper impact positioning.
- ___28 Mount an accelerometer on the impactor with its sensitive axis in line with the longitudinal centerline of the impactor.
- ___29 Release the impactor 4.2 – 4.4 m/s at the instant of contact with the dummy.
- ___30 At the instant of contact, the probe should be horizontal $\pm 1^\circ$, and the centerline of the probe should be within 2 mm of the centerline of the iliac load cell access hole.
- ___31 The data acquisition system conforms to SAE Recommended Practice J211.
- ___32 The probe and pelvis accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- ___33 The iliac force is collected and filtered using a Channel Class 600 phaseless filter.
- ___34 Time zero is defined as the time of contact between the impactor and the pelvis. All channels are at a zero level at this point.
- ___35 Record the peak impactor acceleration, peak pelvic acceleration, and peak iliac force in Table V10. Verify that the measurements meet specification by indicating “Pass” or “Fail” in the far right column.
- ___36 If the test results do not meet specification, wait at least 2 hours, conduct another test.
- ___37 Record and report the results of each additional test in a separate table.

Table V10. Pelvis Iliac Impact Test

Tested Parameter		Units	Specification	Result	Pass/ Fail
Dummy Soak Time		Minutes	≥ 180		
Temperature - During Soak	Max	°C	20.6 to 22.2		
	Min	°C			
Humidity - During Soak	Max	%	10.0 to 70.0		
	Min	%			
Temperature – During test		°C	20.6 to 22.2		
Humidity – During test		%	10.0 to 70.0		
Peak Impactor Acceleration		G’s	36 to 45		
Pelvis Acceleration (Y)		G’s	28 to 39		
Peak Iliac Force (Y)		kN	4.10 to 5.10		
Pelvis Plug Serial No. _____					

Signature

Completion Date

¹³ Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

ATTACHMENT 1

ATTACHMENT OF THORACIC AND ABDOMINAL PADS IN THE SID-IISD

ATTACHMENT OF THORACIC AND ABDOMINAL PADS IN THE SID-II_sD

Use approximately 185mm (7.31”) long, 4.67mm (0.184”) wide, 1.33mm thick cable ties to attach the pads to the ribs. The cable ties should be used at each rib on both the left and right edges of the pad. Route the cable ties through the holes punched into the pad and around the rib making certain that the cable tie locking apparatus is at the back side of the rib. Be sure not to wrap over rib damping material or over the larger flared out portion of the ribs near the red urethane. Tighten the cable tie so that pad is pulled against the rib and the pad becomes compressed by the cable tie. Once the cable tie is tightened, the cable “tail” (excess which was pulled through the locking mechanism) should be approximately 125mm long. About 55 mm of the tie will be utilized on the loop around the ribs (*Note: about 5 mm of the tie remains inside the locking mechanism*). An indication of the proper “tightness” can be identified in Figure A1 below. After tightening the cable tie the proper amount, cut off the excess “tail” so that no further tightening will occur as well as to reduce interference.

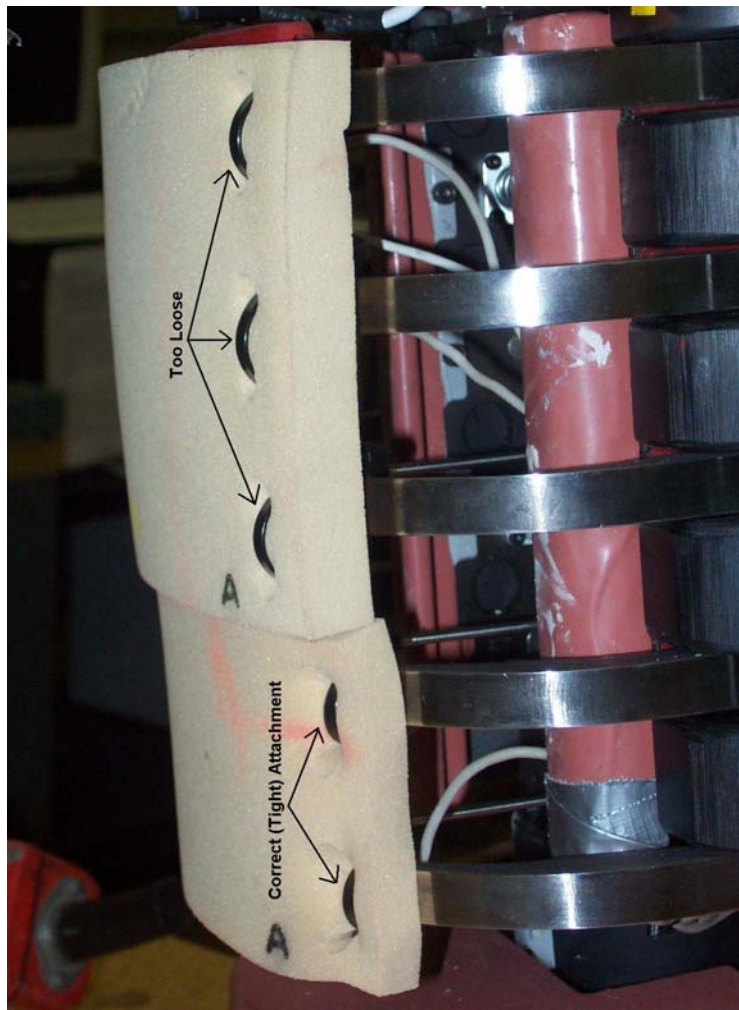
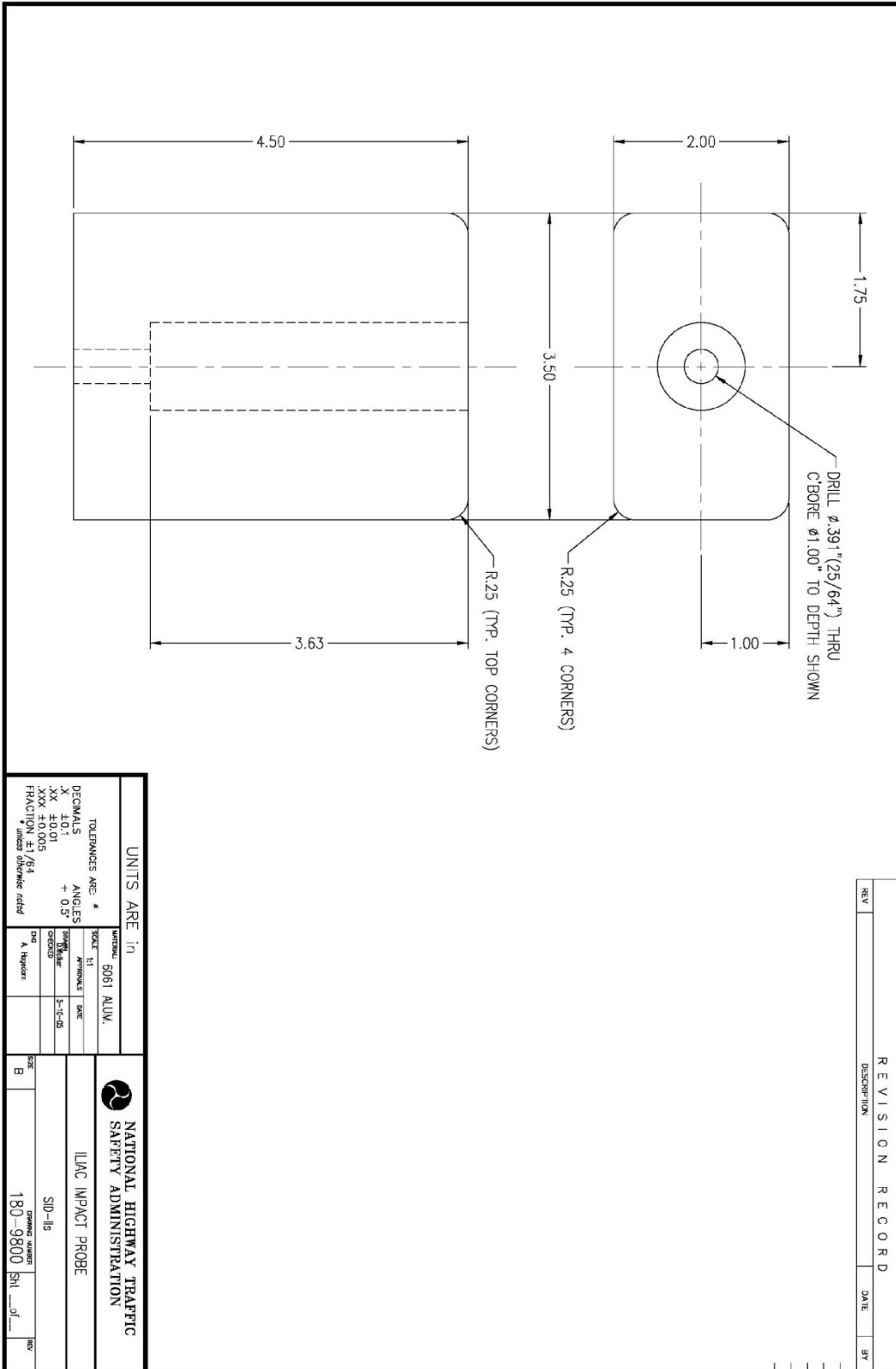


Figure A1. Cable tie attachment to hold the pads for the SID-II_sD

ATTACHMENT 2

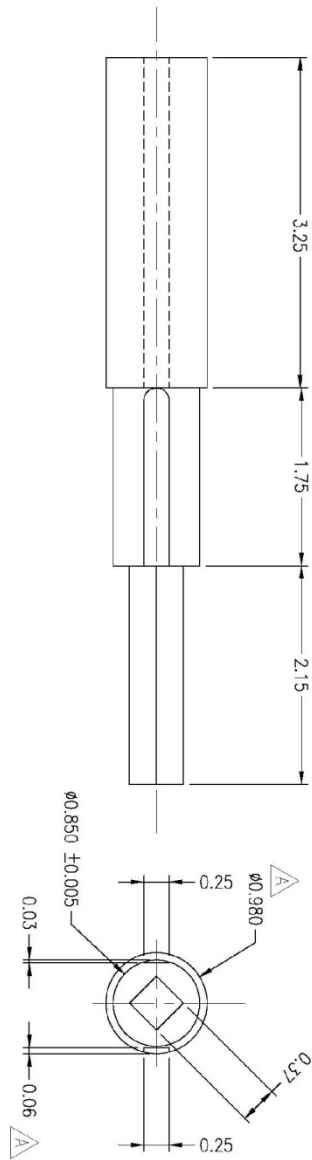
ILIAC PROBE FACE



ATTACHMENT 3

ILIAC ALIGNMENT TOOL

REVISION RECORD			
REV	DESCRIPTION	DATE	BY
A	CHANGED DIM. .03 TO .06 & .594 to .980	11/22/05	JJR



UNITS ARE in		UTRICAL 1045 CRS	
TOLERANCES ARE: #		SCALE 1:1	
DECIMALS	ANGLES	APPROXIMATE DATE	
.XX ±0.01	+ 0.5°	5-11-05	
.XXX ±0.005			
FRACTION ±1/64			
* unless otherwise noted		DRG A	Revised
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION		SIZE B	REV A
ILMC IMPACT PROBE ALIGNMENT TOOL		DRAWING NUMBER	
SID-115		180-9801	SN ___ of ___

APPENDIX C

Positioning Dummies In the Test Vehicle

ES-2re 50th Percentile Male Dummy in the Driver Seating Position

NOTE: *Position the rear seat occupant (SID-IIs 5th percentile female), if applicable, prior to positioning the driver seat occupant (ES-2re 50th percentile male).*

- A. Using the reference marks on the seat, set the driver's seat at the mid-fore/aft, full down, mid seat cushion angle position determined in Section 11.1S of the main MDB SINCAP test procedure.
- B. If adjustable, set the seat back angle at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 25 degrees from the vertical.
- C. Upper Torso.

Once the H-point has been determined (see **APPENDIX F, "Determining the H-Point Location"**), position a calibrated ES-2re test dummy in the driver's seat.

- (1) Place the dummy in the seat such that the plane of symmetry (i.e., mid-sagittal plane) of the dummy coincides with the longitudinal centerline marking on the seat cushion upper surface, seat back, and head restraint of the driver's seat.
NOTE: *Move the seat and seat back rearward as necessary to get the test dummy in the seat.*
 - (2) Bend the upper torso forward and then lay it back against the seat back. Push the shoulders of the dummy fully rearward.
- D. Pelvis.
- (1) Remove the foam blocks from the pelvis flesh.
 - (2) Position the dummy so that it sits square and level in the seat.
 - (3) If the seat was adjusted in step C, repeat steps A and B to set the seat at the mid-fore/aft position and the seat back to the manufacturer's nominal design riding angle.
 - (4) The correct position of the dummy's pelvis may be checked relative to the H-point determined by the H-point machine. Locate the M3 holes in the H-point back plates at each side of the ES-2re pelvis. Position the dummy's pelvis such that the M3 holes are located within a circle of radius 10 mm (0.39 in.) around the H-point location (x,z) of the H-point machine. Note that the hip point of the dummy is located 21 mm forward of the H-point determined by the H-point machine.
 - (5) Position the pelvis of the dummy such that a horizontal (lateral) line passing through the dummy hip pivot center is perpendicular to the longitudinal center plane of the seat. Verify that the line through the dummy H-points is horizontal with a maximum inclination of ± 2 degrees. The dummy may be equipped with tilt sensors in the thorax and the pelvis. These instruments can help to obtain the desired position. If the pelvic tilt angle(Y) is not within specification (± 2 degrees), go back to step C(1) and repeat steps to re-adjust the position of the test dummy.

E. Legs and Feet.

- (1) Without inducing pelvis or torso movement, place the right foot of the dummy on the unpressed accelerator pedal with the heel resting as far forward as possible on the floor pan.
- (2) Set the left foot perpendicular to the lower leg with the heel resting on the floor pan in the same lateral line as the right heel.
- (3) Set the knees of the dummy such that their outside surfaces are 150 ± 10 mm (5.9 ± 0.4 in) from the plane of symmetry of the dummy. If possible within these constraints, place the thighs of the dummy in contact with the seat cushion.

F. Seat belt.

Place the seat belt around the dummy and fasten the latch. Ensure that the seat belt is routed through the shoulder belt guide, if equipped, unless manufacturer directions state otherwise. Remove all slack from the lap belt portion. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 9 N (2 lbf) to 18 N (4 lbf) tension load to the lap belt. If the seat belts are equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the vehicle manufacturer in the vehicle owner's manual. If not, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

G. Arms.

Place the dummy's upper arms such that the angle between the projection of the arm centerline on the mid-sagittal plane of the dummy and the torso reference line is $40^\circ \pm 5^\circ$. The torso reference line is defined as the thoracic spine centerline. The shoulder-arm joint allows for discrete arm positions at 0, 40, and 90 degree settings forward of the spine.

**SID-IIs 5th Percentile Female Dummy
in the Rear Left Seating Position**

- A. Set the rear outboard seat at the full rearward, lowest height, mid-angle position determined in Section 11.1S of the main MDB SINCAP test procedure.
- B. Verify that the fixed lower neck load cell is not installed. Adjust the dummy's upper and lower neck brackets to align the zero degree index marks.
- C. Fully recline the seat back, if adjustable. Place the dummy in the passenger's seat, such that when the legs are 120 degrees to the thighs, the calves of the legs are not touching the seat cushion. If necessary, use a fixed gauge, inserted into the hip, knee, and ankle joints, to maintain the 120 degree angle. If a 120 degree angle between the legs and the thighs cannot be achieved due to interference with the front seat back when the front seat is set to the mid-fore/aft full down position and the front seat back is set to the manufacturer's nominal design riding position for a 50th percentile adult male, move the front seat to its full-forward position, and adjust the front seat back to its most upright position. If a 120 angle between the legs and the thighs still cannot be achieved due to interference with the front seat back, place the legs at the largest angle possible while allowing the feet to just contact the front seat back; record this angle.
- D. Center the dummy on the seat cushion so that its mid-sagittal plane is vertical and passes within ± 10 mm (± 0.4 in) of the longitudinal centerline markings on the seat cushion upper surface, seat back, and head restraint that lie in the same vertical longitudinal plane as the SgRP.
- E. Hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic angle.
- F. While maintaining a leg-thigh angle of 120 degrees (or the largest angle possible, as determined in step C), set the initial transverse distance between the longitudinal centerlines at the front of the dummy's knees at 160 to 170 mm (6.3 to 6.7 in), with the thighs and legs of the dummy in vertical planes. Center the knee separation with respect to the longitudinal centerline markings of the seat cushion.
- G. Without allowing the angle between the thighs and lower legs determined in step C to change, push rearward on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the front of the seat cushion. If friction is prohibiting the dummy from moving rearward as the knees are being pushed rearward such that a gap still exists between the pelvis and the seat back after this step has been performed and the back of the dummy's calves have not yet contacted the front of the seat cushion, perform one of the following steps until there is no gap between the pelvis and the seat back, or until contact occurs between the back of the dummy's calves and the front of the seat cushion, whichever occurs first:
 - (1) Pull forward slightly on the dummy's upper torso while holding the dummy at the base of the back of the neck. Rock the torso from side-to-side while pushing back on the dummy's knees.
 - (2) Lift the dummy from beneath the buttocks and slide the pelvis rearward into the seat.

NOTE: *In vehicles with long seat pans, the dummy's pelvis may not contact the seat back even when the back of the calves are touching the front of the seat cushion.*

- H. If the dummy's calves make contact with the front of the seat cushion and prohibit the pelvis from contacting the seat back in step G, and a 120 degree angle between the legs and the thighs could not be achieved in step C due to interference with the front seat back, attempt to once again achieve a 120 degree angle between the legs and the thighs. Verify that the transverse distance between the longitudinal centerlines at the front of the dummy's knees is still set to 160 to 170 mm (6.3 to 6.7 in.), with the thighs and legs of the dummy in vertical planes. If a 120 degree angle between the legs and the thighs still cannot be achieved due to interference with the front seat back, place the legs at the largest angle possible while allowing the feet to just contact the front seat back; record this angle. If the leg-thigh angle is adjusted, repeat step G.
- I. Gently rock the upper torso laterally side to side three times through a ± 5 degree arc (approximately 51 mm (2 in) side to side) to reduce friction between the dummy and the seat. Return the dummy's upper torso to the seat back.
- J. If needed, extend the legs slightly so that the feet are not in contact with the floor pan. Let the thighs rest on the seat cushion to the extent permitted by the foot movement. Verify that the transverse distance between the longitudinal centerlines at the front of the dummy's knees is still set to 160 to 170 mm (6.3 to 6.7 in.) with the thighs and the legs of the dummy in vertical planes. With the feet perpendicular to the legs, place the heels on the floor pan. After initial positioning, it should be possible to lift the legs behind the ankles and, when slowly released, the legs should return to the original position with the heel contacting the floor. If a heel will not contact the floor pan, place it as close to the floor pan as possible.
- K. Head Leveling.
- When leveling the head, the dummy's torso should be resting on the seat back and/or the dummy's head should be resting on the head restraint.
- (1) *Vehicles with fixed seat backs.* Adjust the lower neck bracket to level the transverse instrumentation platform angle of the head to within ± 0.5 degrees. If it is not possible to level the transverse instrumentation platform to within ± 0.5 degrees, select the neck bracket adjustment position that minimizes the difference between the transverse instrumentation platform angle and level.
 - (2) *Vehicles with adjustable seat backs.* While holding the thighs in place, rotate the seat back forward until the transverse instrumentation platform angle of the head is level to within ± 0.5 degrees, making sure that the pelvis does not interfere with the seat bight and the head does not get pinched under the head restraint. If the pelvis interferes with the seat bight, shift the pelvis forward on the slightly on the seat cushion and complete steps to level the head. If the head gets pinched under the head restraint, it may be necessary to pull the dummy's torso forward slightly as the seat back is raised and then return the torso to the seat back. If it is not possible to level the transverse instrumentation platform to within ± 0.5 degrees, select the seat back adjustment position that minimizes the difference between the transverse instrumentation platform angle and level, then adjust the neck bracket to level the transverse instrumentation platform angle to within ± 0.5 degrees. If it is still not possible to level the transverse instrumentation platform to within ± 0.5 degrees, select the neck bracket angle position that minimizes the difference between the transverse instrumentation platform angle and level.
- L. Measure and set the dummy's pelvic angle to 20.0 degrees ± 2.5 degrees using the pelvic angle gauge. If the dummy's pelvic angle is within the specified range at the head angle determined in step K, continue to step M. If the dummy's pelvic angle is outside of the specified range at the head angle determined in step K, adjust the pelvic angle as

close to 20.0 degrees as possible by performing the applicable step listed below while keeping the transverse instrumentation platform of the head as level as possible, as specified in step K. **If it is not possible to achieve both the head level and the specified pelvic angle, priority goes to leveling the head.**

- (1) If the pelvic angle is above the specified range, decrease the pelvic angle by rotating the torso forward and then holding the dummy's thighs down and slowly rotating the torso rearward until it is supported by the seat back and/or the head is supported by the head restraint, making sure the transverse instrumentation platform angle of the head can still be leveled to within ± 0.5 degrees or, at most, to the angle determined in step K. If the seat back is fixed, or if the dummy's pelvic angle is within the specified range and the transverse instrumentation platform angle of the head can still be leveled to within ± 0.5 degrees or, at most, to the angle determined in step K, record the pelvic angle and head angle. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. Proceed to step M.

If the pelvic angle is still outside of the range, and the seat back is adjustable, rotate the seat back forward while holding the dummy's thighs in place until the dummy's pelvic angle is within the specified range, or until the head can no longer be leveled to within ± 0.5 degrees (or, at most, to the angle determined in step K), whichever occurs first. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. When rotating the seat back forward, make sure that the pelvis does not interfere with the seat bight and the head does not get pinched under the head restraint. If the pelvis interferes with the seat bight, shift the pelvis forward slightly on the seat cushion and complete steps to level the head. If the head gets pinched under the head restraint, it may be necessary to pull the dummy's torso forward slightly as the seat back is raised and then return the torso to the seat back. Record the pelvic angle and head angle. Proceed to step M.

- (2) If the pelvic angle is below the specified range, increase the pelvic angle by holding the dummy's thighs down and pushing rearward on the upper torso, making sure the transverse instrumentation platform angle of the head can still be leveled to within ± 0.5 degrees or, at most, to the angle determined in step K. If the seat back is fixed, or if the dummy's pelvic angle is within the specified range and the transverse instrumentation platform angle of the head can still be leveled to within ± 0.5 degrees or, at most, to the angle determined in step K, record the pelvic angle and head angle. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. Proceed to step M.

If the pelvic angle is still outside of the range, and the seat back is adjustable, rotate the seat back rearward while holding the dummy's thighs in place and pushing rearward on the dummy's upper torso until the dummy's pelvic angle is within the specified range, or until the head can no longer be leveled to within ± 0.5 degrees (or, at most, to the angle determined in step K), whichever occurs first. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. Record the pelvic angle and head angle. Proceed to step M.

M. Foot Positioning.

Set the front seat to the mid-fore/aft full down position as determined in Section 11.1S of the main MDB SINCAP test procedure and set the front seat back to the manufacturer's nominal design riding position for a 50th percentile adult male.

- (1) Place the rear seat passenger's feet flat on the floor pan **and** beneath the front seat as far as possible without front seat interference.
- (2) If either foot does not contact the floor pan completely, place the foot parallel to the floor and place the leg as perpendicular to the thigh as possible, even if this causes the dummy's calf to contact the front of the seat cushion.

N. Check again the alignment of the dummy and verify that the head is level. If everything is in position, move to Step O. If not, repeat the steps to get the head as level as possible. The head angle should not be larger than the angle determined in Step K.

O. Place the seat belt around the dummy and fasten the latch. Ensure that the seat belt is routed through the shoulder belt guide, if equipped, unless manufacturer directions state otherwise. Remove all slack from the lap belt portion. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 9 N (2 lbf) to 18 N (4 lbf) tension load to the lap belt. If the seat belts are equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the vehicle manufacturer in the vehicle owner's manual. If not, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

P. Arm Positioning.

Place the dummy's upper arm such that the angle between the projection of the arm centerline on the midsagittal plane of the dummy and the torso reference line is 45 ± 5 degrees. The torso reference line is defined as the thoracic spine centerline. The shoulder-arm joint allows for discrete arm positions at $0, \pm 40, \pm 90, \pm 140,$ and 180 degree settings where positive is forward of the spine.

APPENDIX D

ALUMINIUM HONEYCOMB CRUSH STRENGTH CERTIFICATION

1.0 OBJECTIVE

The National Highway Traffic Safety Administration (NHTSA) developed a moving deformable barrier (MDB) for use in full-system crash tests. Attached to the MDB carriage is a crushable aluminum face that simulates the stiffness of the front end of a vehicle. All specifications for the MDB face assembly are found in Part 587.14. Contractors must assure that aluminum honeycomb barriers used during compliance tests meet all specifications in accordance with Part 587.14. The test procedure contained herein provides Contractors a method of verifying that the main core of aluminum honeycomb barriers procured for NHTSA tests meet the specifications for crush strength.

2.0 TEST PROCEDURE

2.1 *Hardware Specifications*

The testing hardware must have a capacity of applying about 13.3 kn (3,000 lb) over a stroke of at least 16.5 mm (0.65"), at a constant and known rate. The crush plates must be parallel (within 0.127 mm (0.005")), be at least 165 mm x 165 mm (6.5" x 6.5") in size, have a surface roughness approximately equivalent to 60 grit sandpaper, and be marked to ensure centering of the applied load on the sample.

The hardware used for certifying aluminum honeycomb must be capable of applying a sufficient load (about 13.3 kn (3,000 lb)), over at least a 16.5 mm (0.65") stroke. The crush rate must be constant and known (see Section 3.3). To ensure that the load is applied to the entire sample, the top and bottom crush plates must be no smaller than 165 mm by 165 mm (6.5" x 6.5"). The engaging surfaces of the crush plates must also have a roughness approximately equivalent to 60 grit sandpaper. The bottom crush plate should be marked to ensure that the applied load is centered on the sample. Also, the crush plate assemblies must have an average angular rigidity (about axes normal to the direction of crush) of at least 1017 N•m/deg (750 ft-lb/deg), over the range of 0 N•m to 203 N•m (0 ft-lb to 150 ft-lb) applied torque.

2.2 *Sample Size*

Samples of unstabilized aluminum honeycomb are to be used that have the following dimensions

Length = 152 mm ± 6 mm (6" ± 0.25")

Width = 152 mm ± 6 mm (6" ± 0.25")

Thickness = 25 mm ± 1.6 mm (1" ± 0.0625")

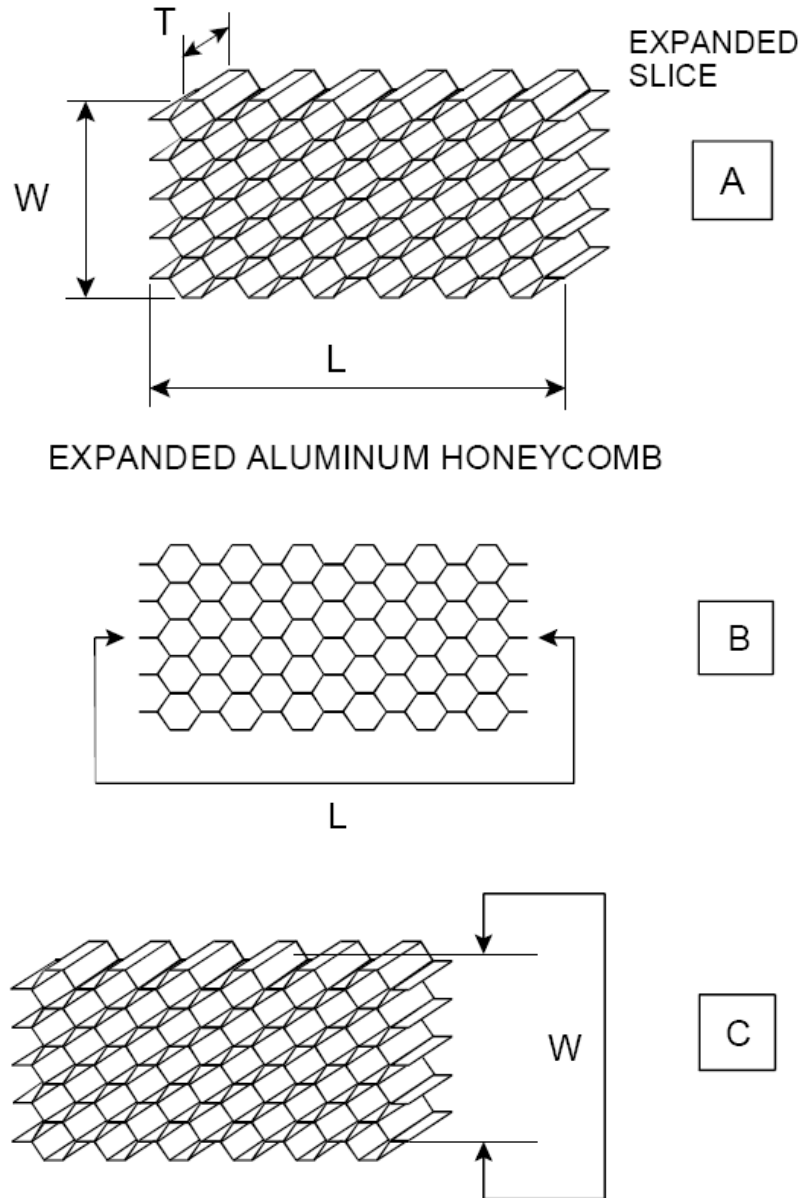


FIGURE 1

2.3 Measurement of the Sample

Three length measurements are taken, fringe to fringe, and recorded as L_1 , L_2 , and L_3 . These are to be located one-half of an inch from each end and at the middle of each sample. If these locations fall between the fringes, the measurements are to be taken from lines projected between the adjacent fringes, as shown in Figure 1, Item B. In the same manner, the width is to be measured and recorded as W_1 , W_2 and W_3 . All length and width measurements are to be taken at the centerline plane of the

thickness, as shown in Figure 1, Item C. The crush area is then calculated using the following formula:

$$A = \frac{(L1 + L2 + L3)}{3} \times \frac{(W1 + W2 + W3)}{3}$$

2.4 *Crush Rate and Distance*

The sample is to be crushed at a rate not less than 5 mpm (0.2 ipm) and not more than 7.6 mpm (0.3 ipm). The sample is to be crushed a minimum of 16.5 mm (0.65").

2.5 *Data Collection*

Force versus deflection data are to be collected in either analog or digital form for each sample tested. If analog data are collected, a means of converting this to digital data must be available. All digital data must be collected at a rate of no less than 5 Hz (5 points per second). The rated tolerance on the load cell used to obtain this data must not be more than ± 0.5 percent, while that of the displacement transducer used must not exceed ± 1 percent. The calibration interval for each of these must be less than six months and the standard must be traceable to NIST.

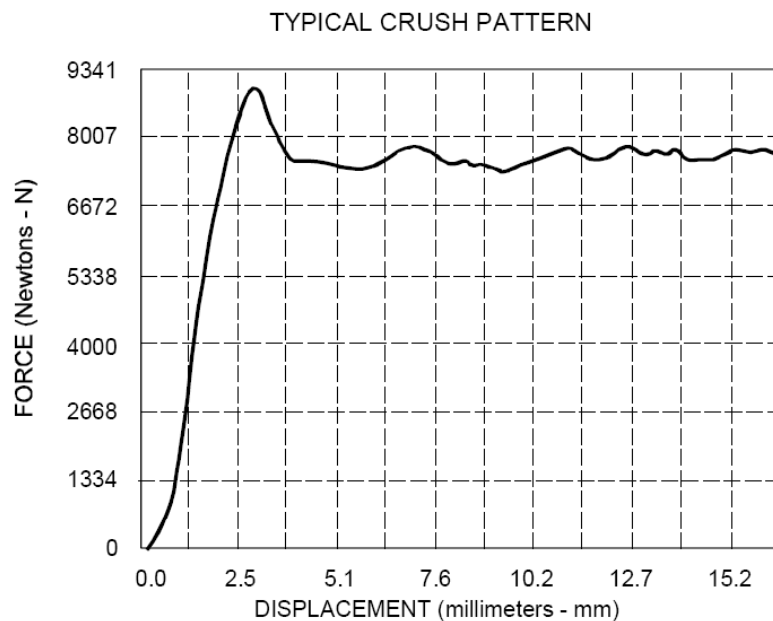


FIGURE 2

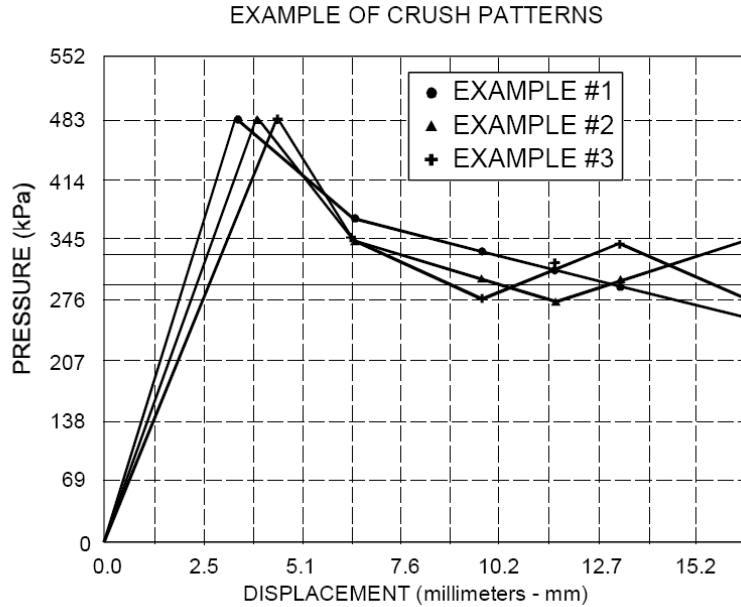


FIGURE 3

2.6 Crush Strength Determination

Ignore all data prior to 6 mm (0.25") of crush and after 16.5 mm (0.65 inch) of crush. Divide the remaining data into three sections or displacement intervals ($n = 1, 2, 3$) as follows:

- A. 6 mm to 9.6 mm (0.25" to 0.38"), inclusive
- B. 9.6 mm to 13.2 mm (0.38" to 0.52"), exclusive
- C. 13.2 mm to 16.5 mm (0.52" to 0.65"), inclusive

Find the average force for each section as follows:

$$F(n) = \frac{[F(n)_1 + F(n)_2 + \dots + F(n)_l]}{l}; \quad n = 1, 2, 3$$

In this equation, "l" represents the number of data points measured in each of the three intervals. Calculate the average crush strength of each section as follows:

$$S(n) = \frac{F(n)}{A}; \quad n = 1, 2, 3$$

2.7 Sample Crush Strength Specification

For a honeycomb sample to pass this certification, the following condition must be met:

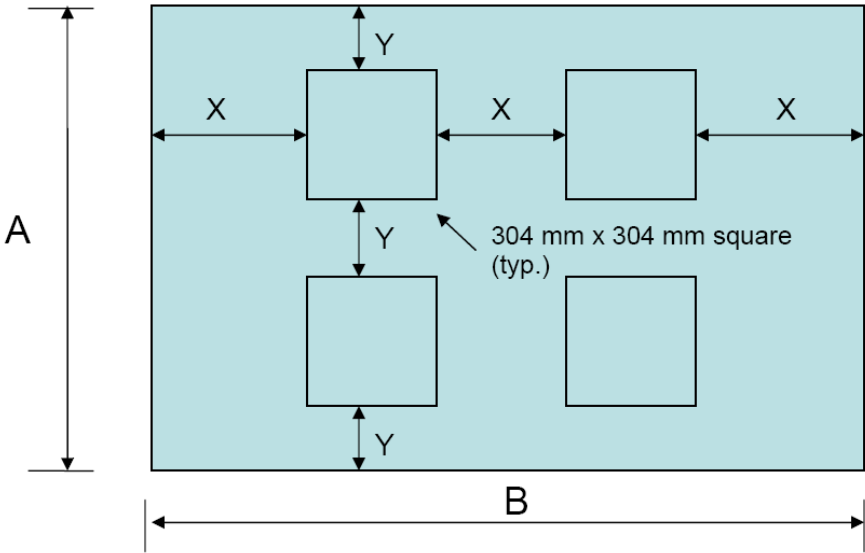
$$293 \text{ kPa} \leq S(n) \leq 327 \text{ kPa} \quad (42.5 \text{ psi} \leq S(n) \leq 47.5 \text{ psi})$$
$$n = 1,2,3$$

2.8 *Block Crush Strength Specification*

Eight (8) samples are to be tested from 4 locations, evenly spaced across the block. For a block to pass certification, 7 of the 8 samples must meet the crush strength specification outlined in the previous section.

HONEYCOMB SAMPLE LOCATIONS

IF $A \geq 914 \text{ mm}$: $X = 1/3(B - 610 \text{ mm})$ & $Y = 1/3(A - 610)$
[FOR $A \leq B$]



IF $A < 914 \text{ mm}$: $X = 1/5(B - 1220 \text{ mm})$ & $Y = 1/2(A - 304 \text{ mm})$
[FOR $A \leq B$]

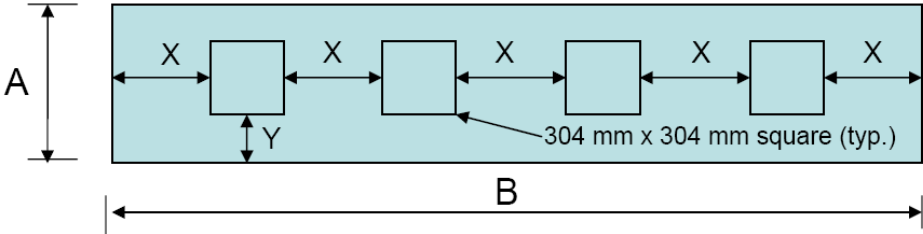


FIGURE 4

APPENDIX E.

**DELIVERABLE GUIDELINES
FOR
NEW CAR ASSESSMENT PROGRAM
SIDE IMPACT
MOVING DEFORMABLE BARRIER TESTING**

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1. FINAL TEST REPORT

Instructions for the preparation of the Final Test Report are provided in this section. To maintain standardization of Final Test Reports, the format outlined below must be adhered to.

1.1 FIRST THREE PAGES

Instructions for the preparation of the first three pages of the final test report are provided on the following pages for standardization purposes.

A. COVER PAGE

The cover page for the test report shall contain the following information:

- (1) Final Report Number, such as SINCAP-ABC-1X-001, where

SINCAP	denotes a Side MDB NCAP Test
ABC	are the Laboratory Initials
1X	is the Model Year of the test vehicle
001	is the Group Number (001 for the 1st test, 002 for the 2nd test, etc.)

- (2) Final Report Title and Subtitle, such as

NEW CAR ASSESSMENT PROGRAM (NCAP) Moving Deformable Barrier Side Impact Test ***** World Motors Corporation 201X ABC 4-door Sedan NHTSA No. MX0000

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

ABC LABORATORIES 405 Main Street Detroit, MI 48070
--

NOTE: DOT symbol should 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 Office of Crashworthiness Standards Mail Code: NVS-111 1200 New Jersey Ave, SE, Room W43-410 Washington, DC 20590
--

B. FIRST PAGE AFTER COVER PAGE

A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows:

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or 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 OCWS:

 Division Chief, New Car Assessment Program
 NHTSA, Office of Crashworthiness Standards

Date: _____

 COTR, New Car Assessment Program
 NHTSA, Office of Crashworthiness Standards

Date: _____

C. SECOND PAGE AFTER COVER PAGE

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

Block No. 1--REPORT NUMBER

SINCAP-ABC-1X-001

Block No. 2--GOVERNMENT ACCESSION NUMBER

Please leave blank

Block No. 3--RECIPIENT'S CATALOG NUMBER

Please leave blank

Block No. 4--TITLE AND SUBTITLEFinal Report of New Car Assessment Program
Side Impact MDB Testing of 201X Ace Super Sedan,
NHTSA No. MX0000Block No. 5--REPORT DATE

March 1, 20XX

Block No. 6--PERFORMING ORGANIZATION CODE

ABC

Block No. 7--AUTHOR(S)John Smith, Project Manager
Bill Doe, Project EngineerBlock No. 8--PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-20XX-001

Block No. 9--PERFORMING ORGANIZATION NAME AND ADDRESSABC Laboratories
405 Main Street
Detroit, MI 48070Block No. 10--WORK UNIT NUMBER

Please leave blank.

Block No. 11--CONTRACT OR GRANT NUMBER

DTNH22-1X-D-12345

Block No. 12--SPONSORING AGENCY NAME AND ADDRESSUS Department of Transportation
National Highway Traffic Safety Administration
Office of Crashworthiness Standards (NVS-111)
1200 New Jersey Ave, SE, Room W43-410
Washington, DC 20590

Block No. 13--TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Feb. 15 to Mar. 15, 201X

Block No. 14--SPONSORING AGENCY CODE

NVS-111

Block No. 15--SUPPLEMENTARY NOTES

Please leave blank

Block No. 16--ABSTRACT

A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 201X Ace Super 4-door sedan in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at the ABC Laboratories facility in Detroit, Michigan on November 15, 20XX.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.90 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 28°C. The target vehicle post test maximum crush was 250 mm at level 3. The test vehicle's performance was as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	
Maximum Thoracic Rib Deflection	mm	44	
Total Abdominal Force	N	2500	
Pubic Symphysis Force	N	6000	

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	
Lower Spine Acceleration	G	82	
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	
Maximum Thoracic Rib Deflection	mm	38*	
Maximum Abdominal Rib Deflection	mm	45*	

* Proposed IARV

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

Block No. 17--KEY WORDS

New Car Assessment Program (NCAP)
 Side Impact
 MDB
 ES-2re
 SID-IIs

Block No. 18--DISTRIBUTION STATEMENT

Copies of this report are available from:

National Highway Traffic Safety Administration
 Technical Information Services Division, NPO-411
 1200 New Jersey Ave, SE
 Washington, DC 20590

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

Block No. 19--SECURITY CLASSIFICATION OF REPORT

Unclassified

Block No. 20--SECURITY CLASSIFICATION OF PAGE

Unclassified

Block No. 21--NUMBER OF PAGES

Add appropriate number.

Block No. 22--PRICE

Please leave blank.

1.2 *TABLE OF CONTENTS*

The Final Test Report Table of Contents shall include the following:

<u>Section</u>	
1	Test Purpose and Procedure
2	Summary of Test Results
3	Occupant and Vehicle Information
<u>Appendix</u>	
A	Photographs
B	Vehicle and Dummy Response Data Plots
C	Dummy Configuration and Performance Verification Data
D	Test Equipment and Instrumentation Calibration Data

1.3 *SECTION 1 - TEST PURPOSE AND PROCEDURE*

This section briefly describes the purpose for conducting the side impact test and states the appropriate test procedure followed during the test. The following is provided as an example.

This moving deformable barrier side impact test is part of the MY____ New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number _____. The purpose of this test is to generate comparative side impact performance in a 20XX Ace Super 4-door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure, dated _____.

1.4 SECTION 2 - SUMMARY OF TEST RESULTS

This section gives a summary of the side impact event. The following is an example of the content needed in this section.

A 20XX Ace Super 4-door sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of _____ km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the ABC Laboratories in Detroit, Michigan, on November 15, 201_. Pretest and post test photographs of the test vehicle, the MDB and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated _____. The side impact event was documented by ___ cameras. Camera locations are included in this report.

The dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)
 Primary and redundant head CG tri-axial accelerometers
 Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
 Abdomen forward, middle, and rear y-axis load cells
 Lower spine (T12) tri-axial accelerometers
 Pubic symphysis y-axis load cell

PASSENGER ATD (SID-IIs)
 Primary and redundant head CG triaxial accelerometers
 Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
 Abdomen upper rib and lower rib y-axis displacement potentiometers
 Lower spine (T12) tri-axial accelerometers
 Acetabulum and iliac wing y-axis load cells

APPENDIX B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in APPENDIX C of this report. APPENDIX D of this report contains the test equipment and instrumentation calibration data.

Dummy injury readings were recorded as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	Threshold	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	
Maximum Thorax Rib Deflection	mm	44	
Combined Abdominal Force	N	2500	
Pubic Symphysis Force	N	6000	

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	
Lower Spine (T12) Resultant Acceleration	G	82	
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	
Maximum Thoracic Rib Deflection	mm	38*	
Maximum Abdominal Rib Deflection	mm	45*	

* Proposed IARV

Supplemental restraint information is given below:

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag				
Knee Airbag				
Side Airbag 1 (Indicate Type)				
Side Airbag 2 (Indicate Type, if app.)				
Side Airbag 3 (Indicate Type, if app.)				
Seat Belt Pretensioner				
Seat Belt Load Limiter				
Other				

GENERAL COMMENTS

EXAMPLE: The driver door became unlatched and open during impact. The fuel line was broken upon impact and fuel leaked at a rate of 30 oz. per minute. The side air bag of the driver failed to deploy. The side air bag of the rear seat passenger (behind the driver) was deployed late, and thus failed to provide adequate cushioning for the occupant. The HIC values for both the driver and passenger exceeded the threshold.

1.5 SECTION 3 - OCCUPANT AND VEHICLE INFORMATION

This section requires the reporting of all information found in the following Data Sheets. Data Sheets can be found in Section 2 of these Deliverable Guidelines. The Contractor may expand upon the data sheets if desired; however, the data must be presented in the order listed below.

- Data Sheet No. 1 - General Test and Vehicle Parameter Data
- Data Sheet No. 2 – Seat, Seat Belt, Steering Wheel Adjustment and Fuel System Data
- Data Sheet No. 3 – Dummy Longitudinal Clearance Dimensions
- Data Sheet No. 4 – Dummy Lateral Clearance Dimensions
- Data Sheet No. 5 – Camera and Instrumentation Data
- Data Sheet No. 6 – Test Vehicle Accelerometer Locations
- Data Sheet No. 7 – MDB Accelerometer Locations
- Data Sheet No. 8 – Post-Test Observations
- Data Sheet No. 9 – MDB Summary of Results
- Data Sheet No. 10 – Test Vehicle Profile Measurements
- Data Sheet No. 11 – Test Vehicle Exterior Crush Measurements
- Data Sheet No. 12 – MDB Exterior Static Crush Measurements
- Data Sheet No. 13 – FMVSS No. 301 Static Rollover Results
- Data Sheet No. 14 – Dummy/Vehicle Temperature and Humidity Stabilization Data

1.6 APPENDIX A - PHOTOGRAPHS

The following photographs shall be included in this appendix in the following order. All additional photographs taken for clarification should be added after Photograph 103. The Contractor should present two photographs per page.

TABLE OF PHOTOGRAPHS

No.	Description	Page
001	As-Delivered Right Front $\frac{3}{4}$ View of Test Vehicle	A-1
002	As-Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle	A-1
003	Pre-Test Frontal View of Test Vehicle	A-2
004	Post-Test Frontal View of Test Vehicle	A-2
005	Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-3
006	Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-3
007	Pre-Test Left Side View of Test Vehicle	A-4
008	Post-Test Left Side View of Test Vehicle	A-4
009	Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle	A-5
010	Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle	A-5
011	Pre-Test Rear View of Test Vehicle	A-6
012	Post-Test Rear Side View of Test Vehicle	A-6
013	Pre-Test Right Side View of Test Vehicle	A-7
014	Post-Test Right Side View of Test Vehicle	A-7
015	Pre-Test Overhead View of Test Area	A-8
016	Post-Test Overhead View of Test Area	A-8
017	Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle	A-9
018	Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle	A-9
019	Pre-Test Close-Up View of Impact Point Target	A-10
020	Post-Test Close-up View of Impact Point Target	A-10
021	Pre-Test Left Front Door Latch Close-Up	A-11
022	Post-Test Left Front Door Latch Close-Up	A-11
023	Pre-Test Left Rear Door Latch Close-Up	A-12
024	Post-Test Left Rear Door Latch Close-Up	A-12
025	Pre-Test Front Close-up View of Driver Dummy	A-13
026	Post-Test Front Close-up View of Driver Dummy	A-13
027	Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking	A-14
028	Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View	A-14
029	Post-Test Left Side View of Driver Dummy Shoulder and Door Top View	A-15
030	Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning	A-15
031	Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint	A-16
032	Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning	A-16
033	Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan	A-17
034	Pre-Test Placement of Driver Dummy's Feet	A-17
035	Pre-Test View of Belt Anchorage for Driver Dummy	A-18
036	Pre-Test Left Side View of Steering Wheel	A-18

037	View of Disengaged Parking Brake	A-19
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041	Pre-Test Close-Up View of Driver Seat Back or Head Restraint	A-21
042	Pre-Test Driver Dummy and Door Clearance View	A-21
043	Post-Test Driver Dummy and Door Clearance View	A-22
044	Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment	A-22
045	Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment	A-23
046	Pre-Test Driver Inner Door Panel View	A-23
047	Post-Test Driver Inner Door Panel View	A-24
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049	Post-Test Driver Dummy Close-Up Head Contact with Side Airbag View	A-25
050	Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View	A-25
051	Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View	A-26
052	Post-Test Driver Dummy Close-Up Pelvis Contact View	A-26
053	Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View	A-27
054	Post-Test Driver Dummy Close-Up Knee Contact View	A-27
055	Pre-Test Left Side View of Passenger Dummy Showing Belt and Chalking	A-28
056	Pre-Test Left Side View of Passenger Dummy Shoulder and Door Top View	A-28
057	Post-Test Left Side View of Passenger Dummy Shoulder and Door Top View	A-29
058	Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning	A-29
059	Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint	A-30
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062	Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket	A-31
063	Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level	A-32
064	Pre-Test Placement of Rear Passenger Dummy's Feet	A-32
065	Pre-Test View of Belt Anchorage for Rear Passenger Dummy	A-33
066	Pre-Test Close-Up Left Side View of Rear Passenger Seat Track	A-33
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068	Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint	A-34
069	Pre-Test Passenger Dummy and Door Clearance View	A-35
070	Post-Test Passenger Dummy and Door Clearance View	A-35
071	Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment	A-36
072	Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment	A-36
073	Pre-Test Passenger Inner Door Panel View	A-37

074	Post-Test Passenger Inner Door Panel View	A-37
075	Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View	A-38
076	Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View	A-38
077	Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View	A-39
078	Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View	A-39
079	Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View	A-40
080	Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View	A-40
081	Post-Test Rear Passenger Dummy Close-Up Knee Contact View	A-41
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083	Post-Test View of Fuel Filler Cap or Fuel Filler Neck	A-42
084	Pre-Test Front View of MDB Impactor Face	A-42
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090	Pre-Test Right Side View of MDB Impactor Face	A-45
091	Post-Test Right Side View of MDB Impactor Face	A-46
092	Close-Up View of Vehicle's Certification Label (photograph of certification label, include a photograph of the reduced load carrying capacity as No. 092a, if applicable)	A-46
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094	Pre-Test Ballast View	A-47
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103	Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual	A-52
104	Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual	A-52

1.7 APPENDIX B - VEHICLE AND DUMMY RESPONSE DATA PLOTS

The following table and respective vehicle and dummy (filtered) data plots should be included in Appendix B.

TABLE OF DATA PLOTS

Driver & Passenger Dummy Instrumentation Plots

No.	Description	Page
1	Driver Head Acceleration (X) Primary vs. Time	B-1
2	Driver Head Acceleration (Y) Primary vs. Time	B-1
3	Driver Head Acceleration (Z) Primary vs. Time	B-1
4	Driver Head Resultant Acceleration Primary vs. Time	B-1
5	Driver Upper Thorax Rib Deflection (Y) vs. Time	B-2
6	Driver Middle Thorax Rib Deflection (Y) vs. Time	B-2
7	Driver Lower Thorax Rib Deflection (Y) vs. Time	B-2
8	Driver Thorax Rib Deflection Maximum vs. Time	B-2
9	Driver Anterior Abdominal Force (Y) vs. Time	B-3
10	Driver Middle Abdominal Force (Y) vs. Time	B-3
11	Driver Posterior Abdominal Force (Y) vs. Time	B-3
12	Driver Total Abdominal Force (Y) vs. Time	B-3
13	Driver Pubic Symphysis Force (Y) vs. Time	B-4
14	Passenger Head Acceleration (X) vs. Time Primary	B-4
15	Passenger Head Acceleration (Y) vs. Time Primary	B-4
16	Passenger Head Acceleration (Z) vs. Time Primary	B-4
17	Passenger Head Resultant Acceleration Primary vs. Time	B-5
18	Passenger Lower Spine T12 Acceleration (X) vs. Time	B-5
19	Passenger Lower Spine T12 Acceleration (Y) vs. Time	B-5
20	Passenger Lower Spine T12 Acceleration (Z) vs. Time	B-5
21	Passenger Lower Spine T12 Resultant Acceleration vs. Time	B-6
22	Passenger Iliac Force on Impact Side (Y) vs. Time	B-6
23	Passenger Acetabulum Force on Impact Side (Y) vs. Time	B-6
24	Passenger Total Pelvic Force on Impact Side (Y) vs. Time	B-6

The following information should also be provided:

The following additional data for this test can be obtained from the Research and Development section of the NHTSA website (<http://www.NHTSA.gov>)

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)
 Driver Lower Spine T12 Acceleration (Y)
 Driver Lower Spine T12 Acceleration (Z)
 Passenger Upper Thorax Rib Deflection (Y)

Passenger Middle Thorax Rib Deflection (Y)
 Passenger Lower Thorax Rib Deflection (Y)
 Passenger Upper Abdomen Rib Deflection (Y)
 Passenger Lower Abdomen Rib Deflection (Y)
 Driver Head Acceleration Redundant (X)
 Driver Head Acceleration Redundant (Y)
 Driver Head Acceleration Redundant (Z)
 Passenger Head Acceleration Redundant (X)
 Passenger Head Acceleration Redundant (Y)
 Passenger Head Acceleration Redundant (Z)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
 Vehicle Center of Gravity Acceleration (Y)
 Vehicle Center of Gravity Acceleration (Z)
 Right Side Sill at Front Seat Acceleration (X)
 Right Side Sill at Front Seat Acceleration (Y)
 Right Side Sill at Front Seat Acceleration (Z)
 Right Side Sill at Rear Seat Acceleration (X)
 Right Side Sill at Rear Seat Acceleration (Y)
 Right Side Sill at Rear Seat Acceleration (Z)
 Left Side Sill at Front Seat Acceleration (Y)
 Left Side Sill at Rear Seat Acceleration (Y)
 Lower A-Post Acceleration (Y)
 Middle A-Post Acceleration (Y)
 Lower B-Post Acceleration (Y)
 Middle B-Post Acceleration (Y)
 Front Seat Track Acceleration (Y)
 Rear Seat Structure Acceleration (Y)
 Right Rear Occupant Compartment Acceleration (Y)
 Engine Block (X)
 Engine Block (Y)
 Rear Floorpan Above Axle Acceleration (X)
 Rear Floorpan Above Axle Acceleration (Y)
 Rear Floorpan Above Axle Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)
 MDB Center of Gravity Acceleration (Y)
 MDB Center of Gravity Acceleration (Z)
 MDB Rear Acceleration (X)
 MDB Rear Acceleration (Y)
 Left MDB Contact Switch
 Right MDB Contact Switch

1.8 APPENDIX C - DUMMY PERFORMANCE CALIBRATION TEST DATA

APPENDIX C includes the pre- and post-test calibration data for the test dummies. The following data tables and plots shall be included in the order indicated below (See calibration test procedures or 49 CFR §572, Subpart U (for ES-2re) or Subpart V (for SID-IIs)).

TABLE OF CALIBRATION MEASUREMENTS AND PLOTS**ES-2re (Driver) Dummy****Description****Table 1.** External Measurements**Table 2.** Head Drop Test

Resultant Head Acceleration (G's) vs. Time (ms)

Head (X) Acceleration (G's) vs. Time (ms)

Head (Y) Acceleration (G's) vs. Time (ms)

Head (Z) Acceleration (G's) vs. Time (ms)

Table 3 Neck Pendulum Test

Pendulum Acceleration (G's) vs. Time (ms)

Pendulum Velocity (m/s) vs. Time (ms)

Flexion Angle (°) vs. Time (ms)

Potentiometer A (°) vs. Time (ms)

Potentiometer B (°) vs. Time (ms)

Potentiometer C (°) vs. Time (ms)

Table 4. Shoulder Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Table 5. Thorax – Upper Rib Drop Test

Upper Rib Displacement @ 459 mm Drop Height (mm) vs. Time (ms)

Upper Rib Displacement @ 815 mm Drop Height (mm) vs. Time (ms)

Table 6. Thorax – Middle Rib Drop Test

Middle Rib Displacement @ 459 mm Drop Height (mm) vs. Time (ms)

Middle Rib Displacement @ 815 mm Drop Height (mm) vs. Time (ms)

Table 7. Thorax – Lower Rib Drop Test

Lower Rib Displacement @ 459 mm Drop Height (mm) vs. Time (ms)

Lower Rib Displacement @ 815 mm Drop Height (mm) vs. Time (ms)

Table 8. Thorax – Full Body Impact Test

Pendulum Acceleration (G's) vs. Time (ms)

Impactor Force (kN) vs. Time (ms)

Upper Rib Displacement (mm) vs. Time (ms)

Middle Rib Displacement (mm) vs. Time (ms)

Lower Rib Displacement (mm) vs. Time (ms)

Table 9. Abdomen Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Impactor Force (kN) vs. Time (ms)

Total Abdomen Force (kN) vs. Time (ms)

Front Abdomen Force (kN) vs. Time (ms)

Middle Abdomen Force (kN) vs. Time (ms)

Rear Abdomen Force (kN) vs. Time (ms)

Table 10. Lumbar Spine Flexion Test

Pendulum Acceleration (G's) vs. Time (ms)

Pendulum Velocity (m/s) vs. Time (ms)

Spine Flexion Angle (°) vs. Time (ms)
 Potentiometer A (°) vs. Time (ms)
 Potentiometer B (°) vs. Time (ms)
 Potentiometer C (°) vs. Time (ms)

Table 11. Pelvis Impact Test

Pendulum Acceleration (G's) vs. Time (ms)
 Impactor Force (kN) vs. Time (ms)
 Pubic Symphysis (Y) Force (kN) vs. Time (ms)

TABLE OF CALIBRATION MEASUREMENTS AND PLOTS

SID-IIs (Rear Passenger) Dummy

Description

Table 1. External Measurements

Table 2. Head Drop Test

Resultant Head Acceleration (G's) vs. Time (ms)
 Head (X) Acceleration (G's) vs. Time (ms)
 Head (Y) Acceleration (G's) vs. Time (ms)
 Head (Z) Acceleration (G's) vs. Time (ms)

Table 3. Lateral Neck Pendulum Test

Pendulum Acceleration (G's) vs. Time (ms)
 Pendulum Velocity (m/s) vs. Time (ms)
 Neck (X) Force (N) vs. Time (ms)
 Neck (X) Moment (Nm) vs. Time (ms)
 Flexion Angle (°) vs. Time (ms)
 Moment About Occipital Condyle (Nm) vs. Time (ms)
 D-Plane Rotation (°) vs. Time (ms)

Table 4. Shoulder Impact Test

Impactor Acceleration (G's) vs. Time (ms)
 Shoulder Displacement (mm) vs. Time (ms)
 Upper Spine Acceleration (G's) vs. Time (ms)

Table 5. Thorax (With Arm) Impact Test

Impactor Acceleration (G's) vs. Time (ms)
 Shoulder Displacement (mm) vs. Time (ms)
 Upper Rib Displacement (mm) vs. Time (ms)
 Middle Rib Displacement (mm) vs. Time (ms)
 Lower Rib Displacement (mm) vs. Time (ms)
 Upper Spine Acceleration (G's) vs. Time (ms)
 Lower Spine Acceleration (G's) vs. Time (ms)

Table 6. Thorax (Without Arm) Impact Test

Impactor Acceleration (G's) vs. Time (ms)
 Upper Rib Displacement (mm) vs. Time (ms)
 Middle Rib Displacement (mm) vs. Time (ms)
 Lower Rib Displacement (mm) vs. Time (ms)
 Upper Spine Acceleration (G's) vs. Time (ms)
 Lower Spine Acceleration (G's) vs. Time (ms)

Table 7. Abdomen Impact Test

Impactor Acceleration (G's) vs. Time (ms)
 Upper Abdominal Rib Displacement (mm) vs. Time (ms)
 Lower Abdominal Rib Displacement (mm) vs. Time (ms)

Lower Spine Acceleration (G's) vs. Time (ms)

Table 8. Pelvis Plug Quasi-Static Test (Optional*)

Table 9. Pelvis Acetabulum Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Pelvis (Y) Acceleration (G's) vs. Time (ms)

Acetabulum Force (N) vs. Time (ms)

Table 10. Pelvis Iliac Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Pelvis (Y) Acceleration (G's) vs. Time (ms)

Iliac Force (N) vs. Time (ms)

* - *If pre-certified pelvis plugs are used during the calibration tests, include a copy of the certification data provided by the supplier.*

1.9 APPENDIX D – TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

APPENDIX D should identify all test equipment, dummy sensors, potentiometers, and load cells used to collect data during the test. Calibration dates for each should be provided for each, as indicated in the sample tables below. Comments should also be included, if appropriate.

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X			
		Y			
		Z			
	Redundant	X			
		Y			
		Z			
Thorax Rib Displacement Potentiometers	Upper	Y			
	Middle	Y			
	Lower	Y			
Abdomen Load Cells	Forward	Y			
	Middle	Y			
	Rear	Y			
Lower Spine Accelerometers (T12)		X			
		Y			
		Z			
Pubic Symphysis Load Cell		Y			

TABLE 2 – Dummy Instrumentation (SID-IIs)

			SID-IIs S/N		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X			
		Y			
		Z			
	Redundant	X			
		Y			
		Z			
Displacement Potentiometers	Thoracic Rib	Upper	Y		
		Middle	Y		
		Lower	Y		
	Abdominal Rib	Upper	Y		
		Lower	Y		
Lower Spine Accelerometers (T12)		X			
		Y			
		Z			
Acetabulum Load Cell		Y			
Iliac Wing Load Cell		Y			
Pelvis Plug (struck side)					
Pelvis Plug (non-struck side)					

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X			
	Vehicle Center of Gravity	Y			
	Vehicle Center of Gravity	Z			
2	Right Sill at Front Seat	X			
	Right Sill at Front Seat	Y			
	Right Sill at Front Seat	Z			
3	Right Sill at Rear Seat	X			
	Right Sill at Rear Seat	Y			
	Right Sill at Rear Seat	Z			
4	Left Sill at Front Door	Y			
5	Left Sill at Rear Door	Y			
6	Left A-Post Lower	Y			
7	Left A-Post Middle	Y			
8	Left B-Post Lower	Y			
9	Left B-Post Middle	Y			
10	Front Seat Track	Y			
11	Rear Seat Track or Structure	Y			
12	Right Rear Occ. Compartment	Y			
13	Engine Block	X			
	Engine Block	Y			
14	Rear Floorpan Above Axle	X			
	Rear Floorpan Above Axle	Y			
	Rear Floorpan Above Axle	Z			

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X			
MDB Center of Gravity	Y			
MDB Center of Gravity	Z			
Left Frame at Rear Axle Centerline	X			
Left Frame at Rear Axle Centerline	Y			

2. DATA SHEETS

Data Sheets are provided as templates to document test data in the Final Test Report format outlined in the previous section. The Contractor is not restricted from using other tools or expanding the Data Sheets provided in this section. Nevertheless, for consistency and uniformity in reporting data, the Contractor must present, at a minimum, all information in the following Data Sheets in the Draft Test Report and in the Final Test Report. This data must be presented in the order outlined in Section 1 of this Appendix.

**DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.		Traction Control System (TCS)	
Model Year		Auto-Leveling System	
Make		Automatic Door Locks (ADL)	
Model		Power Window Auto-Reverse	
Body Style		Other Optional Feature	
VIN		Driver Front Airbag	
Body Color		Driver Curtain Airbag	
Odometer Reading (km/mi)		Driver Head/Torso Airbag	
Engine Displacement (L)		Driver Torso Airbag	
Type/No. Cylinders		Driver Torso/Pelvis Airbag	
Engine Placement		Driver Pelvis Airbag	
Transmission Type		Driver Knee Airbag	
Transmission Speeds		Rear Pass. Curtain Airbag	
Overdrive		Rear Pass. Head/Torso Airbag	
Final Drive		Rear Pass. Torso Airbag	
Roof Rack		Rear Pass. Torso/Pelvis Airbag	
Sunroof/T-Top		Rear Pass. Pelvis Airbag	
Running Boards		Driver Seat Belt Pretensioner	
Tilt Steering Wheel		Rear Pass. Seat Belt Pretensioner	
Power Seats		Driver Load Limiter	
Anti-Lock Brakes (ABS)		Rear Pass. Load Limiter	
		Other Safety Restraint	

Does owner's manual provide instructions to turn off automatic door locks?

DATA FROM CERTIFICATION LABEL

Manufactured By		GVWR (kg)	
Date of Manufacture		GAWR Front (kg)	
Vehicle Type		GAWR Rear (kg)	

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)				
Capacity Weight (VCW) (kg)				
DSC x 68.04 (kg)				
Cargo Weight (RCLW) (kg)				

(A)
(B)
(A-B)

VEHICLE SEAT TYPE

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat							
Rear or Second Row Seat							
Third Row Seat							

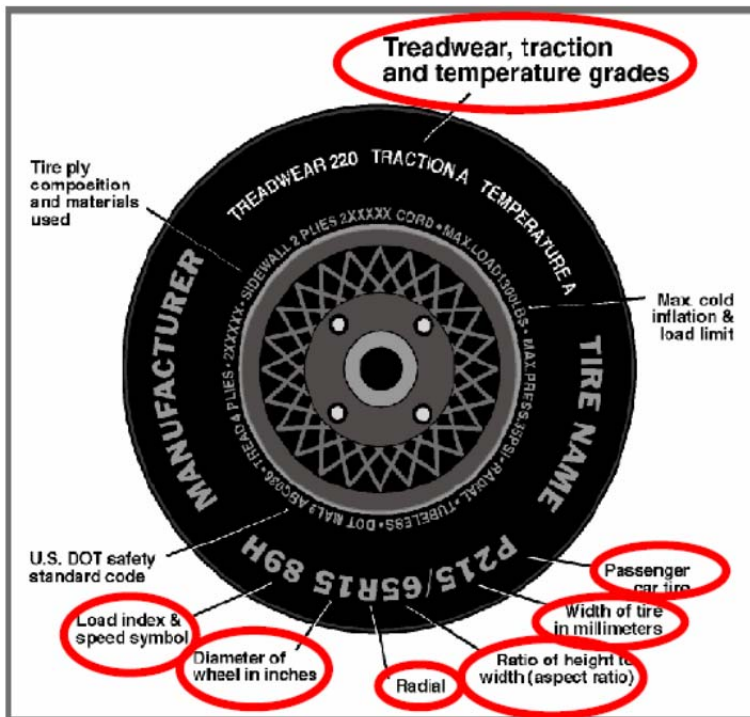
**DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

VEHICLE TIRE INFORMATION

Collect year, make, model, VIN, items circled in red, and tire manufacturer and tire name.



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)		
Cold Pressure (kPa)		
Recommended Tire Size		
Tire Size on Vehicle		
Tire Manufacturer		
Tire Model		
Treadwear		
Traction		
Temperature Grades		
Tire Plies Sidewall		
Tire Plies Body		
Load Index/Speed Symbol		
Tire Material		
DOT Safety Code Left		
DOT Safety Code Right		

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa				
Tire Placard	kPa				
Owner's Manual	kPa				
As Tested	kPa				

MDB TIRE SPECIFICATIONS

	Units	Requirement	LF	RF	LR	RR
Tire Size		P205/75R15				
Tire Pressure	kPa	200 ± 21				

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg									
Right	kg									
Ratio	%									
Totals	kg									

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg		(A)
Sum of Actual Weight of 2 P572 ATDS Used	kg		(B)
Rated Cargo/Luggage Weight (RCLW)	kg		(C)
Calculated Target Vehicle Test Weight (TVTW)	kg		(A+B+C)

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to 9 kg)? YES NO

TEST VEHICLE ATTITUDE AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Requirement***
LF	mm			
RF	mm			
RR	mm			
LR	mm			
Vehicle CG (Aft of Front Axle)	mm			
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm			

***The "As Tested" vehicle attitude measurements must be equal to or within ± 10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirement".

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Ballast (if any)	

DATA SHEET NO. 2
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passengers' seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat			
Front Passenger Seat			
Front Center Seat*			
Struck Side Rear Seat			
Non-Struck Side Rear Seat			
Rear Center Seat*			

*If applicable

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore/Aft	Forward-Most
Driver Seat			Max			
			Mid			
			Min			
Front Passenger Seat			Max			
			Mid			
			Min			
Front Center Seat*			Max			
			Mid			
			Min			
Struck Side Rear Seat			Max			
			Mid			
			Min			
Non-Struck Side Rear Seat			Max			
			Mid			
			Min			
Rear Center Seat*			Max			
			Mid			
			Min			

*If applicable

DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

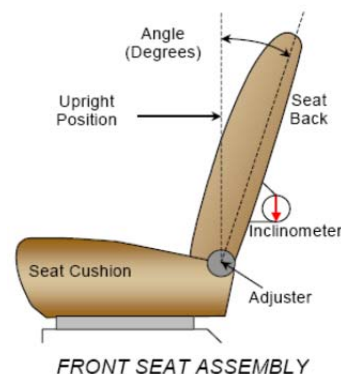
SEAT FORE/AFT POSITION

Seat	Total Fore/Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat				
Front Passenger Seat				
Front Center Seat*				
Struck Side Rear Seat				
Non-Struck Side Rear Seat				
Rear Center Seat*				

*If applicable

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck side rear seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck-side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degree	Detent*
Driver Seat w/ Seated Dummy				
Front Passenger Seat				
Front Center Seat*				
Struck Side Rear Seat w/ Seated Dummy				
Non-Struck Side Rear Seat				
Rear Center Seat*				

*If applicable

DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1.

	Total # of Positions	Placed in Position #
Driver Seat		
Rear Seat		

HEAD RESTRAINT ADJUSTMENT

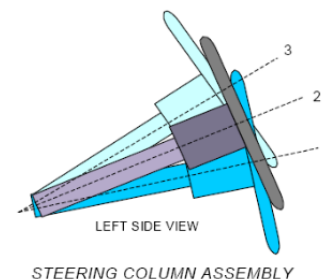
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat		
Rear Seat		

STEERING COLUMN ADJUSTMENT

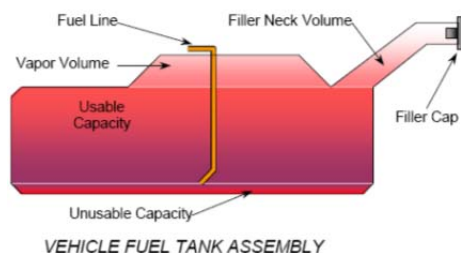
Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1		
Geometric Center – Position 2		
Uppermost – Position 3		
Telescoping Steering Wheel Travel		
Test Position		



FUEL PUMP

Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck.



DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: _____ **NHTSA No.:** _____
Test Program: _____ **Test Date:** _____

FUEL TANK CAPACITY

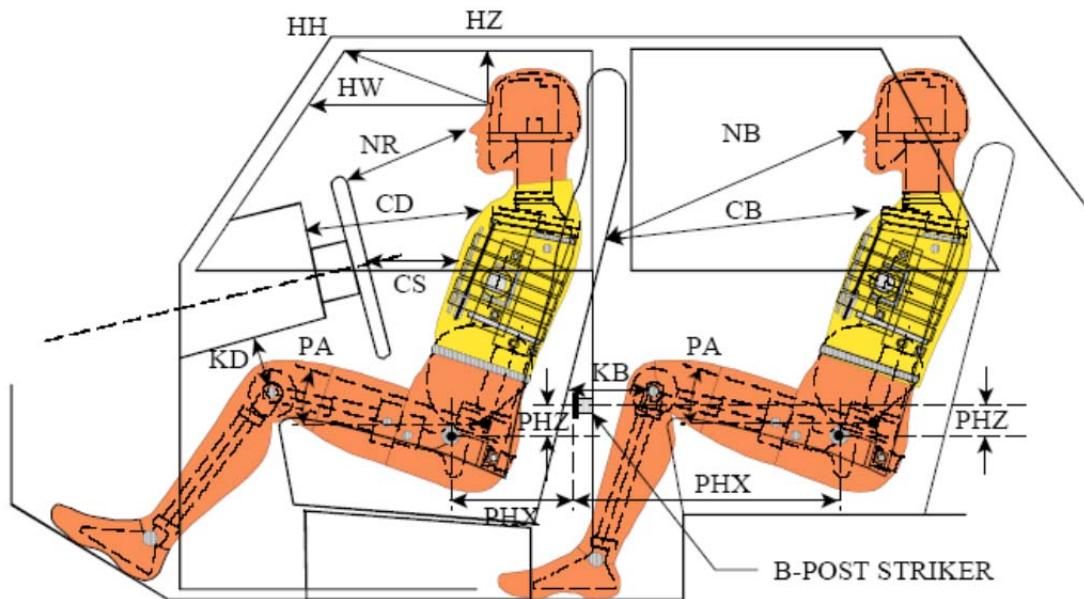
	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of Standard Tank (see Owner's Manual)	
Usable Capacity of Optional Tank (see Owner's Manual)	
93% of Usable Capacity	
Actual Amount of Solvent Used in Test	
1/3 of Usable Capacity	

Is the Actual Amount of Solvent Used in the test equal to 93% ± 1% of the Usable Capacity stated in on Form No. 1? YES NO

**DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



LEFT SIDE VIEW

NOTE: 2-DOOR VEHICLE SHOWN.
REAR DUMMY PHX & PHZ
MEASUREMENTS FOR A 4-DOOR
VEHICLE WOULD USE THE C-POST
STRIKER AS A REFERENCE POINT

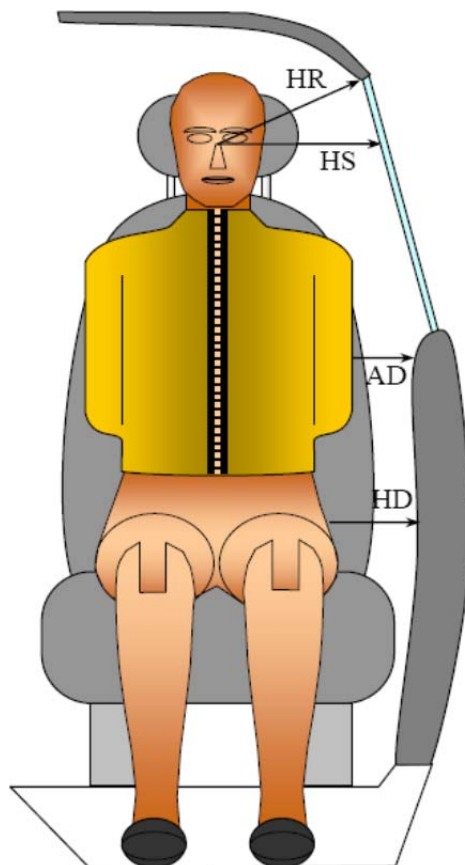
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Measurement Description	Driver		Passenger	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header				
HW		Header to Windshield				
HZ	HZ	Head to Roof Liner				
NR	NB	Nose to Rim/Seat Back				
CD	CB	Chest to Dash/Seat Back				
CS		Chest to Steering Wheel				
KD(L)/KDA(L) [°]	KB(L)/KBA(L) [°]	Left Knee to Dash/Seat Back				
KD(R)/KDA(R) [°]	KB(R)/KBA(R) [°]	Right Knee to Dash/Seat Back				
PAX [°]	PAX [°]	Pelvic Tilt Angle X				
	PAY [°]	Pelvic Tilt Angle Y				
PHX	PHX	Hip Point to Striker (X-Axis)				
PHZ	PHZ	Hip Point to Striker (Z-Axis)				

**DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



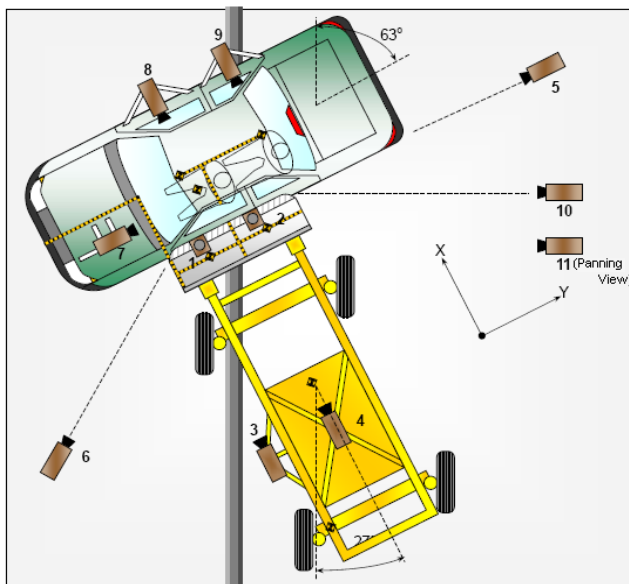
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Description	Units	Driver	Passenger
HR	Head to Side Header	mm		
HS	Head to Side Window	mm		
AD	Arm to Door	mm		
HD	Hip Point to Door	mm		

**DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall					
2	Overhead Close-up					
3	Left Impact Point (MDB)					
4	Side Overall (MDB)					
5	Rear					
6	Left Front					
7	Driver Front (OB)					
8	Driver Side (OB)					
9	Passenger Side (OB)					
10	Real-time Left Rear					
11	Real-time Inrun					

Reference: Impact Point projected to Ground; +X = To Front of MDB, +Y = To Right of MDB, +Z = Down
*All measurements accurate to ± 6 mm.

If applicable, explain why camera(s) did not operate as intended: _____

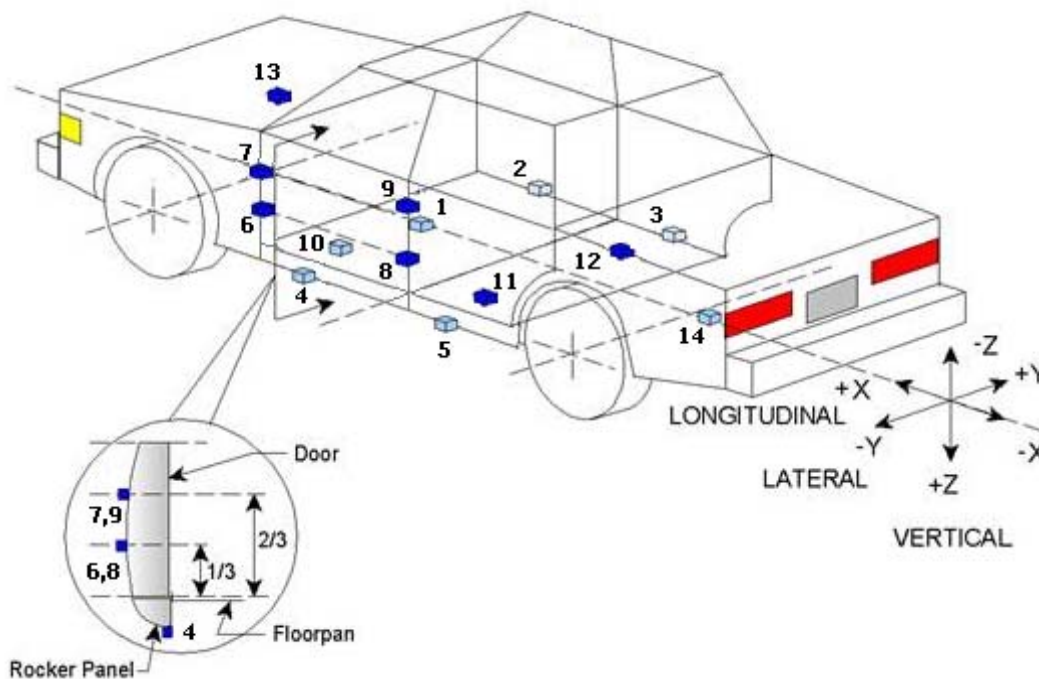
INSTRUMENTATION

Driver Dummy Channels	
Passenger Dummy Channels	
Vehicle Structure Accelerometers	
MDB Accelerometers	
Total	

**DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



TEST VEHICLE ACCELEROMETER LOCATIONS

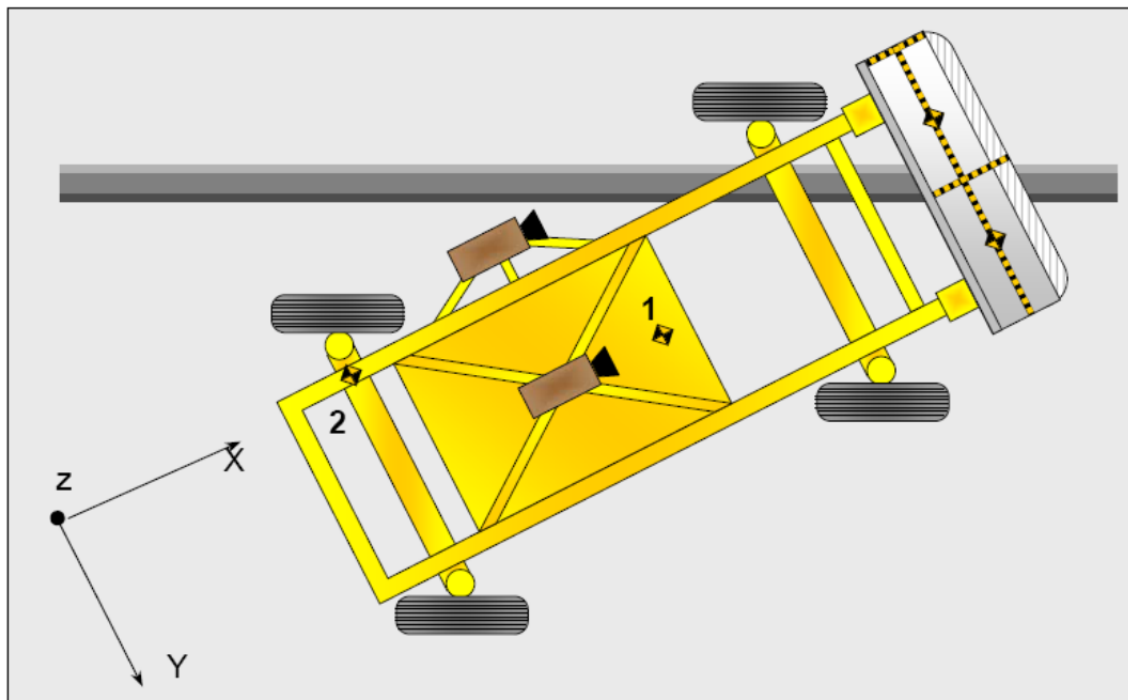
Loc. No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG			
2	Right Sill at Front Seat			
3	Right Sill at Rear Seat			
4	Left Sill at Front Door			
5	Left Sill at Rear Door			
6	A-Post Lower			
7	A-Post Middle			
8	B-Post Lower			
9	B-Post Middle			
10	Front Seat Track			
11	Rear Seat Structure			
12	Rt. Rear Occ. Compartment			
13	Engine Block			
14	Rear Above Axle			

Reference: X – Rear surface of vehicle (+ forward)
Y – Vehicle centerline (+ to right)
Z – Ground plane (+ down)

DATA SHEET NO. 7
MDB ACCELEROMETER LOCATIONS

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



MDB ACCELEROMETER LOCATIONS

Loc No.	Accelerometer Locations	Coordinates (mm)		
		X	Y	Z
1	MDB CG			
2	MDB Rear			

Reference: X – Face of MDB (+ forward)
Y – MDB centerline (+ to right)
Z – Ground plane (+ down)

**DATA SHEET NO. 8
POST-TEST OBSERVATIONS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face		
Top of Head		
Left Side of Head		
Back of head		
Left Shoulder		
Upper Torso		
Lower Torso		
Left Hip		
Left Knee		

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other Door
	Front	Rear	Front	Rear	
Remained Closed and Operational					
Total Separation from Vehicle at Hinges or Latches					
Latch or Hinge Systems Pulled Out of Their Anchorages					
Disengaged from Latched Position					
Latch Separated from Striker					
Jammed Shut					
If Door Opened at Striker, Record Width of Opening at Striker (mm)					

**** NOTE:** Indicate "Yes", "No", or "N/A".

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track				
Seat Disengagement from Floor pan				
Seat Back Movement from Initial Position				
Seat Back Collapse				

**** NOTE:** Indicate "Yes", "No", or "N/A".

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	
Sill Separation	
Windshield Damage	
Side Window Damage	
Other Notable Effects	

**DATA SHEET NO. 8 (CONTINUED)
POST-TEST OBSERVATIONS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag				
Knee Airbag				
Side Airbag 1 (Indicate Type)				
Side Airbag 2 (Indicate Type, if app.)				
Side Airbag 3 (Indicate Type, if app.)				
Seat Belt Pretensioner				
Seat Belt Load Limiter				
Other				

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		
Vertical Impact Reference Line (Aft of Front Axle)(Intended Impact Point)	mm		
Actual Impact Point (Aft of Front Axle)	mm		
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	

**DATA SHEET NO. 9
MDB SUMMARY OF RESULTS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	
Overall Length Including Honeycomb Frame	
Wheel Base of Framework Carriage	
CG Location of Front Axle	

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg			
Right	kg			
Ratio	%			
Totals	kg			

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	

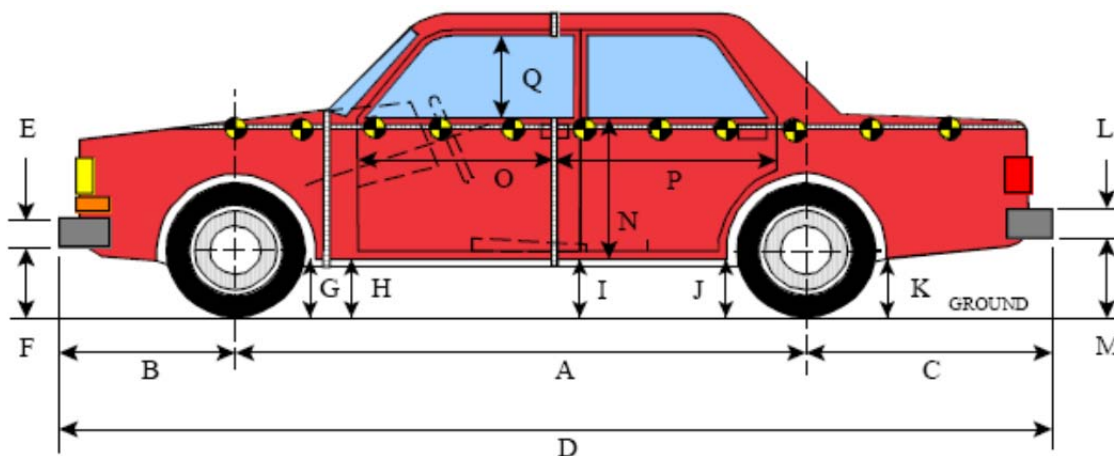
MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Row	Vertical Location		From Centerline		Maximum Crush
	Description	Height	Distance	Direction	
A	Center of Bumper	432	800		
B	Top of Bumper	533	700		
C	Mid-Level	686	800		
D	Top of Stack	813	800		

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



LEFT SIDE VIEW

All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3 mm

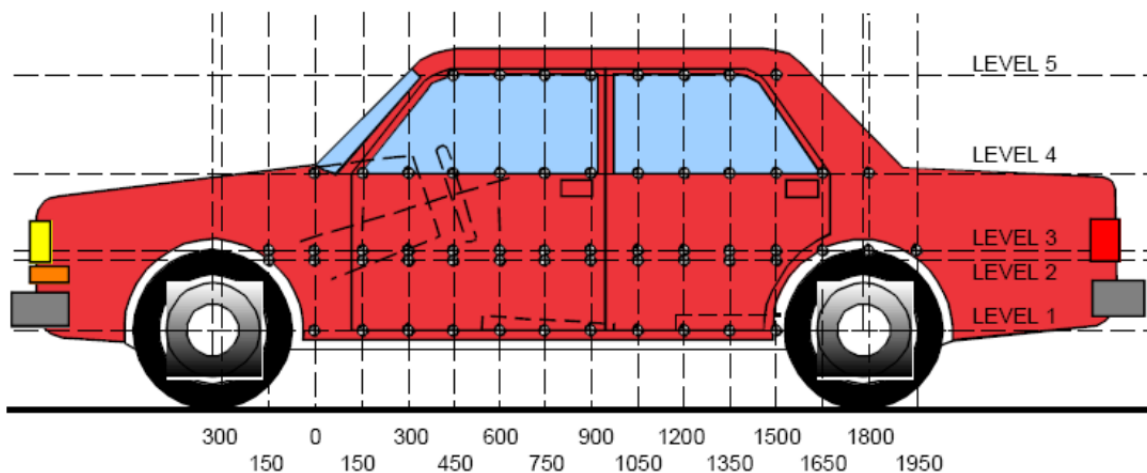
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase			
B	Front Axle to FSOV			
C	Rear Axle to RSOV			
D	Total Length at Centerline			
E	Front Bumper Thickness			
F	Front Bumper Bottom to Ground			
G	Sill Height at Front Wheel Well			
H	Sill Height at Front Door Leading Edge			
I	Sill Height at B Pillar			
J1	Sill Height at Rear Wheel Well			
J2	Pinch Weld Height at Rear Wheel Well			
K	Sill Height Aft of Rear Wheel Well			
L	Rear Bumper Thickness			
M	Rear Bumper Bottom to Ground			
N	Sill Height to Bottom of Front Window Sill			
O	Front Door Leading Edge to Impact CL			
P	Rear Door Trailing Edge to Impact CL			
Q	Front Window Opening			
R	Right Side Length			
S	Left Side Length			
T	Maximum Vehicle Width			

**DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top			
2	Driver Hip Point			
3	Mid-Door			
4	Window Sill			
5	Window Top			

NOTE: *The above measurements should be taken along the vertical impact reference line. Vehicle measurements forward of the vertical impact reference line are negative.*

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

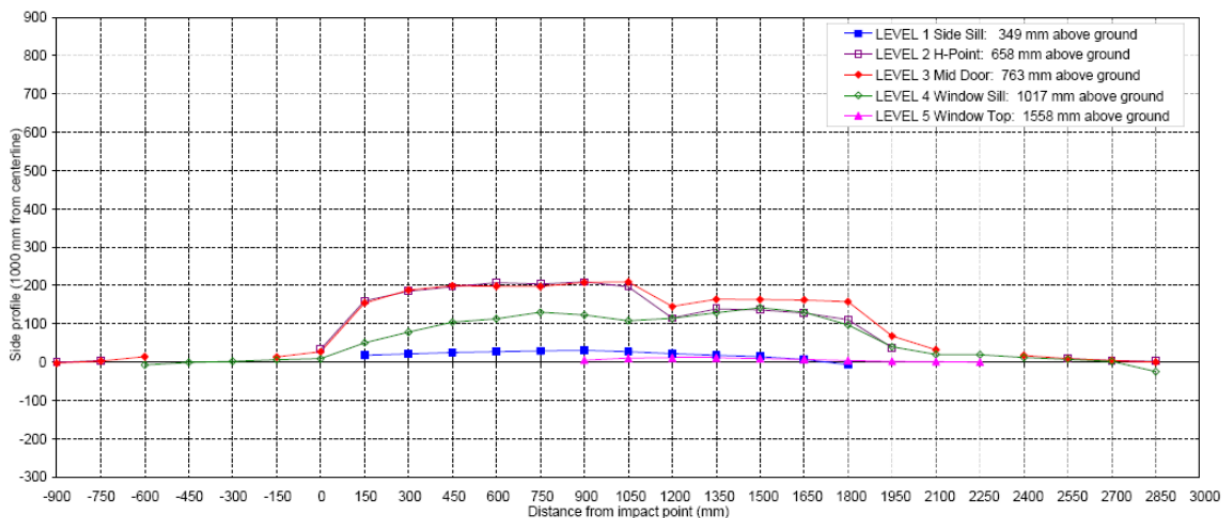
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300															
-150															
0															
150															
300															
450															
600															
750															
900															
1050															
1200															
1350															
1500															
1650															
1800															
1950															
2100															
2250															
2400															
2550															
2700															
2850															

NOTE: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point.

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

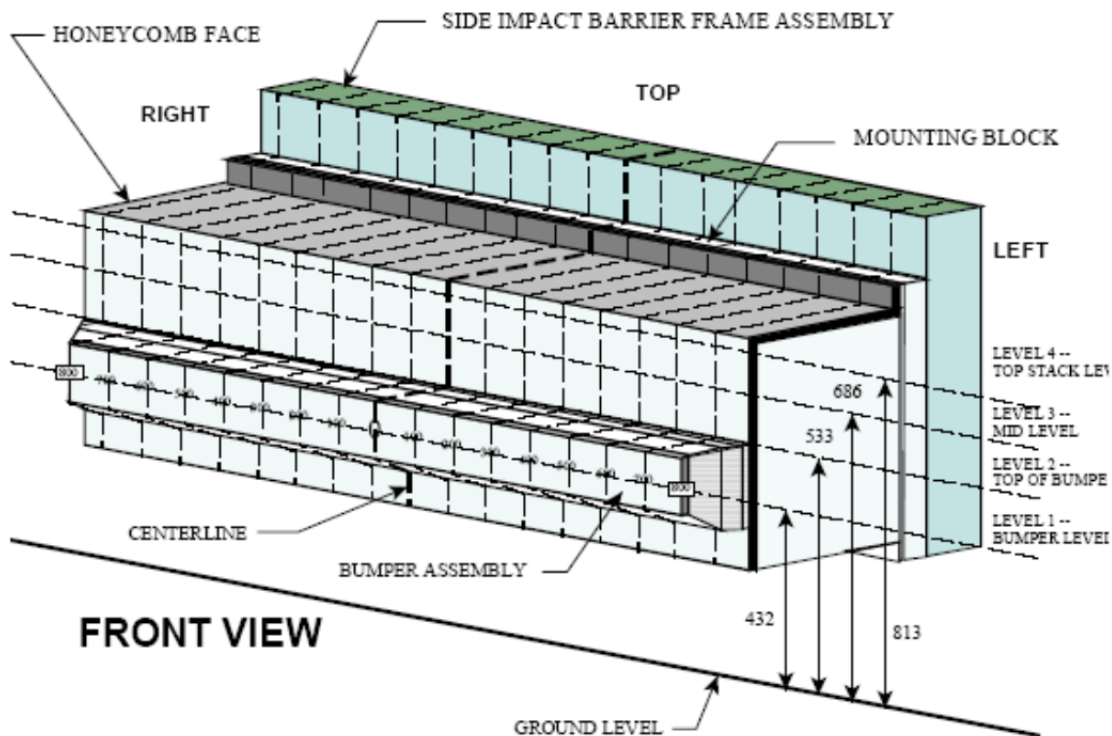


A visual representation of the vehicle exterior crush measurements, such as the one above, should be placed in this space.

**DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



NOTE: Dimensions are shown in millimeters, mm

DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center								
	800	700	600	500	400	300	200	100		0	100	200	300	400	500	600	700	800
1									0									
2									0									
3									0									
4									0									

**DATA SHEET NO. 13
FMVSS NO. 301 STATIC ROLLOVER RESULTS**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

Test Time: _____ Temperature: _____

- A. From impact until vehicle motion ceases: _____ oz.
(Maximum allowable is 1 oz.)
- B. For the 5-minute period after motion ceases: _____ oz.
(Maximum allowable is 5 oz.)
- C. For the following 25 minutes: _____ oz.
(Maximum allowable is 1 oz./minute)
- D. Spillage Details: _____

FMVSS NO. 301 STATIC ROLLOVER DATA



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0 to 90			
90 to 180			
180 to 270			
270 to 360			

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0 to 90				
90 to 180				
180 to 270				
270 to 360				

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0 to 90	
90 to 180	
180 to 270	
270 to 360	

DATA SHEET NO. 14
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

Please place the temperature and humidity stabilization chart/data for both dummies and test vehicle in this space.

3. FORMS

Forms, like Data Sheets, are provided as **tools** to use in the exchange of data between the COTR and the Contractor. Forms, unlike Data Sheets, **are not part** of the Final Test Report. The Contractor is not restricted from using other tools or expanding the forms outlined in this section.

A. **Form No. 1 – Test Vehicle Information**

A “Test Vehicle Information” form will be supplied by the COTR to the Contractor before testing preparation. Information on this form is supplied by the automobile manufacturer to aid in the initial test setup and shall be considered as **reference material**. After vehicle preparation is complete, the Test Vehicle Information form shall be retained by the Contractor for at least five (5) years.

B. **Form No. 2 - Vehicle Condition Report**

A “Vehicle Condition Report” form must be submitted to the COTR with the copies of the Final Test Report. The first page of the form shall be completed when the test vehicle arrives at the testing laboratory. The second page of the form is completed after the test. The forms shall be **legible** (hand written forms are unacceptable) and **complete** (all information requested is filled out).

C. **Form No. 3 - Laboratory Notice of Test Failure**

A “Laboratory Notice of Test Failure” form will be submitted to the NHTSA COTR to report a test failure. Performance requirements can be found in Section 2, General Requirements, of the Side NCAP MDB Laboratory Test Procedure. The failure shall be described **thoroughly** in the space provided.

D. **Form No. 4 - Monthly Vehicle Status Report**

A “Monthly Vehicle Status Report” form shall be submitted to the COTR each month until all vehicles have been discarded.

E. **Form No. 5 - QuickLook Report**

The QuickLook Report is a preliminary summary of the test. It should be filled out in its entirety. A completed QuickLook Report includes data traces. Anything interesting or out of the ordinary should be noted in the “Comments” field of the form.

TEST VEHICLE INFORMATION (FORM 1)

NCAP Frontal, Side MDB, and Side Pole Tests

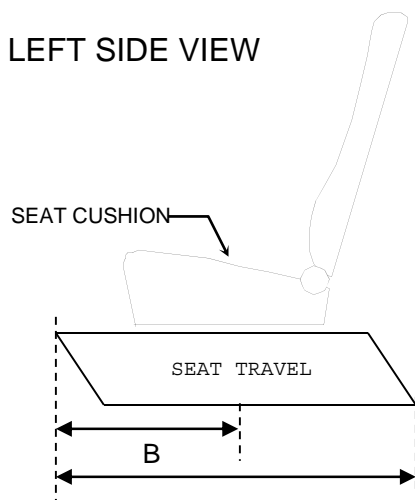
Vehicle Model Year and Make: _____

Vehicle Model and Body Style: _____

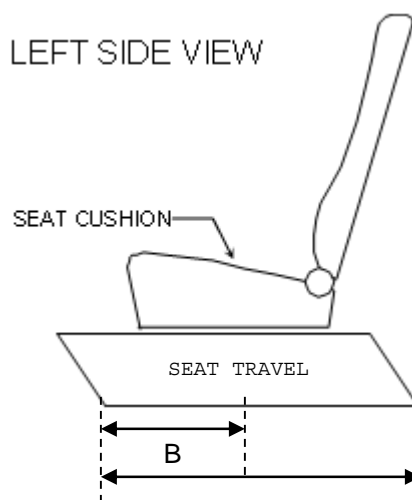
1. SEAT FORE-AFT POSITION, CUSHION ANGLE, AND HEIGHT

Provide instructions for positioning the driver, front outboard passenger, and rear left passenger seat(s) in their testing positions. Since seat positioning procedures differ between the Frontal NCAP 50th male and the Side NCAP 50th male, two diagrams are provided below to assist in positioning the seat. These diagrams assume that the seat will move forward if the seat cushion is moved upward in height.

SEAT POSITIONING FOR FRONTAL NCAP 50TH PERCENTILE MALE



SEAT POSITIONING FOR ALL OTHER NCAP DUMMIES



A = Total range of seat travel; B = Mid-track position

For more clarification regarding foremost and rearmost seat positions, please refer to FMVSS 208 S8.1.2 (50th Male Driver), FMVSS 208 S16.2.10.3 (5th Female Front Passenger), FMVSS 214 S8.3.1.3 (50th Male Driver), FMVSS 214 S10.3.2.3 (5th Female Driver), and FMVSS 214 S8.3.3.3 (5th Female Rear Passenger).

1.1 Driver's Seat

1.1A Seat Fore-Aft Positioning

Depending on the seat track adjuster type, complete one of the tables below.

<i>Manual Seat Track Adjuster</i>	
Total number of detents:	
Frontal impact test detent* (50 th percentile male):	
Side impact test detent* (50 th percentile male):	
Side impact test detent* (5 th percentile female):	

* For manual seat track adjustments, test detent is measured from foremost detent, which is defined as 0.

<i>Power Seat Track Adjuster</i>	
Complete range of travel as determined for Frontal NCAP (mm):	
Frontal impact test distance from the foremost position (50 th percentile male):	
Complete range of travel as determined for Side NCAP (mm):	
Side impact test distance from the foremost position (50 th percentile male):	
Side impact test distance from the foremost position (5 th percentile female):	

1.1B Seat Cushion Angle

If the seat cushion angle is adjustable while maintaining the test fore-aft seat track position, describe the angle used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Frontal Impact - 50 th Male		
Side Impact – 50 th Male		
Side Impact – 5 th Female		

1.1C Seat Cushion Height

If the seat and/or seat cushion height is adjustable at the test fore-aft seat track position and can be adjusted so that the seat cushion angle can be at the angle used in the certification test, describe the height used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Height Used	Additional Description
Frontal Impact - 50 th Male		
Side Impact – 50 th Male		
Side Impact – 5 th Female		

1.1D Provide any other instructions for positioning the driver’s seat at the required test position(s):

Frontal: _____

Side MDB: _____

Side Pole: _____

1.2 Front Outboard Passenger Seat (5th percentile dummy in frontal impact only)

1.2A *Seat Fore-Aft Positioning*

Depending on the seat track adjuster type, complete one of the tables below.

<i>Manual Seat Track Adjuster</i>	
Total number of detents:	
Frontal impact test detent* (5 th percentile female):	

* For manual seat track adjustments, test detent is measured from foremost detent, which is defined as 0.

<i>Power Seat Track Adjuster</i>	
Complete range of travel (mm):	
Frontal impact test distance from the foremost position (5 th percentile female):	

1.2B *Seat Cushion Angle*

If the seat cushion angle is adjustable while maintaining the test fore-aft seat track position, describe the angle used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Frontal Impact - 5 th Female		

1.2C *Seat Cushion Height*

If the seat and/or seat cushion height is adjustable at the test fore-aft seat track position and can be adjusted so that the seat cushion angle can be at the angle used in the certification test, describe the height used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Frontal Impact - 5 th Female		

1.2D Provide any other instructions for positioning the front passenger seat at the required test position:

Frontal: _____

In addition, please indicate the manufacturer of the 5th percentile dummy used for FMVSS 208 crash test certification: _____

1.3 Rear Seats (5th percentile dummy in MDB side impact only)

1.3A *Seat Fore-Aft Positioning*

Depending on the seat track adjuster type, complete one of the tables below.

<i>Manual Seat Track Adjuster</i>	
Total number of detents:	
Side impact test detent* (5 th percentile female):	

* For manual seat track adjustments, test detent is measured from foremost detent, which is defined as 0.

<i>Power Seat Track Adjuster</i>	
Complete range of travel (mm):	
Side impact test distance from the foremost position (5 th percentile female):	

1.3B *Seat Cushion Angle*

If the seat cushion angle is adjustable while maintaining the test fore-aft seat track position, describe the angle used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Side Impact - 5 th Female		

1.3C *Seat Cushion Height*

If the seat and/or seat cushion height is adjustable at the test fore-aft seat track position and can be adjusted so that the seat cushion angle can be at the angle used in the certification test, describe the height used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Side Impact - 5 th Female		

1.3D Provide any other instructions for positioning the rear seat at the required test position:

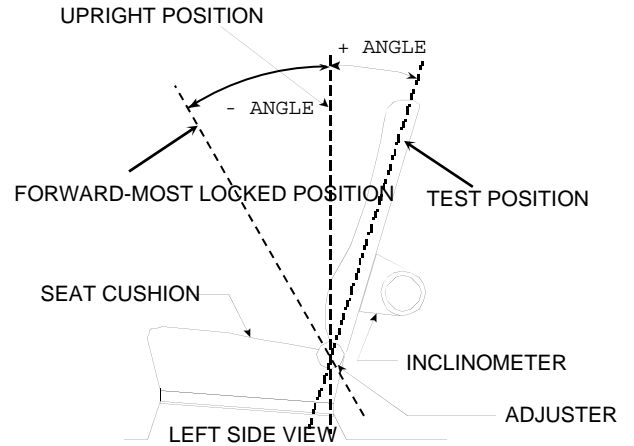
Side MDB: _____

2. SEAT BACK ANGLE

2.1 Driver's Seat

With the seat in the test fore-aft seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Frontal Impact – 50 th Male	
Side Impact – 50 th Male	
Side Impact – 5 th Female	



With the seat in the test fore-aft seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: For the frontal impact test and the side impact test with the 50th male dummy, the seat back angle will be set to the Nominal Design Position. For the side impact test with the 5th female dummy, the seat back angle will be determined by the related dummy seating procedure.)

Dummy	Angle
Frontal Impact – 50 th Male	
Side Impact – 50 th Male	
Side Impact – 5 th Female	

For the 50th percentile male, is the seat back angle measured with the dummy in the seat?

Frontal: YES NO
 Side: YES NO

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).) *If possible, include measurement from bottom front of head rest post to outboard sun visor anchor, or from bottom back of head rest post to middle of rear door striker.*

Frontal: _____

Side MDB: _____

Side Pole: _____

2.2 Front Outboard Passenger Seat (5th percentile female in frontal impact only)

With the seat in the test seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Frontal Impact – 5 th Female	

With the seat in the test seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: The seat back angle will be determined by the related dummy seating procedure for the frontal impact test.)

Dummy	Angle
Frontal Impact – 5 th Female	

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).) *If possible, include measurement from bottom front of head rest post to outboard sun visor anchor, or from bottom back of head rest post to middle of rear door striker.*

Frontal: _____

Side MDB: _____

Side Pole: _____

2.3 2nd Row Seat (5th percentile female in side impact only)

With the seat in the test seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Side Impact – 5 th Female	

With the seat in the test seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: The seat back angle will be determined by the related dummy seating procedure for the side impact barrier test.)

Dummy	Angle
Side Impact – 5 th Female	

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).)

2.4 3rd Row Seat (side impact only)

The seat should be set to accommodate a 5th percentile female dummy; however this dummy will not be part of the test(s).

With the seat in the test seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Side Impact – 5 th Female	

With the seat in the test seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: The seat back angle will be determined by the related dummy seating procedure for the side impact barrier test.)

Dummy	Angle
Side Impact – 5 th Female	

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).)

3. ADJUSTABLE D-RING SEAT BELT ANCHORAGE POSITION

Nominal Design Position (NDP)

Please complete the following table for adjustable seat belt anchorages.

Dummy	Total Range of Travel (mm)	Dist. from Upper-most Position to NDP (mm)	Total No. of Detents (if applicable)	Detent No. of NDP*
Driver/Front Passenger - 50 th Male				
Driver/Front Passenger – 5 th Female				
Rear Passenger - 5 th Female				

* The detent number of the Nominal Design Position is counted with respect to the upper-most detent, which is defined as 0.

4. SEAT BELT GUIDES

Is this vehicle equipped with a seat belt guide for any of the following seating positions?

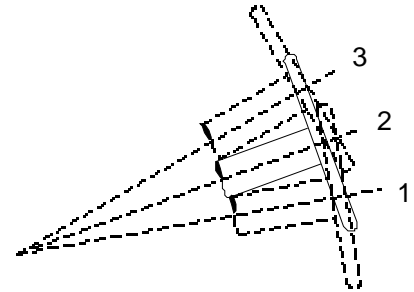
- Driver: YES NO
- Right Front Passenger: YES NO
- Left Rear Passenger: YES NO

If YES for any position, please provide instructions for use:

5. STEERING COLUMN AND WHEEL ADJUSTMENTS

STEERING COLUMN ASSEMBLY

If the steering wheel and /or steering column adjustments are available, provide any specific procedures used to determine the geometric center of the locus the steering wheel hub describes when it is moved through its full range of driving positions.



LEFT SIDE VIEW

Angle of the steering wheel with respect to vertical when the steering wheel hub is positioned at the geometric center of the locus it describes when it is moved through its full range of positions:	
Total number of detents:	
Test detent* when the wheel hub is positioned at the geometric center of the locus it describes when it is moved through its full range of positions:	

* Test detent is taken with respect to the upper-most detent, which is defined as 0.

6. SEATING REFERENCE POINT (SgRP)

Please give the location of the Seating Reference Point (SgRP) for each vehicle seating position.

Seating Position	Coordinates (mm)		
	X(+ forward)	Y(+ right)	Z (+ down)
Left Front (Driver)			
Right Front (Front Passenger)			
Left Second Row (Rear Passenger)			

Describe any references used for measuring the SgRP, e.g., center of the front door striker. (Include photograph(s).)

7. DUMMY MEASUREMENTS FOR THE 50TH MALE AND 5TH FEMALE

See the attached instructions and diagram and provide measurements for the following seat configurations:

	HH	NR	CS	KDL/KDR	SH	SHY	HS
Driver (Manual Seat)							
Driver (Power Seat)							
Passenger (Manual Seat)							
Passenger (Power Seat)							
2nd Row Occupant (Side only)							

8. FUEL TANK CAPACITY DATA

"Usable capacity" of standard equipment fuel tank (gal):	
"Usable capacity" of optional equipment fuel tank (gal):	
Capacity used when certification testing to requirements of FMVSS No. 301 (gal):	

Operational instructions:

Suggested methods for draining:

Is the vehicle equipped with an electric fuel pump?

YES NO

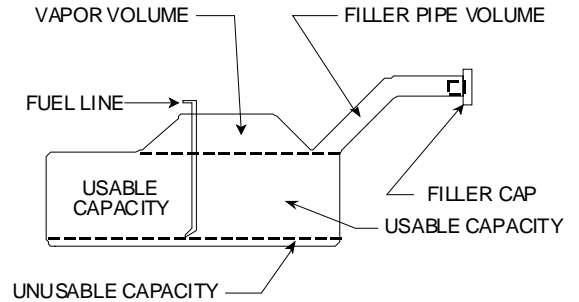
If YES, does the pump normally operate when the vehicle's electrical system is activated?

YES NO

If YES, explain the vehicle operating conditions under which the fuel pump will pump fuel:

Provide a drawing (or description) that shows the undercarriage view and/or location of the fuel tank.

VEHICLE FUEL TANK ASSEMBLY



9. DEACTIVATION OF SIDE AIRBAGS

If this vehicle has side airbags, will they deploy in a Frontal NCAP test?

YES NO

IF YES, please be prepared to disable the side airbags on test day in the event that NCAP requests they be deactivated for the Frontal test. If a representative will not be present, be sure to provide the laboratory with detailed instructions prior to test day.

If this vehicle has side airbags, will the side airbags on the non-struck side deploy in a Side MDB test?

YES NO

IF YES, please be prepared to disable the non-struck side airbags on test day. If a representative will not be present, be sure to provide the laboratory with detailed instructions prior to test day.

If this vehicle has side airbags, will the side airbags on the non-struck side deploy in a Side Pole test?

YES NO

IF YES, please be prepared to disable the side airbags on the non-struck side on test day. If a representative will not be present, be sure to provide the laboratory with detailed instructions prior to test day.

10. OCCUPANT CLASSIFICATION SYSTEMS

Are all related airbags activated when a 5th percentile female or 50th percentile male dummy is in the seat? (Please choose YES or NO for each.)

Frontal: YES NO
 Side MDB: YES NO
 Side Pole: YES NO

If NO, please provide system bypass information.

Frontal: _____

Side MDB: _____

Side Pole: _____

11. SHOULDER BELT LOAD CELL POSITIONING (Frontal NCAP)

Can a shoulder belt load cell be mounted on the seat belts?

YES NO

If YES, please provide the following:

Distance from the Driver's side D-ring to the load cell centerline (mm):	
Distance from the Passenger's side D-ring to the load cell centerline (mm):	

12. HEIGHT ADJUSTABLE SUSPENSION

Does this vehicle have a height adjustable suspension? (Off-road modes that must be manually activated are not applicable.)

YES NO

If YES, and the suspension does not automatically adjust to a default ride mode (comfort-ride, sport-ride, etc.) when the ignition is set to "on" (but, the engine is not running), please list and describe the ride mode options available on the vehicle, and discuss when and how they are activated.

If YES above, designate ONE ride mode to be used for all three crash tests (frontal, side MDB, and side pole tests) and provide instructions for adjusting the test vehicle to that designated ride mode.

13. HEAD RESTRAINTS

Do any of the head restraints in this vehicle have a "non-use" position? Please note that "use" positions are defined in FMVSS No. 202a.

YES NO

If YES, please indicate seating positions that apply and how to properly put the applicable head restraint(s) in the lowest "use" position.

14. EVENT DATA RECORDER (EDR) LOCATION

Please specify where the EDR is located and provide brief instructions for its removal. If available, please include a diagram.

15. LIST OF REMOVABLE PARTS

NCAP will remove the following parts if the target test weight cannot be achieved:

Frontal NCAP test: spare tire, rear door windows, rear radio speakers, interior door trim on the rear doors, rear seat cushions, outboard mirrors, taillights, rear bumper

Side NCAP test: spare tire, rear radio speakers, interior door trim and windows on non-struck side, outboard mirrors on non-struck side, taillights, rear bumper

Please prioritize the items in this list in order of removal preference for each NCAP test. Please make a note of any parts that should not be removed because they serve as load bearing or structural components and therefore, will likely affect NCAP test performance. Also, please feel free to add additional items which are not listed if their removal is deemed acceptable.

Frontal NCAP test:

Side MDB NCAP test:

Side Pole NCAP test

16. SPECIAL INSTRUCTIONS

Please make note of any special instructions that you would like NHTSA to consider or be made aware of for the tested vehicle (ex. towing setup, refrain from using seat belt load cells, etc.):

Frontal NCAP test:

Side MDB NCAP test:

Side Pole NCAP test:

DESCRIPTIONS OF DUMMY MEASUREMENTS

When a level is to be used, it is to ensure that the line containing the two points described is either parallel or perpendicular to the ground. If a measurement to be made is less than 10 inches ignore the directions to use a level and approximate a level measurement. Also, when a measurement is to be taken to or from the center of a bolt on the dummy, take the measurement from the center of the bolt hole if the bolt is recessed.

The following measurements are to be made within a vertical longitudinal plane.

HH - Head to Header, taken from the point where the dummy's nose meets his forehead (between his eyes) to the furthest point forward on the header.

CS - Steering Wheel to Chest, taken from the center of the steering wheel hub to the dummy's chest. Use a level.

NR - Nose to Rim, taken from the tip of the dummy's nose to the closest point on the top of the steering wheel rim. Also indicate the angle this line makes with respect to the horizontal (NA).

KDL, KDR - Left and Right Knees to Dashboard, taken from the center of the knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard. Also reference the angle of this measurement with respect to the horizontal for the outboard knee (KDA).

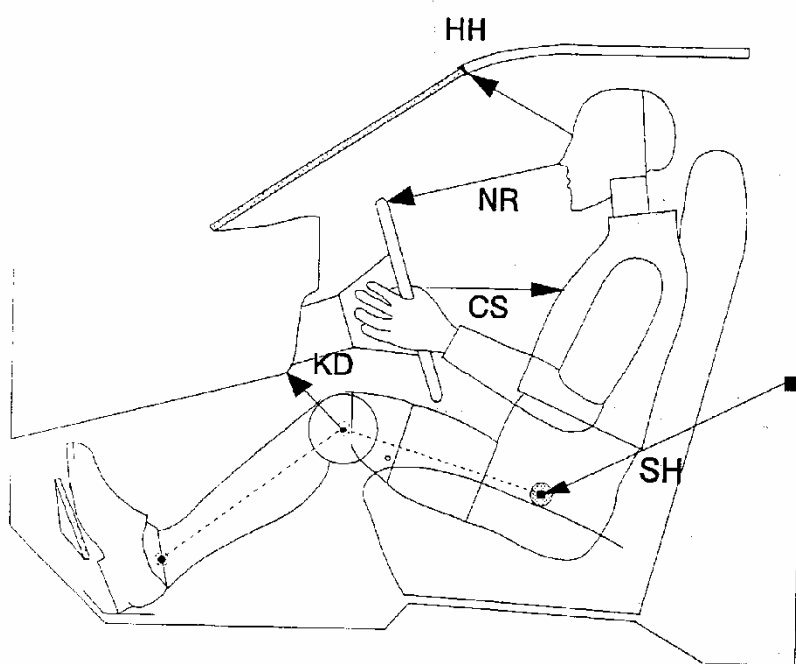
SH - Striker to Hip, this measurement is to be taken in the X-Z plane measured from the forward most center point on the striker to the center of the H-point. When taking this measurement a firm device that can be rigidly connected to the striker should be used. The measurement in the Y (transverse) direction from the striker to the H-point should also be taken (SHY).

The following measurements are to be made within a vertical transverse plane.

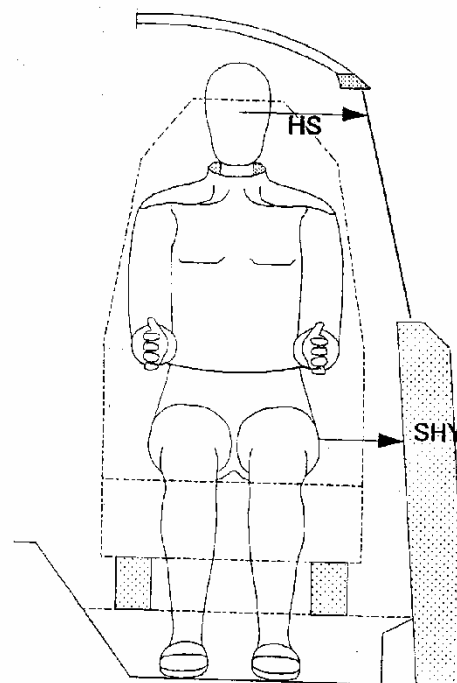
HS - Head to Side Window, taken from the point where the dummy's nose meets his forehead (between his eyes) to the outside of the side window. In order to make this measurement, roll the window down to the exact height which allows a level measurement. Use a level.

SHY - Striker to H-point, taken from a rod rigidly connected to the forward most center point on the striker to the H-point. Use a level.

DUMMY MEASUREMENTS FOR FRONT SEAT PASSENGERS



HH - Head to Header
NR - Nose to Rim
CS - Steering Wheel to Chest
KDL/KDR - Knee to Dash
SH - Striker to H-Point



SHY - Striker to H-Point (Y Dir.)
HS - Head to Side Window

**FORM NO. 2
REPORT OF VEHICLE CONDITION
PRE-TEST**

Contract Number: _____ Date: _____
 From: _____
 To: _____

The vehicle was inspected upon arrival at the laboratory for the test and found to contain all the equipment listed below. All variances have been reported within 2 working days of the vehicle arrival, by letter, to the NHTSA Industrial Property Manager with a copy to the COTR. The vehicle is again inspected, after the above test has been conducted, and all changes are noted below. The final condition of the vehicle is also noted in detail.

NHTSA No.	
Model Year	
Make	
Model	
Body Style	
VIN	
Body Color	
Delivery Date	
Odometer Reading (km/mi)	
Dealer	
Transmission	
Final Drive	
Type/No. Cylinders	
Engine Displacement (L)	
Engine Placement	
Roof Rack	
Sunroof/T-Top	
Tinted Glass	
Traction Control	
Power Brakes	
Front Disc	
Rear Disc	
Other	

Anti-Lock Brakes	
All-Wheel Drive	
Power Steering	
Driver Front Airbag	
Driver Side Torso Airbag	
Driver Side Head Airbag	
Driver Curtain Airbag	
Driver Knee Airbag	
Driver Head/Torso Combo Airbag	
Rear Pass. Front Airbag	
Rear Pass. Side Torso Airbag	
Rear Pass. Side Head Airbag	
Rear Pass. Curtain Airbag	
Rear Pass. Combo Airbag	
Pretensioners	
Load Limiters	
Air Conditioning	
AM/FM CD	
Tilt Steering	
Automatic Door Locks	
Power Windows	
Power Seats	
Other	

PLEASE LIST OTHER PERTINENT OPTIONAL EQUIPMENT ON THE NEXT PAGE IN THE REMARKS SECTION.

**FORM NO. 2 (CONTINUED)
REPORT OF VEHICLE CONDITION
POST-TEST**

Remarks:

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

Explanation for equipment removal:

Test vehicle condition:

	1		2		3	4	5
	Is Seat Track Movable?		Is Adjacent Window in Good Condition?		Adjacent Door Works Properly/In Good Condition?	Is Seat Airbag Deployed?	Is Curtain Airbag Deployed?
Position	Yes/No/NA	Power or Manual	Yes/No	Power or Manual	Yes/No/NA	Yes/No/NA	Yes/No/NA
Left Front (Driver)							
Right Front Passenger							
Right Rear Passenger							
Left Rear Passenger							

If "No" to Items 1-3 in table above, please describe the nature of the damage and if the damage is repairable/replaceable:

RECORDED BY: _____
APPROVED BY: _____

DATE: _____

FORM NO. 3
LABORATORY NOTICE OF TEST FAILURE

TEST DATE: _____

TEST PROGRAM: _____

LABORATORY: _____

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

LABORATORY PROJECT ENGINEER'S NAME: _____

VEHICLE MY/MAKE/MODEL: _____

VEHICLE NHTSA NO.: _____ VIN: _____

APPARENT TEST FAILURE DESCRIPTION: _____

NOTIFICATION TO NHTSA (COTR): _____

DATE: _____ BY: _____

REMARKS:

FORM NO. 5 QUICKLOOK REPORT

<div style="border: 1px solid black; padding: 5px; min-height: 40px;"> Laboratory Name and Logo </div>	QUICKLOOK REPORT 61 km/h (40 mph) Side Impact NCAP 27° Moving Deformable Barrier Test Model Year/Make/Model/Trimline/Body Style/NHTSA No. MXXXXX Test Date (Month, Day, Year)																																																																																																																		
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APPENDIX F

Determining the H-Point Location

Determining the H-Point Location for the Driver Seating Position

Position the three-dimensional H-point manikin (i.e., H-point machine) specified in Society of Automotive Engineers (SAE) Surface Vehicle Standard J826, revised July 1995, Devices for Use in Defining and Measuring Vehicle Seating Accommodation in the seat as follows:

- (1) Place a 910 mm² piece of muslin cotton cloth over the seat area. The muslin cloth shall be comparable to 48 threads/in² and density of 2.85 lb/yd. Tuck the muslin cloth in a sufficient amount to prevent hammocking of the material.
- (2) Place the seat and back assembly of the H-point machine such that its plane of symmetry is coincident with the longitudinal centerline marking on the seat.
- (3) Install the lower leg and foot segments.
- (4) Set the length of the lower leg segment at 414 mm (16.3 in) and the length of the thigh bar at 401 mm (15.8 in).
- (5) Leg and foot placement.
 - (a) Insert the pin so that the foot angle is not less than 87°.
 - (b) Place the right foot on the undepressed accelerator pedal with the sole of the foot on the pedal and the heel as far forward as allowable. Do not place the heel on the toe board.
 - (c) Adjust the left leg to be the same distance from the H-point machine centerline as the right leg.
 - (d) With the T-bar level, place the left foot on the toe board with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toe board and the floor pan and not on the wheel well projection. If the foot cannot be positioned on the toe board, set it on the floor pan.
- (6) Apply the lower leg weights.
- (7) Apply the thigh weights.
- (8) Tilt the back pan forward against the forward stop and draw the H-point machine away from the seat back using the T-bar.
- (9) Re-positioning the back pan.
 - (a) Allow the H-point machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required due to the seat pan contacting the seat back.
 - (b) Slide the H-point machine rearward by a horizontal rearward load applied at the T-bar until the seat pan contacts the seat back.
- (10) Apply a 10 kg load at the intersection of the hip angle quadrant and the T-bar housing along a line from the above intersection to a point just above the thigh bar housing.

- (11) Again apply a 10 kg load at the intersection of the hip angle quadrant and the T-bar housing along a line from the above intersection to a point just above the thigh bar housing.
- (12) Carefully return the back pan to the seat back.
- (13) Install the right and left buttock weights.
- (14) Install the eight torso weights alternating the installation between left and right.
- (15) Tilt the back pan forward until the stop is contacted.
- (16) Rock the H-point machine from side to side over a 10° arc (5° to each side of the vertical centerline) for three complete cycles. Restrain the T-bar during rocking so that the seat pan does not change position. Minimize any inadvertent exterior loads applied in a vertical or fore-aft direction. The feet are free to move during this rocking motion.
- (17) Without applying a forward or lateral load, lift the right foot off of the floor the minimum amount necessary until no additional forward foot movement is obtained.
- (18) Lower the right foot until the heel is in contact with the floor pan and the ball of the foot is in contact with the floor, toe board, or undepressed accelerator pedal.
- (19) Without applying a forward or lateral load, lift the left foot off of the floor the minimum amount necessary until no additional forward foot movement is obtained.
- (20) Lower the left foot until the heel is in contact with the floor pan and the ball of the foot is in contact with the floor or toe board.
- (21) If the seat pan is level, proceed to (a). If it is not, proceed to (b).
 - (a) Apply a sufficient lateral load to the top of the seat back pan to level the H-point machine seat pan on the seat.
 - (b) Holding the T-bar to prevent the H-point from sliding forward on the seat cushion, return the seat back pan to the seat back.
- (22) Holding the T-bar to prevent the H-point from sliding forward on the seat cushion, apply sufficient rearward force perpendicular to the back angle bar just above the torso weights to increase the hip angle 3°. Minimize the exterior downward or side forces applied to the H-point machine. Release the force. Repeat this step until the hip angle readout is identical. Complete as many force applications as necessary and record the results.
- (23) If the H-point machine is level, proceed to (24). If it is not, go back to (15) and repeat steps to re-level the H-point machine.
- (24) Record the H-point location with respect to the horizontal (X, fore-aft of striker), vertical (Z, above/below striker), and angle (torso angle fore/aft).
- (25) Remove the H-point machine and proceed with dummy placement and positioning.

APPENDIX G

Nine-Axis Head Array Information

PROCEDURE FOR CHECKING AND RECORDING DUMMY ACCELEROMETER POLARITY FOR THE HIII 50TH AND 5TH PERCENTILE NINE ACCELEROMETER ARRAY HEAD WITH REDUNDANT C.G. ACCELEROMETERS

Purpose:

The purpose of this procedure is to provide a practical methodology for checking and documenting the recorded polarity of the data channel for each dummy mounted accelerometer relative to the NHTSA sign convention. Documenting the polarity of channels will serve to increase the confidence that polarities have been correctly determined. The polarities in this document are the same as those of the SAE J211 and J1733.

Background:

Standardized coordinate systems and recorded polarities for various transducer outputs defined relative to positive directions of those coordinate systems are defined for crash test dummies, vehicle structures, and laboratory fixtures in the SAE J211 standard. The standardized coordinate system and polarities for data permits comparison of data from different crash test facilities.

There are many ways to influence the polarity of a data channel. NHTSA has required the polarity of any given manufacturer's instrumentation be compatible with and recordable in a J211 channel. The channel by definition includes all the instrumentation from the transducer to the data acquisition system output. The channels therefore include the accelerometers mounted in the dummy connected to a data acquisition system using connectors, wiring, data acquisition software and hardware. The polarity of a data channel for any given dummy may therefore be affected by changing the manufacturer of the accelerometer, positive and negative pins from the accelerometer to the wiring in a connector, the polarity assigned in software, and by changing the way it is mounted in the dummy.

Since there are many ways to influence the polarity of a data channel it is appropriate to document the polarity of the assembled channel just before testing to assure the accelerometer is not exchanged with that of another manufacturer's, and that no changes are made to the way it is mounted in the dummy, the connector pin arrangement, and polarity assigned in software before testing.

When a test dummy is delivered for a test and connected to the data acquisition system the polarity of the internal accelerometers can be established using the following approach. The procedure requires the user to think of the data channel as a black box. The procedure requires manipulating the dummy head to determine the polarity of the black box with respect to the sign convention. If the polarity is wrong, than steps must be taken to correct it prior to submitting data to NHTSA, so that data is in accordance with the sign convention. However, it is recommended to correct and document the channel polarity at the test site so no further modification to the data are required. If difficulty is experienced in determining the polarity when these procedures are being properly followed it may indicate that the accelerometer has not been

mounted in accordance with the dummy instrumentation assembly drawings contained in the appropriate Nine Array Head with Redundant C.G. Accelerometers User's Manual.

SAE J211 Procedure :

The body coordinate system used for reference is attached to the dummy and is x positive pointing forward, y positive pointing to the right, and z positive pointing down. For NHTSA tests the accelerometers referred to are those meeting NHTSA SA572-S4 specifications.

The SAE J1733 explains that for any dummy component oriented in its standard standing position blows to the back side, left side, and top will produce positive accelerations relative to its +x, +y, and +z directions, respectively. As an example to document the polarity of the dummy's head x axis accelerometer data channel in a plot similar to Figure 1, apply a blow to the back of the head with a rubber mallet and record the data channel output. The polarity of the Figure 1 dummy channel is positive and no changes are needed to conform to the sign convention. Similarly to document the polarity of the dummy's head y and z axis accelerometer data channels apply a blow to the left side, and top of the head with a rubber mallet (never apply the blow directly to an accelerometer mount) and record the data channel output as shown for the y axis in Figure 2.

Analysis of Figure 2 for the y axis shows that the polarity of the y axis accelerometer data channel in the dummy head in this example is negative. Change the polarity to be positive (perhaps the simplest way is to change the sign in the software) to agree with the sign convention and make a new plot to document the change. Following this approach it is possible to document the polarity of each accelerometer data channel in the dummy head.

Alternate Procedure :

An alternate approach to determine the polarity of the accelerometers mounted in the dummy head uses the constant force of gravity as the input. This procedure will yield the same polarity as the previous procedure. Since the sign convention is fixed with respect to the dummy, this procedure can be conducted outside the test vehicle on the laboratory floor or table, but the dummy must be attached to the data acquisition system.

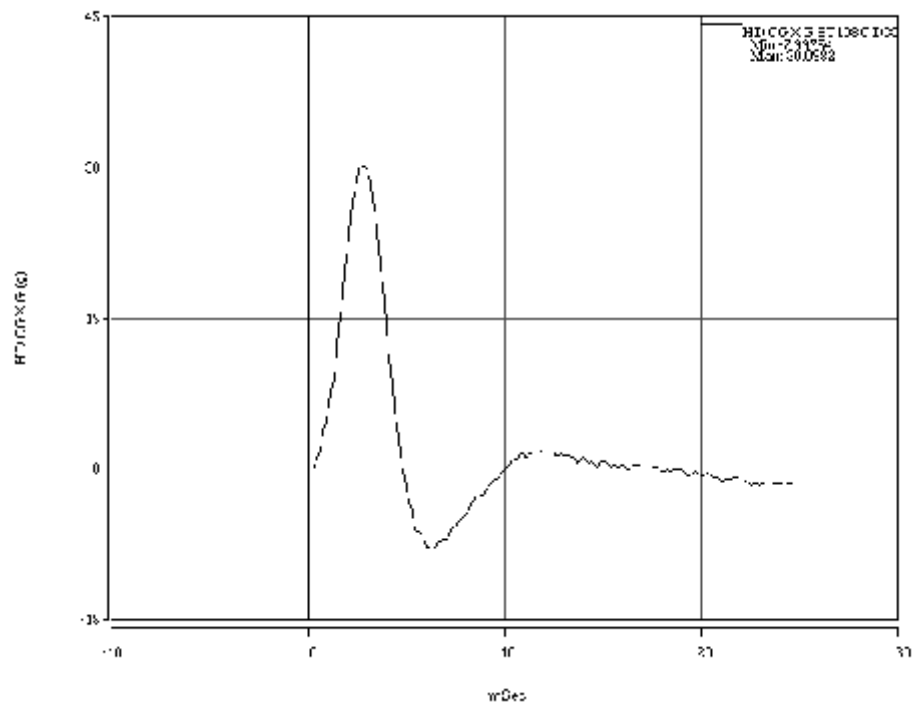


Figure 1 – Response of X Axis Accelerometer Data Channel from blow to rear of head showing desired positive polarity

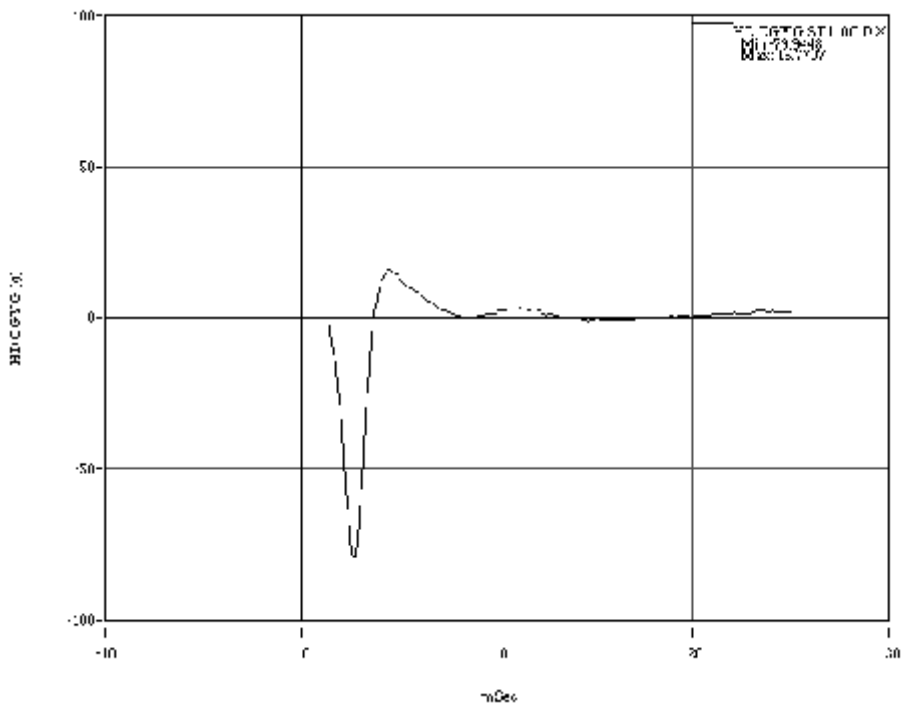


Figure 2 – Response of Y Axis Accelerometer Data Channel from blow to left side of head showing incorrect (negative) polarity

The procedure for each channel requires placing the accelerometers to be checked perpendicular to the axis of gravity in two orientations each 180 degrees apart and recording the sign and value of the acceleration channel due to the earth's gravity for a short period of time. The SA572-S4 accelerometer is defined as perpendicular to the axis of gravity when the plane containing both mounting screw holes is perpendicular to the force of gravity. See Figure 3.

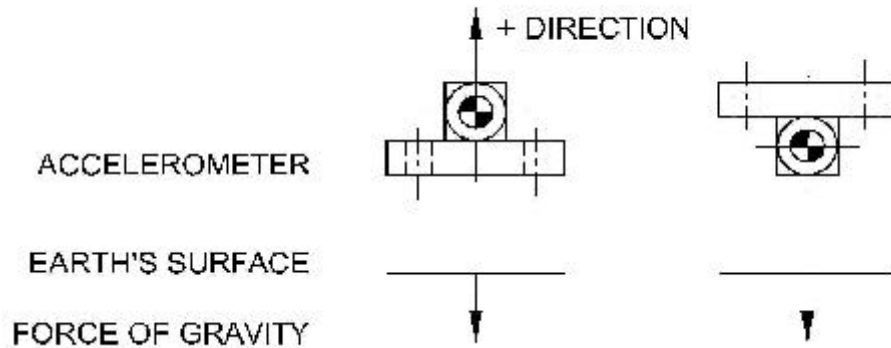


Figure 3 – SA572-S4 Accelerometer Perpendicular to the Force of Gravity in Two Orientations 180 Degrees Apart

When the SA572-S4 accelerometer is mounted in a plane perpendicular to the force of gravity the orientation of the dummy head having the most positive output for that accelerometer channel defines positive polarity when moved away from the earth center. The polarity must agree with the SAE J211 sign convention.

The data collected should be recorded in the Polarity Check Data Sheet respectively for the x, y, and z accelerometers. Samples of these are provided in this Document. As an example, refer to the Polarity Check Data Sheet for documenting the x axis polarity. To determine the polarity of the head x-accelerometer, lay the dummy face down (FD) and record the x-accelerometer's output in g's in the appropriate column. Now place the dummy face up (FU) and record the channel output in g's in the appropriate column. List the orientation of the most positive value in the next column, either FD or FU, paying attention to the sign from the data acquisition system (-1 is more positive than -2 g's). Next, compare the orientation of the most positive value with the J211 orientation for positive sign convention. If the dummy's orientation of the most positive value is consistent with that of the J211 sign convention, then the channel output will be in accordance with the sign convention. If, however, the dummy's orientation of the most positive value is different than that of the J211 sign convention, then the channel's output will have to be reversed by the data acquisition software in order to be in accordance with the sign convention. Place a check in the column titled "Negative Channels To Be Reversed In Data Acquisition System" for those channels that will require reversal by the data acquisition software.

The channel outputs for the x-axis accelerometers can be recorded simultaneously for each orientation. For example, when the dummy is turned face down, the channel outputs for the head can all be recorded at the same time. Then the dummy can be oriented face up and the corresponding channel outputs can be recorded again.

The procedure for the y-axis accelerometers is very similar to that used for the x-axis and can be accomplished on a floor or bench surface. In this instance, the dummy is placed on its side in two different orientations - one where the right shoulder is down (RSD) and one where the right shoulder is up (RSU). Once again, all of the channels can be recorded at one time. Then flip the dummy onto its other side and record the values again. At this point, the procedure is similar to that used for the x-axis channels. List the orientation of the most positive value and compare that with that J211 orientation for positive sign convention. Indicate those channels to be reversed if any.

For the z-axis turning the dummy over and standing it on its head is quite difficult for the larger adult dummies. Thus for the z-axis check it is recommended to secure the dummy in a chair, seat it upright and then rotate the dummy in the chair forward or backward about 60 degrees. The force on the accelerometer varies with the cosine of the angle it makes with respect to tangent to the earth's surface. With the dummy sitting upright (U) in the chair, record the z-axis accelerometer channel outputs in the appropriate column on the Polarity Check Data Sheet. Next, lean the dummy forward or backward approximately 60 degrees and record the z-axis accelerometer outputs in the column labeled "Lean Down." (Note that the symbol "D" for down has been associated with this orientation.) Again, follow the procedure outlined for the x-axis and y-axis accelerometers to complete the z-axis Polarity Check Data Sheet.

Polarity Check Data Sheet For X - Axis Accelerometers

Dummy Type: _____ **Serial No.** _____ **Date:** _____

Component	Channel Output (g)		Orientation of Most Positive Value (FU or FD)	J211 Orientation for Positive Polarity	Negative Channels to be Reversed In Data Acquisition System
	Orientation				
	Face Down (FD)	Face Up (FU)			
Head C.G.				FU	
Head C.G. Redundant NAAH*				FU	
Head Top NAAH*				FU	
Head Left NAAH*				FU	

* NAAH - Indicates Nine Accelerometer Array Head

Polarity Check Data Sheet For Y - Axis Accelerometers

Dummy Type: _____ **Serial No.** _____ **Date:** _____

Component	Channel Output (g)		Orientation of Most Positive Value (RSU or RSD)	J211 Orientation for Positive Polarity	Negative Channels to be Reversed In Data Acquisition System
	Orientation				
	Right Shoulder Down (RSD)	Right Shoulder Up (RSU)			
Head C.G.				RSU	
Head C.G. Redundant NAAH*				RSU	
Head Top NAAH*				RSU	
Head Front NAAH*				RSU	

* NAAH - Indicates Nine Accelerometer Array Head

Polarity Check Data Sheet For Z - Axis Accelerometers					
Dummy Type: _____		Serial No. _____		Date: _____	
Component	Channel Output (g)		Orientation of Most Positive Value (U or D)	J211 Orientation for Positive Polarity	Negative Channels to be Reversed In Data Acquisition System
	Orientation				
	Upright (U)	Lean Down (D)			
Head C.G.				D	
Head C.G. Redundant NAAH*				D	
Head Left NAAH*				D	
Head Front NAAH*				D	

* NAAH - Indicates Nine Accelerometer Array Head